Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Heterogeneous Suzuki−Miyaura Coupling of Heteroaryl Ester via Chemoselective C(acyl)−O Bond Activation

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Contents

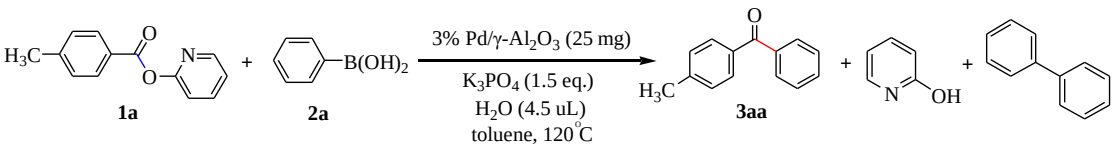
1. Hg(0) poisoning test

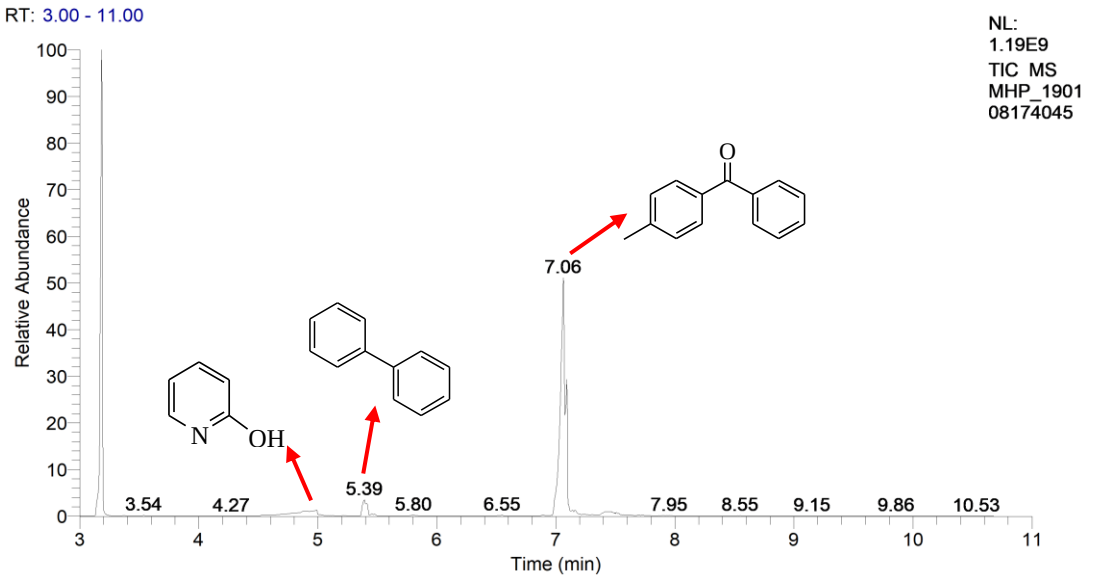
Two model reactions solution were added into over-dried reaction tube under identical reaction conditions. Following reaction for 1 h at 120 ℃ the yields of both reactions were then determined by GC. Elemental mercury (60 mg) was introduced to one reaction tube at 120 ℃. Both reaction mixtures were continued with stirring at 120 ℃ for 4 h. Subsequent analysis of the reaction yields suggests that reaction is inhibited by the introduction of Hg (0). The GC data as follows:

Table S1. The results of Hg (0) poisoning test

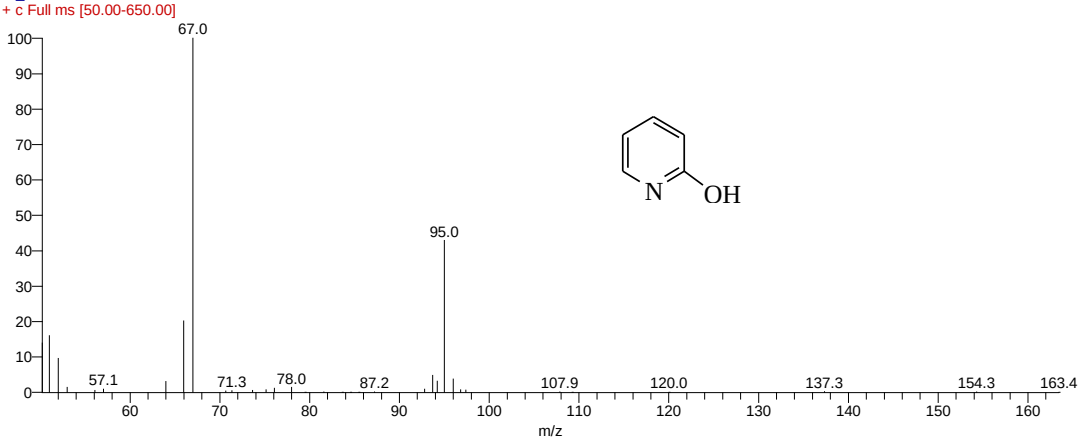
Time (hour)	Yield (%)	Yield (Hg(0) poisoned after 1h) (%)
0	0	0
1	26.13	26.17
5	54.56	28.09

2. GC-MS Analysis of Model Reaction





MHP_190108174045 #1486 RT: 4.98 AV: 1 RF: 6.00, 3 NL: 4.26E6
F: + c Full ms [50.00-650.00]



MHP_190108174045 #1611 RT: 5.39 AV: 1 RF: 6.00, 3 NL: 4.42E6
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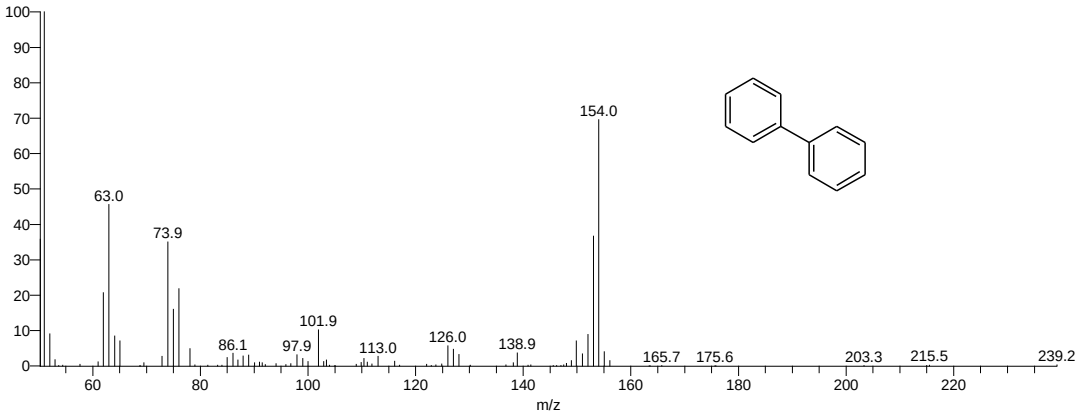

MHP_190108174045 #2117 RT: 7.06 AV: 1 RF: 6.00, 3 NL: 1.21E8
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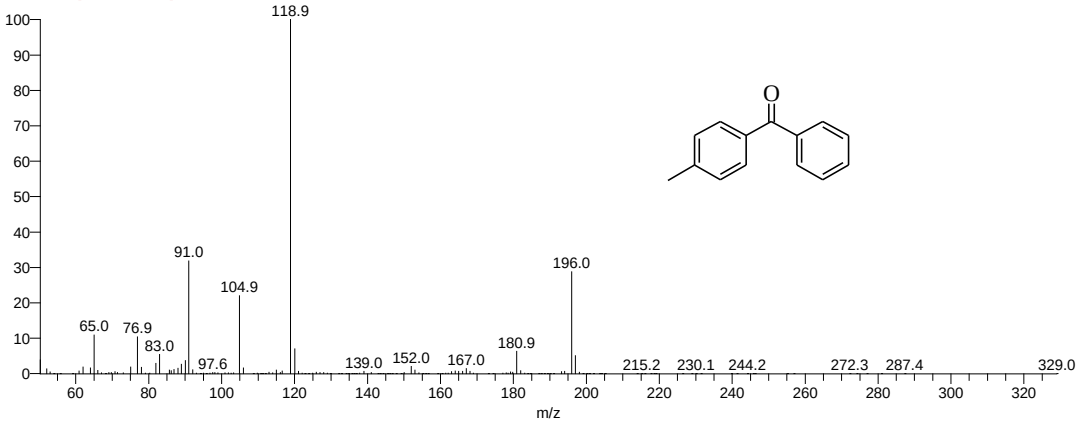
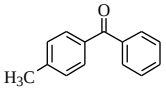
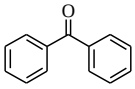


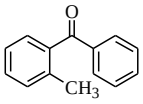
3. Characterization Data of the Products



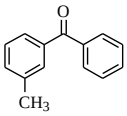
phenyl(*p*-tolyl)methanone **3aa.**[1] Yield: 88% (17.2 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.80-7.76 (m, 2H), 7.74-7.70 (m, 2H), 7.59-7.55 (m, 1H), 7.49-7.45 (m, 2H), 7.28 (d, *J* = 7.9 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.5, 143.3, 138.0, 134.9, 132.2, 130.3, 130.3, 129.9, 129.0, 128.2, 21.7.



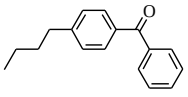
benzophenone **3ba.** [2] Yield: 78% (14.2 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.83-7.77 (m, 4H), 7.61-7.57 (m, 2H), 7.49 (t, *J* = 7.7 Hz, 4H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.8, 137.6, 132.4, 130.1, 128.3.



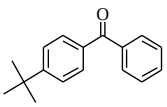
phenyl(*o*-tolyl)methanone **3ca.**[3] Yield: 51% (10.0 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.83-7.78 (m, 2H), 7.60-7.56 (m, 1H), 7.46 (t, *J* = 7.8 Hz, 2H), 7.41-7.37 (m, 1H), 7.33-7.27 (m, 2H), 7.26-7.22 (m, 1H), 2.33 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 198.7, 138.6, 137.8, 136.8, 133.1, 131.0, 130.3, 130.2, 128.5, 128.5, 125.2, 20.0.



phenyl(*m*-tolyl)methanone **3da.** [3] Yield: 62% (12.2 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.82-7.77 (m, 2H), 7.63 (s, 1H), 7.61-7.55 (m, 2H), 7.48 (t, *J* = 7.7 Hz, 2H), 7.41-7.38 (m, 1H), 7.36 (t, *J* = 7.5 Hz, 1H), 2.42 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.0, 138.2, 137.8, 137.7, 133.2, 132.3, 130.5, 130.1, 128.3, 128.1, 127.4, 21.4.

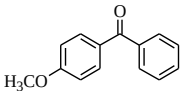


(4-butylphenyl)(phenyl)methanone **3ea.**[4] Yield: 68% (16.1 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.81-7.77 (m, 2H), 7.74 (d, *J* = 8.3 Hz, 2H), 7.60-7.55 (m, 1H), 7.47 (t, *J* = 7.7 Hz, 2H), 7.28 (d, *J* = 7.9 Hz, 2H), 2.69 (t, *J* = 7.8 Hz, 2H), 1.68-1.62 (m, 2H), 1.42-1.34 (m, 2H), 0.95 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.6, 148.2, 138.0, 135.1, 132.2, 130.3, 130.0, 128.4, 128.2, 35.7, 33.3, 22.4, 13.9.

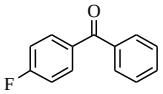


(4-*tert*-butylphenyl)(phenyl)methanone **3fa.**[5] Yield: 71% (16.8 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.82-7.79 (m, 2H), 7.78-7.74 (m, 2H), 7.58 (t, *J* = 7.4 Hz, 1H),

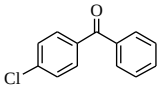
7.52-7.45 (m, 4H), 1.37 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.5, 156.2, 138.0, 134.8, 132.2, 130.1, 130.0, 128.2, 125.3, 35.1, 31.2.



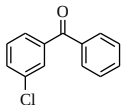
(4-methoxyphenyl)(phenyl)methanone **3ga.**[3] Yield: 66% (13.9 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.83 (d, *J* = 8.7 Hz, 2H), 7.76 (d, *J* = 7.3 Hz, 2H), 7.56 (t, *J* = 7.4 Hz, 1H), 7.47 (t, *J* = 7.7 Hz, 2H), 6.97 (d, *J* = 8.7 Hz, 2H), 3.89 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.6, 163.2, 138.3, 132.6, 131.9, 130.2, 129.7, 128.2, 113.6, 55.5.



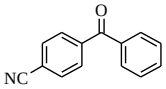
(4-fluorophenyl)(phenyl)methanone **3ha.**[3] Yield: 68% (13.6 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.88-7.82 (m, 2H), 7.77 (dd, *J* = 8.1, 1.1 Hz, 2H), 7.62-7.58 (m, 1H), 7.49 (t, *J* = 7.7 Hz, 2H), 7.19-7.14 (m, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.29, 165.4 (d, *J*=252.2 Hz, 1C), 137.52, 133.8 (d, *J*=1.8 Hz, 1C), 132.7 (d, *J*=9.2 Hz, 1C), 132.48, 129.89, 128.37, 115.5 (d, *J*=21.6 Hz, 1C); ^{19}F NMR (565 MHz, $CDCl_3$) δ -190.27.



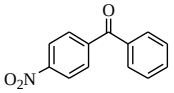
(4-chlorophenyl)(phenyl)methanone **3ia.**[6] Yield: 84% (18.2 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.80-7.73 (m, 4H), 7.60 (t, *J* = 7.4 Hz, 1H), 7.53-7.45 (m, 4H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.5, 138.9, 137.3, 135.9, 132.7, 131.5, 129.9, 128.7, 128.4.



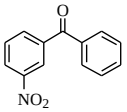
(3-chlorophenyl)(phenyl)methanone **3ja.**[7] Yield: 77% (16.6 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.81-7.77 (m, 3H), 7.68-7.65 (m, 1H), 7.64-7.59 (m, 1H), 7.58-7.55 (m, 1H), 7.50 (t, *J* = 7.8 Hz, 2H), 7.43 (t, *J* = 7.8 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.3, 139.3, 137.0, 134.6, 132.9, 132.4, 130.0, 129.9, 129.6, 128.5, 128.1.



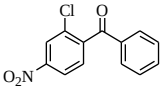
4-benzoylbenzonitrile **3ka.**[8] Yield: 53% (11.0 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.88 (d, *J* = 8.1 Hz, 2H), 7.82-7.76 (m, 4H), 7.65 (t, *J* = 7.2 Hz, 1H), 7.52 (t, *J* = 7.7 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.1, 141.3, 136.4, 133.3, 132.2, 130.3, 130.1, 128.7, 118.0, 115.7.



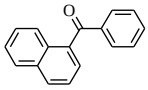
(4-nitrophenyl)(phenyl)methanone **3la.**[3] Yield: 76% (17.3 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.35 (d, *J* = 8.7 Hz, 2H), 7.94 (d, *J* = 8.7 Hz, 2H), 7.85 – 7.76 (m, 2H), 7.66 (t, *J* = 7.5 Hz, 1H), 7.53 (t, *J* = 7.8 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 194.8, 149.9, 142.9, 136.3, 133.5, 130.7, 130.1, 128.7, 123.6.



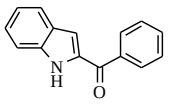
(3-nitrophenyl)(phenyl)methanone **3ma.**[9] Yield: 36% (8.1 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.63 (s, 1H), 8.47-8.42 (m, 1H), 8.15 (d, *J* = 7.6 Hz, 1H), 7.84-7.78 (m, 2H), 7.71 (t, *J* = 7.9 Hz, 1H), 7.66 (t, *J* = 7.4 Hz, 1H), 7.54 (t, *J* = 7.7 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 194.2, 148.1, 139.1, 136.3, 135.5, 133.4, 130.0, 129.7, 128.8, 126.7, 124.8.



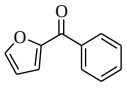
(2-chloro-4-nitrophenyl)(phenyl)methanone **3na.**[10] Yield: 25% (6.5 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.36 (d, *J* = 2.1 Hz, 1H), 8.25 (dd, *J* = 8.3, 2.1 Hz, 1H), 7.81-7.77 (m, 2H), 7.66 (t, *J* = 7.4 Hz, 1H), 7.57 (d, *J* = 8.3 Hz, 1H), 7.51 (t, *J* = 7.8 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 193.3, 148.9, 144.5, 135.3, 134.6, 132.6, 130.0, 129.6, 129.0, 125.3, 121.9.



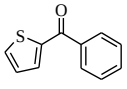
naphthalen-1-yl(phenyl)methanone **3oa.**[9] Yield: 48% (11.1 mg); ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.09 (d, *J* = 8.3 Hz, 1H), 8.01 (d, *J* = 8.2 Hz, 1H), 7.92 (d, *J* = 7.9 Hz, 1H), 7.87 (d, *J* = 7.3 Hz, 2H), 7.62-7.56 (m, 2H), 7.56-7.48 (m, 3H), 7.46 (t, *J* = 7.8 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 198.0, 138.3, 136.4, 133.7, 133.2, 131.3, 131.0, 130.4, 128.5, 128.4, 127.8, 127.3, 126.5, 125.7, 124.4.



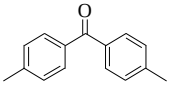
(*1H*-indol-2-yl)(phenyl)methanone **3pa.**[11] Yield: 100% (22.1 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.53 (s, 1H), 8.05-7.96 (m, 2H), 7.73 (d, *J* = 8.1 Hz, 1H), 7.66-7.60 (m, 1H), 7.55 (t, *J* = 7.7 Hz, 2H), 7.52-7.47 (m, 1H), 7.41-7.34 (m, 1H), 7.22-7.13 (m, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 187.3, 138.0, 137.6, 134.4, 132.4, 129.3, 128.5, 127.8, 126.6, 123.3, 121.1, 112.9, 112.2.



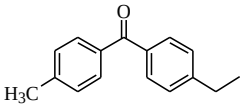
furan-2-yl(phenyl)methanone **3qa.**[12] Yield: 85% (14.7 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.98 (d, *J* = 7.6 Hz, 2H), 7.72 (s, 1H), 7.60 (t, *J* = 7.4 Hz, 1H), 7.50 (t, *J* = 7.7 Hz, 2H), 7.24 (d, *J* = 3.5 Hz, 1H), 6.60 (dd, *J* = 3.3, 1.4 Hz, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 182.6, 152.3, 147.1, 137.3, 132.6, 129.3, 128.4, 120.6, 112.2.



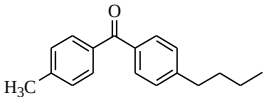
phenyl(thiophen-2-yl)methanone **3ra.**[13] Yield: 90% (16.9 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.87 (d, *J* = 7.5 Hz, 2H), 7.73 (d, *J* = 4.9 Hz, 1H), 7.65 (d, *J* = 3.7 Hz, 1H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.50 (t, *J* = 7.7 Hz, 2H), 7.19-7.14 (m, 1H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 188.3, 143.7, 138.2, 134.9, 134.2, 132.3, 129.2, 128.4, 128.0.



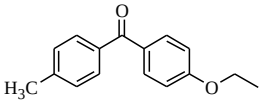
di-p-tolyl-methanone **3ab**.[44] Yield: 62% (13.0 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.1 Hz, 2H), 7.27 (d, *J* = 7.9 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.3, 142.9, 135.2, 130.2, 128.9, 21.64.



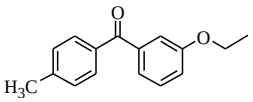
(4-ethylphenyl)(*p*-tolyl)methanone **3ac.**[14] Yield: 51% (11.4 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.72 (dd, *J* = 9.9, 8.2 Hz, 4H), 7.29 (dd, *J* = 13.1, 8.0 Hz, 4H), 2.73 (q, *J* = 7.6 Hz, 2H), 2.44 (s, 3H), 1.28 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.3, 149.1, 142.9, 135.5, 135.2, 130.3, 130.2, 128.9, 127.7, 29.0, 21.6, 15.3.



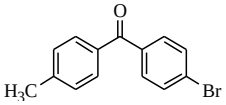
(4-butylphenyl)(*p*-tolyl)methanone **3ad.**[15] Yield: 58% (14.6 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.82-7.62 (m, 4H), 7.30-7.26 (m, 4H), 2.69 (t, *J* = 7.8 Hz, 2H), 2.44 (s, 3H), 1.70-1.60 (m, 2H), 1.43-1.34 (m, 2H), 0.95 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.3, 147.9, 142.9, 135.4, 135.3, 130.2, 128.9, 128.3, 35.7, 33.3, 22.4, 21.7, 13.9.



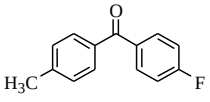
(4-ethoxyphenyl)(*p*-tolyl)methanone **3ae.**[16] Yield: 62% (14.9 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.7 Hz, 2H), 7.68 (d, *J* = 8.0 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 1H), 6.94 (d, *J* = 8.7 Hz, 2H), 4.12 (q, *J* = 7.0 Hz, 2H), 2.44 (s, 3H), 1.46 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.4, 162.5, 142.6, 135.6, 132.5, 130.3, 130.0, 128.9, 113.9, 63.8, 21.6, 14.7.



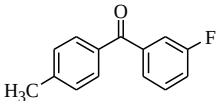
(3-ethoxyphenyl)(*p*-tolyl)methanone **3af.**[17] Yield: 79% (18.9 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.1 Hz, 2H), 7.39-7.33 (m, 1H), 7.33-7.30 (m, 2H), 7.28 (d, *J* = 8.0 Hz, 2H), 7.16-7.07 (m, 1H), 4.08 (q, *J* = 7.0 Hz, 2H), 2.44 (s, 3H), 1.43 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.3, 158.9, 143.2, 139.2, 134.9, 130.3, 129.2, 129.0, 122.5, 119.1, 115.0, 63.7, 21.7, 14.8.



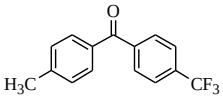
(4-bromophenyl)(*p*-tolyl)methanone **3ah.**[3] Yield: 67% (18.3 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.1 Hz, 2H), 7.68-7.64 (m, 2H), 7.64-7.60 (m, 2H), 7.29 (d, *J* = 8.0 Hz, 2H), 2.45 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.4, 143.6, 136.7, 134.5, 131.6, 131.5, 130.2, 129.1, 127.2, 21.68.



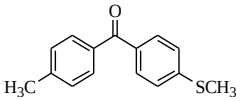
(4-fluorophenyl)(*p*-tolyl)methanone **3ai.**[18] Yield: 82% (17.6 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.82 (dd, *J* = 8.0, 5.7 Hz, 2H), 7.69 (d, *J* = 7.8 Hz, 2H), 7.29 (d, *J* = 7.8 Hz, 2H), 7.15 (t, *J* = 8.4 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.1, 165.3 (d, *J* = 253.7 Hz, 1C), 143.3, 134.8, 134.2 (d, *J* = 3.0 Hz, 1C) , 132.5 (d, *J* = 9.1 Hz, 2C) , 130.2, 129.1, 115.4 (d, *J* = 21.9 Hz, 2C) , 21.7; ^{19}F NMR (565 MHz, $CDCl_3$) δ -190.26.



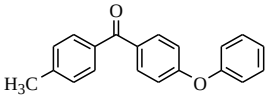
(3-fluorophenyl)(*p*-tolyl)methanone **3aj.**[19] Yield: 80% (17.2 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.72 (d, *J* = 8.1 Hz, 2H), 7.55 (d, *J* = 7.7 Hz, 1H), 7.50-7.42 (m, 2H), 7.32-7.27 (m, 3H), 2.45 (s, 3H); ^{19}F NMR (565 MHz, $CDCl_3$) δ -190.26.



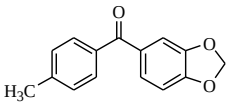
p-tolyl(4-(trifluoromethyl)phenyl)methanone **3ak.**[20] Yield: 70% (18.4 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.0 Hz, 2H), 7.74 (d, *J* = 8.1 Hz, 2H), 7.72 (d, *J* = 8.1 Hz, 2H), 7.30 (d, *J* = 7.9 Hz, 2H), 2.45 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.3, 144.1, 141.1, 134.1, 133.5 (q, *J* = 32.6 Hz, 1C), 130.4(2C), 130.0(2C), 129.2(2C), 125.3 (q, *J* = 3.7 Hz, 2C), 123.7 (q, *J* = 272.7 Hz, 1C), 21.7; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.97.



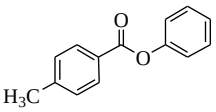
(4-(methylthio)phenyl)(*p*-tolyl)methanone **3al.**[21] Yield: 55% (13.3 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.73 (d, *J* = 8.4 Hz, 2H), 7.69 (d, *J* = 8.1 Hz, 2H), 7.31-7.26 (m, 4H), 2.54 (s, 3H), 2.44 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.6, 144.9, 143.0, 135.1, 134.1, 130.6, 130.1, 129.0, 124.86, 77.24, 77.03, 76.81, 21.65, 14.91.



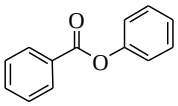
(4-phenoxyphenyl)(*p*-tolyl)methanone **3am.**[22] Yield: 48% (13.8 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.7 Hz, 2H), 7.70 (d, *J* = 8.0 Hz, 2H), 7.40 (t, *J* = 7.9 Hz, 2H), 7.28 (d, *J* = 7.9 Hz, 2H), 7.20 (t, *J* = 7.4 Hz, 1H), 7.10 (d, *J* = 7.9 Hz, 2H), 7.03 (d, *J* = 8.7 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.3, 161.4, 155.7, 142.9, 135.2, 132.3, 132.3, 130.1, 130.0, 129.0, 124.5, 120.1, 117.2, 21.6.



benzo[d][1,3]dioxol-5-yl(*p*-tolyl)methanone **3an.**[23] Yield: 45% (10.8 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8.0 Hz, 2H), 7.39-7.32 (m, 2H), 7.29-7.26 (m, 2H), 6.86 (d, *J* = 8.0 Hz, 1H), 6.06 (s, 2H), 2.44 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 195.0, 151.3, 147.9, 142.8, 135.4, 132.3, 130.0, 128.9, 126.6, 110.0, 107.7, 101.8, 21.6.



4-methylbenzoic acid phenyl ester **5aa**.[24] Yield: 48% (10.2 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.10 (d, *J* = 8.2 Hz, 2H), 7.45-7.40 (m, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 7.28-7.25 (m, 1H), 7.23-7.20 (m, 2H), 2.45 (s, 3H).



benzoic acid phenyl ester **5ga**.[24] Yield: 32% (6.3 mg); ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21 (d, *J* = 7.4 Hz, 2H), 7.62 (t, *J* = 7.3 Hz, 1H), 7.50 (t, *J* = 7.6 Hz, 2H), 7.42 (t, *J* = 7.7 Hz, 2H), 7.27 (t, *J* = 7.3 Hz, 1H), 7.22 (d, *J* = 7.8 Hz, 2H).

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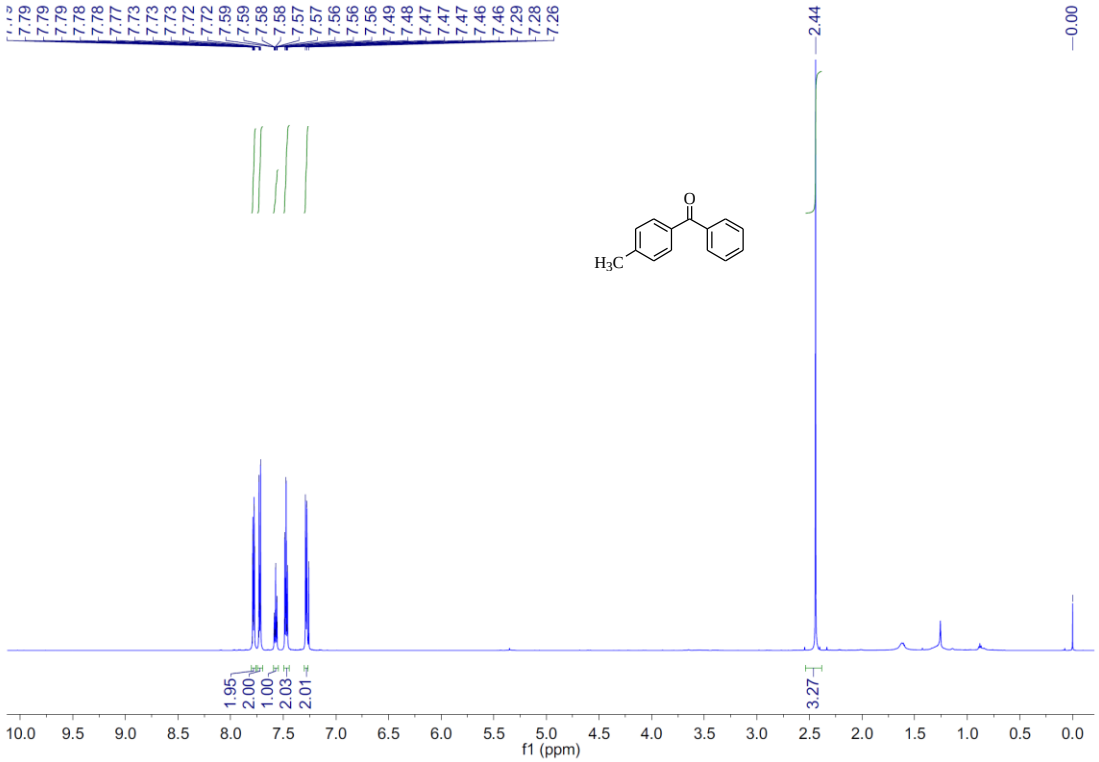
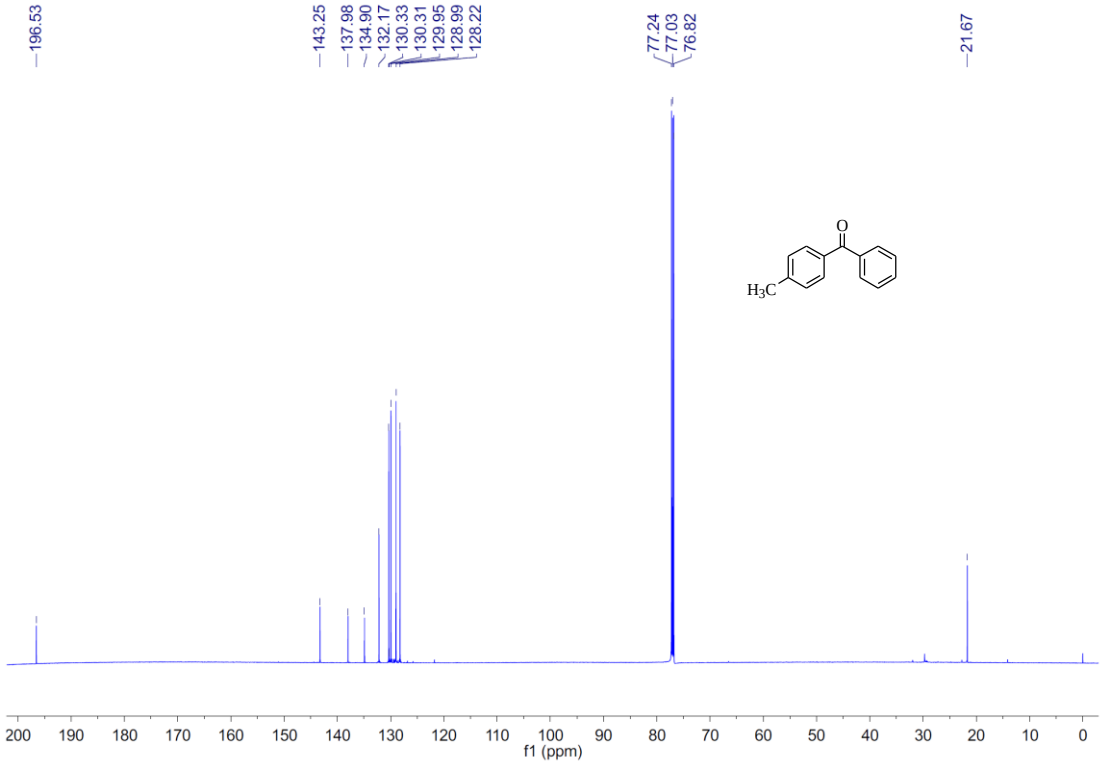
4. ^{1}H NMR and ^{13}C NMR Spectra of the Products

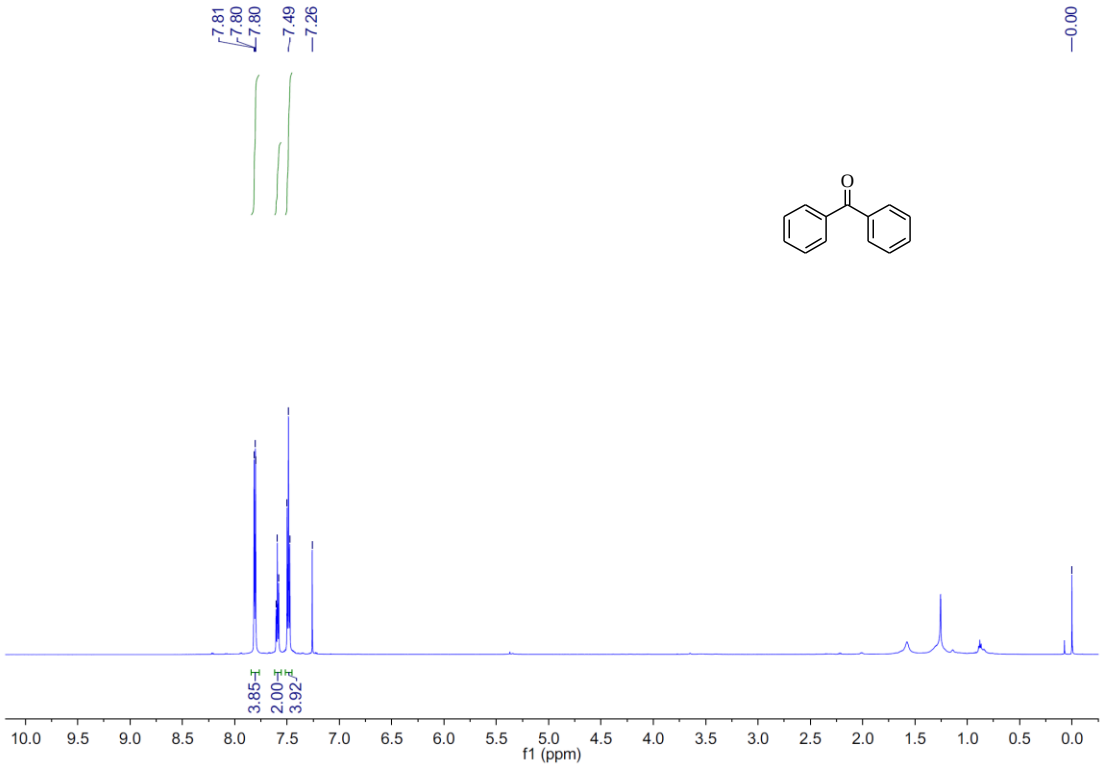
^{1}H NMR of phenyl(p-tolyl)methanone **3aa**



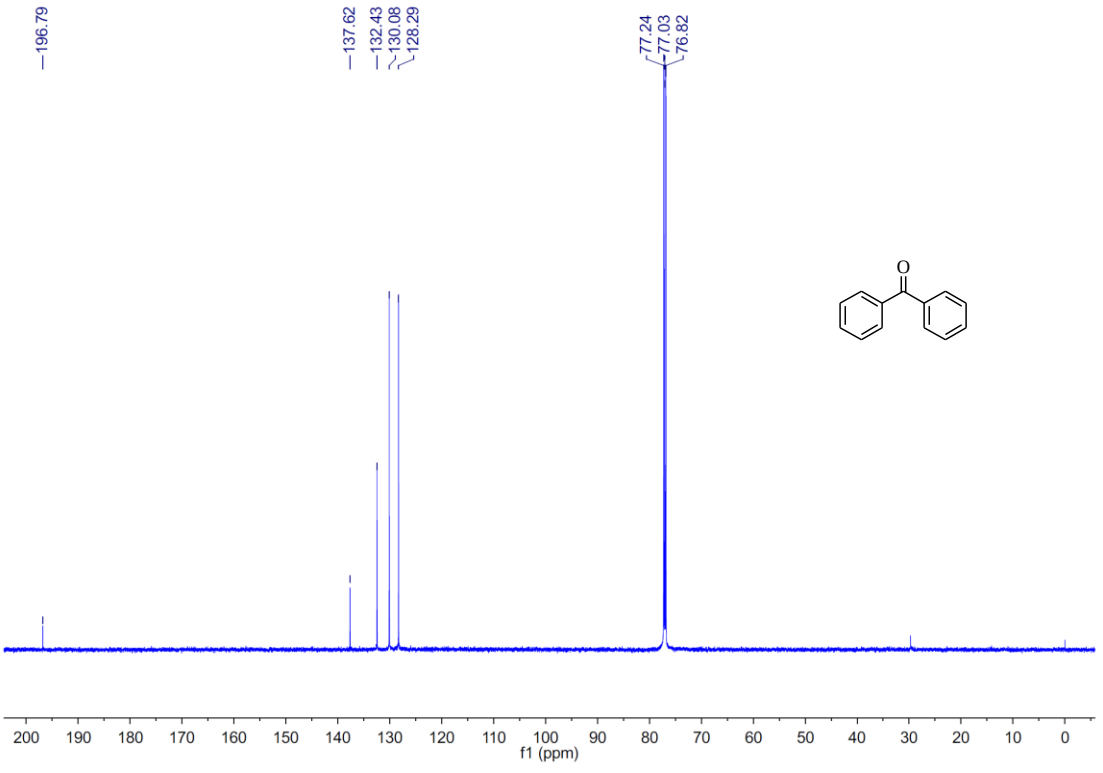
^{13}C NMR of phenyl(p-tolyl)methanone **3aa**



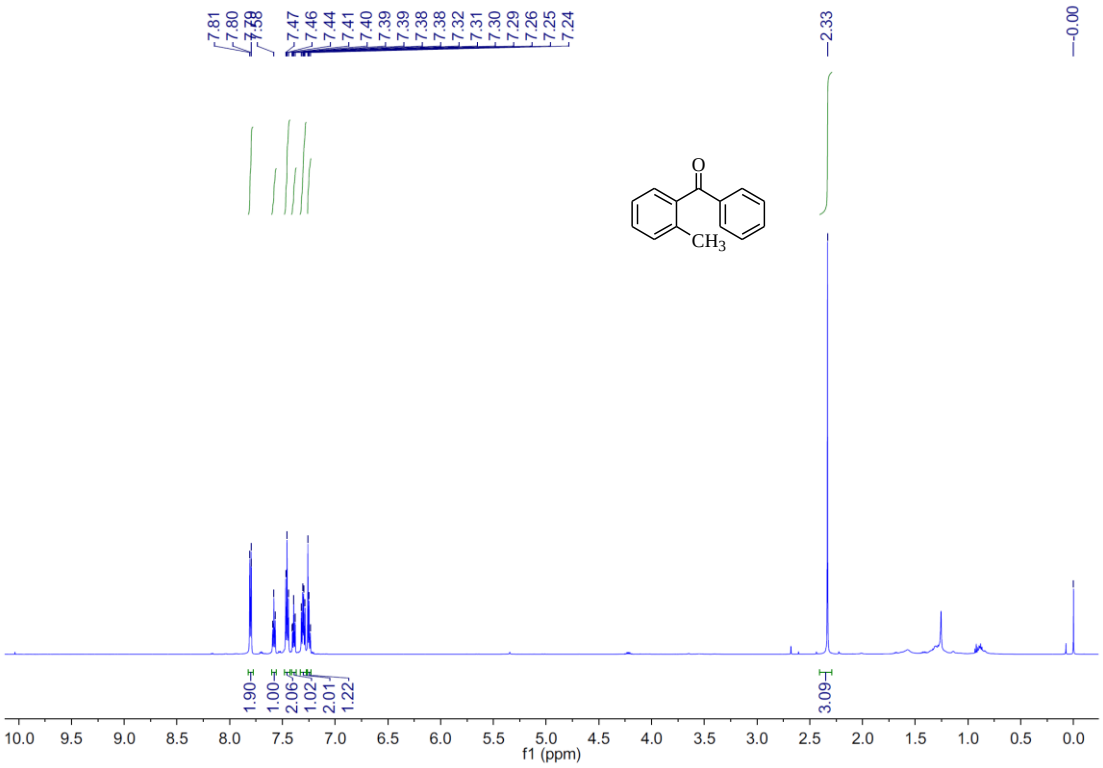
^{1}H NMR of benzophenone **3ba**



^{13}C NMR of benzophenone **3ba**



^{1}H NMR of phenyl(o-tolyl)methanone **3ca**



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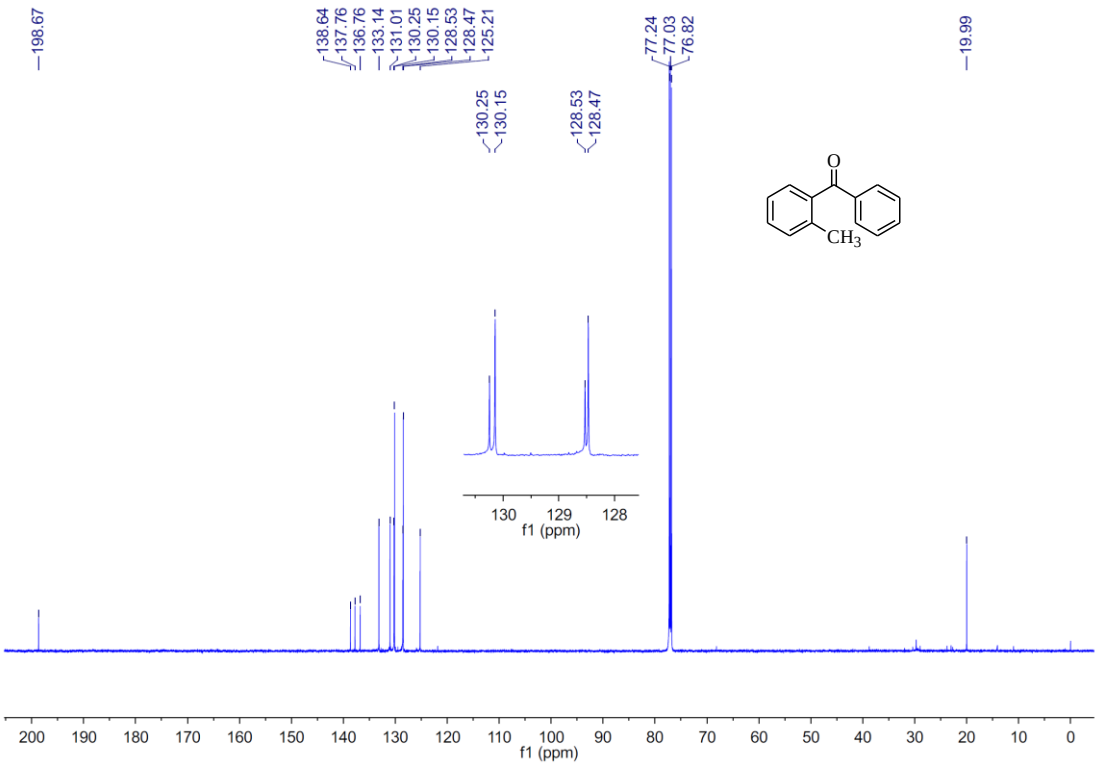
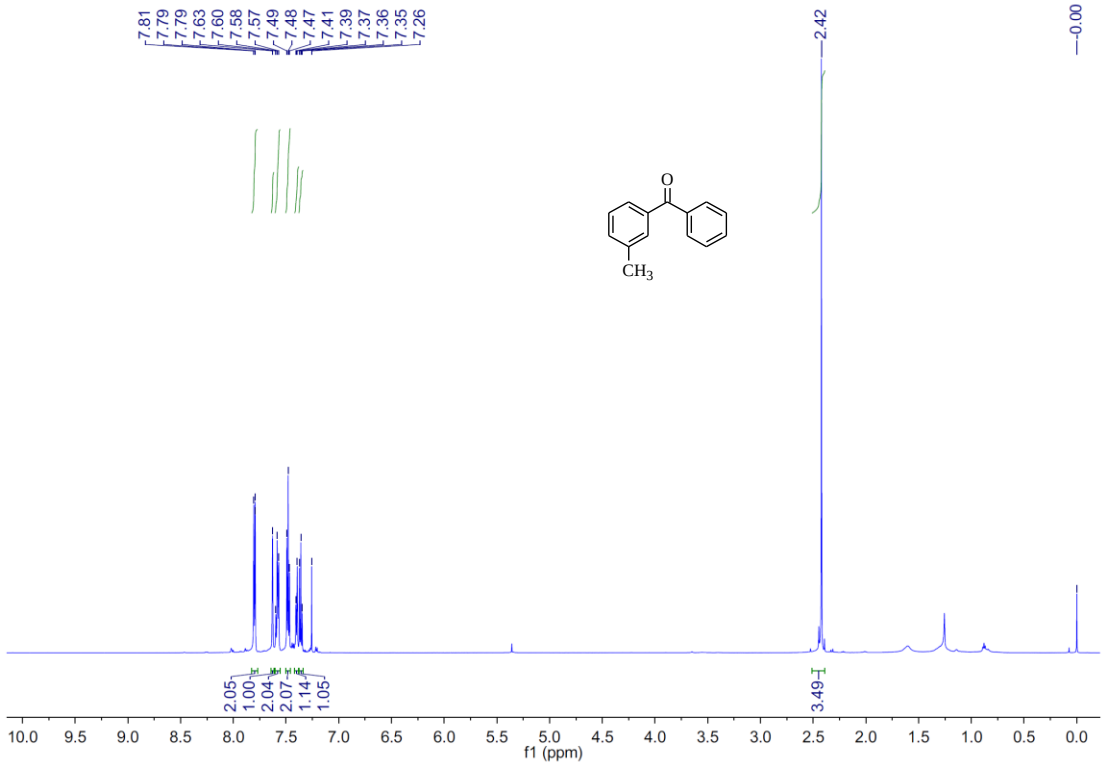
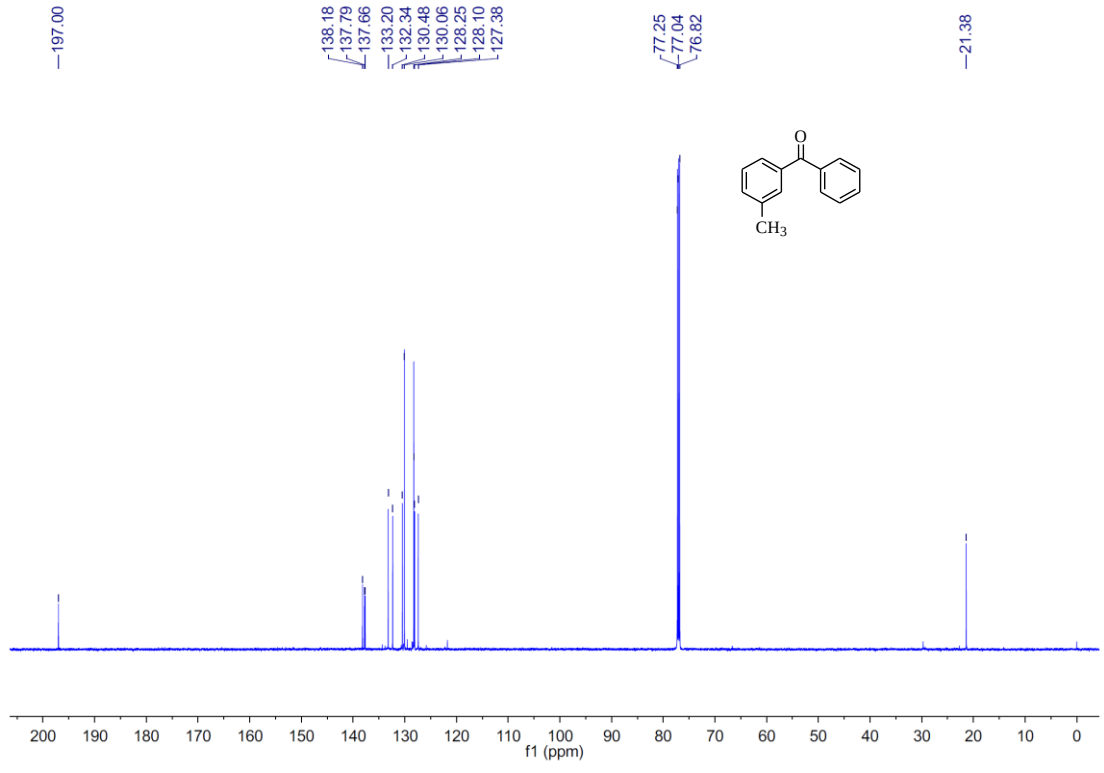


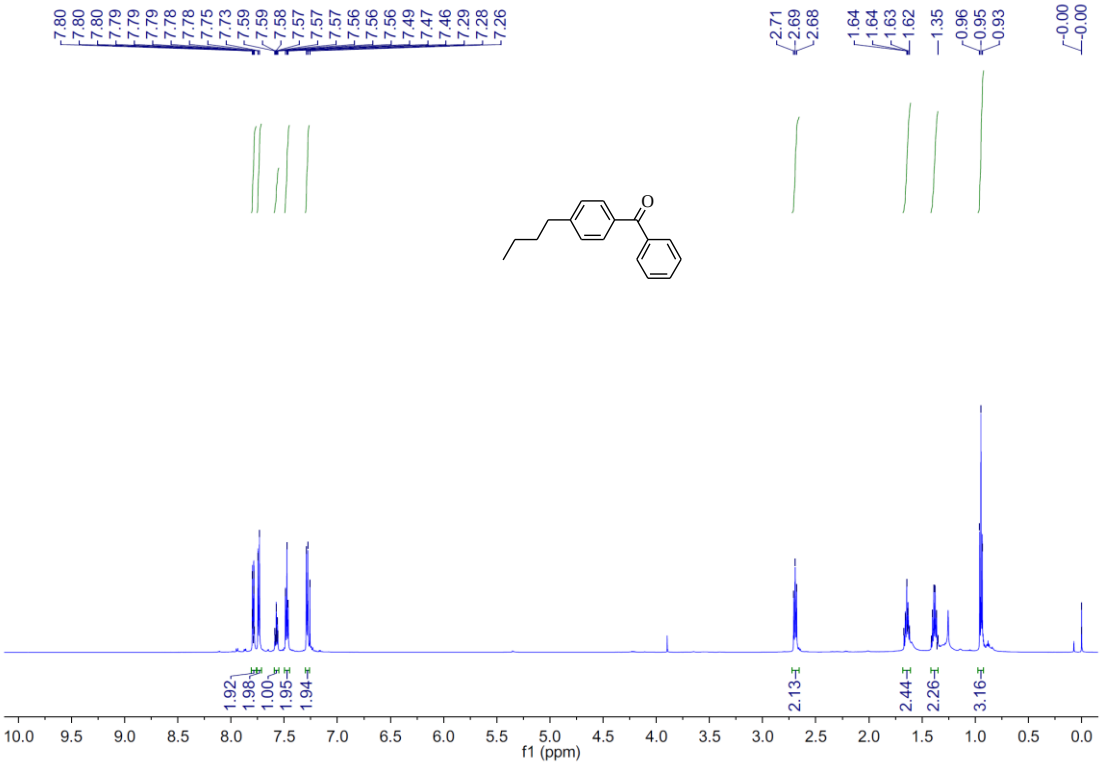
^{1}H NMR of phenyl(m-tolyl)methanone **3da**



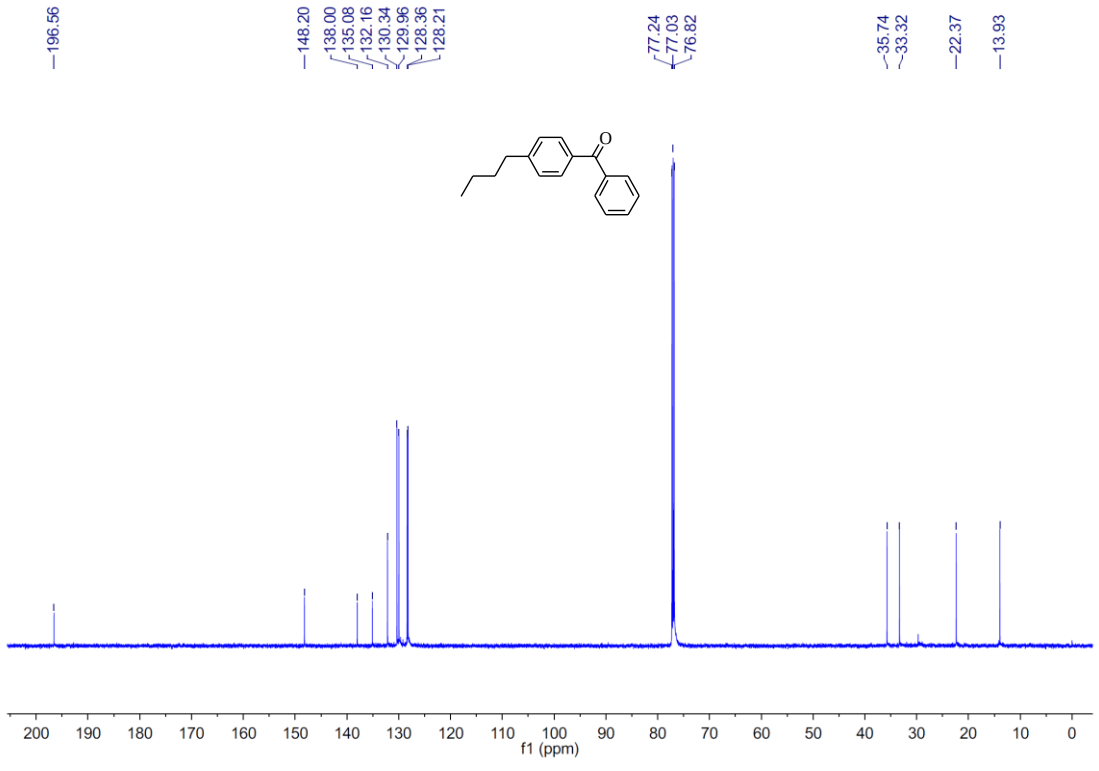
^{13}C NMR of phenyl(m-tolyl)methanone **3da**



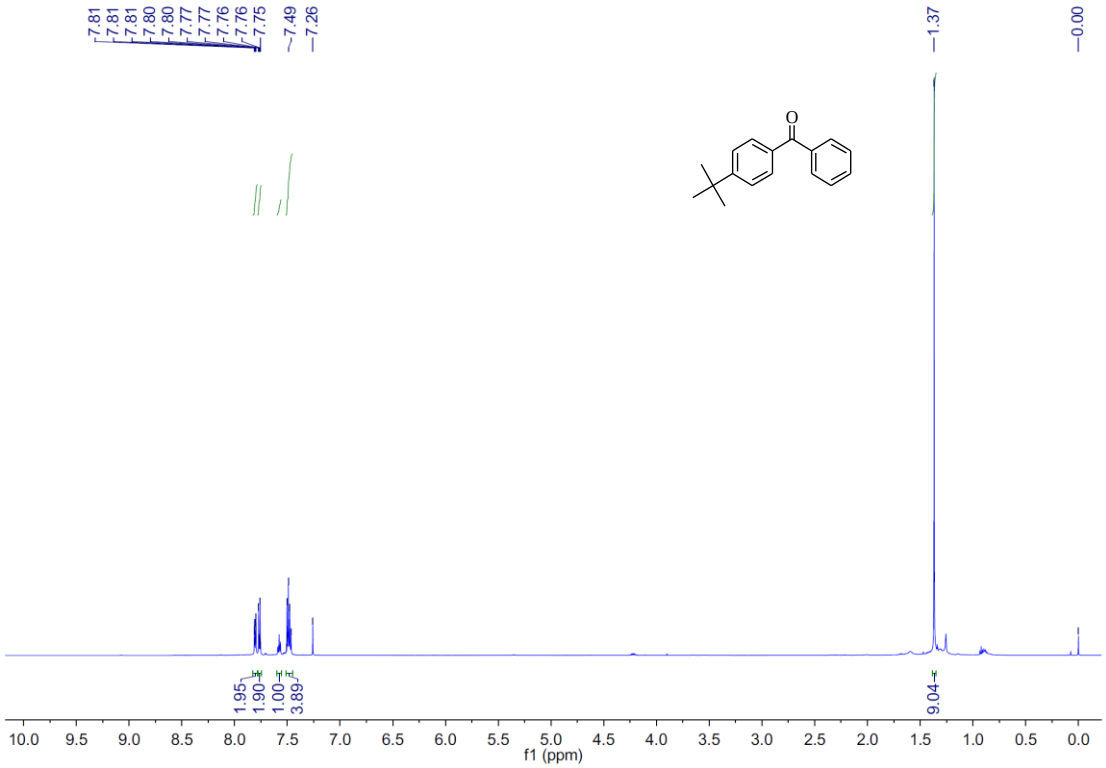
^{1}H NMR of (4-butylphenyl)(phenyl)methanone **3ea**



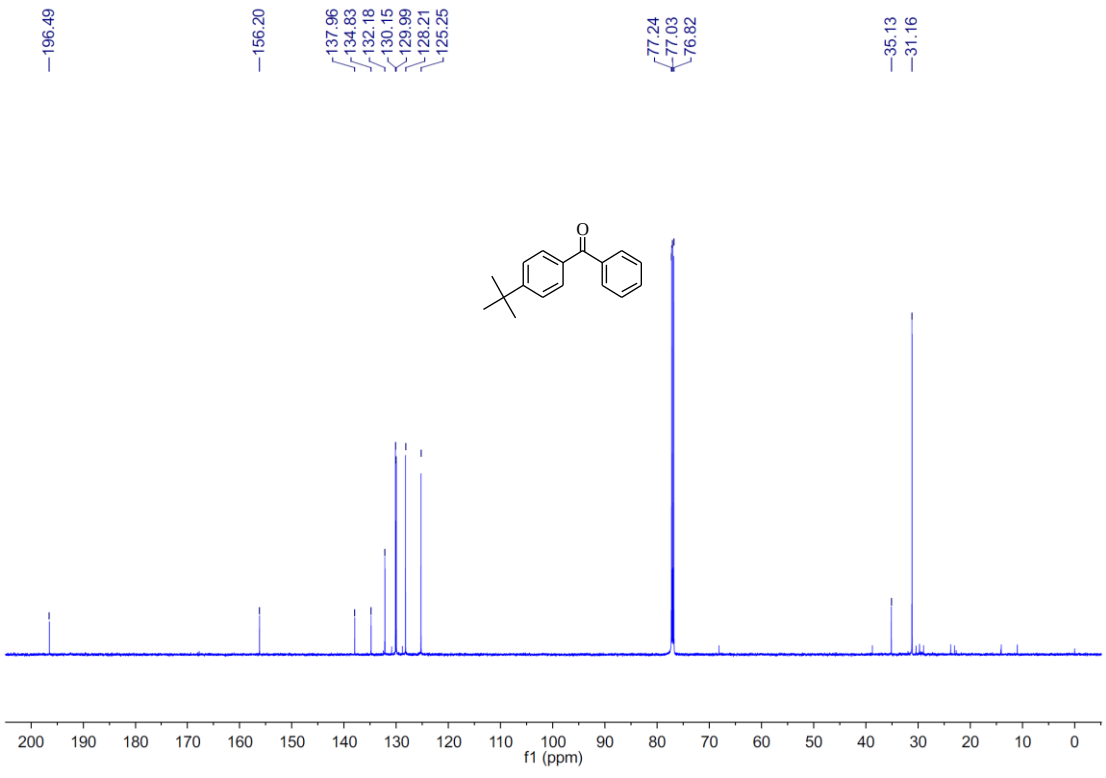
^{13}C NMR of (4-butylphenyl)(phenyl)methanone **3ea**



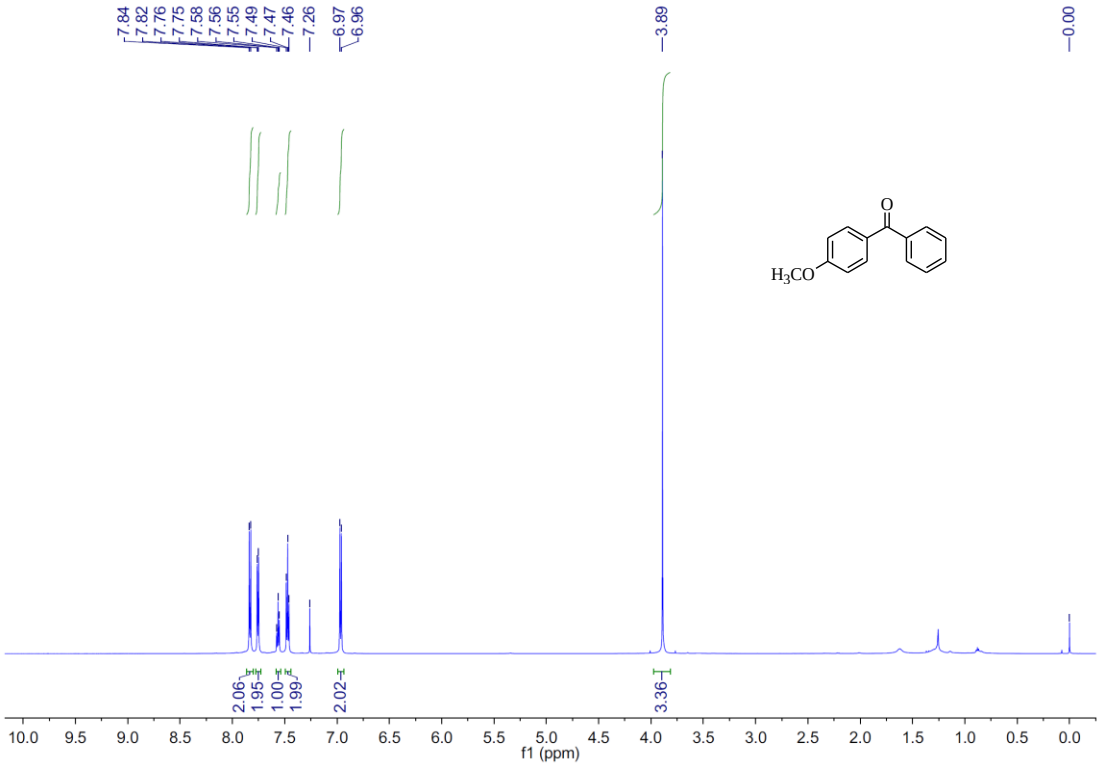
^{1}H NMR of (4-tert-butylphenyl)(phenyl)methanone **3fa**



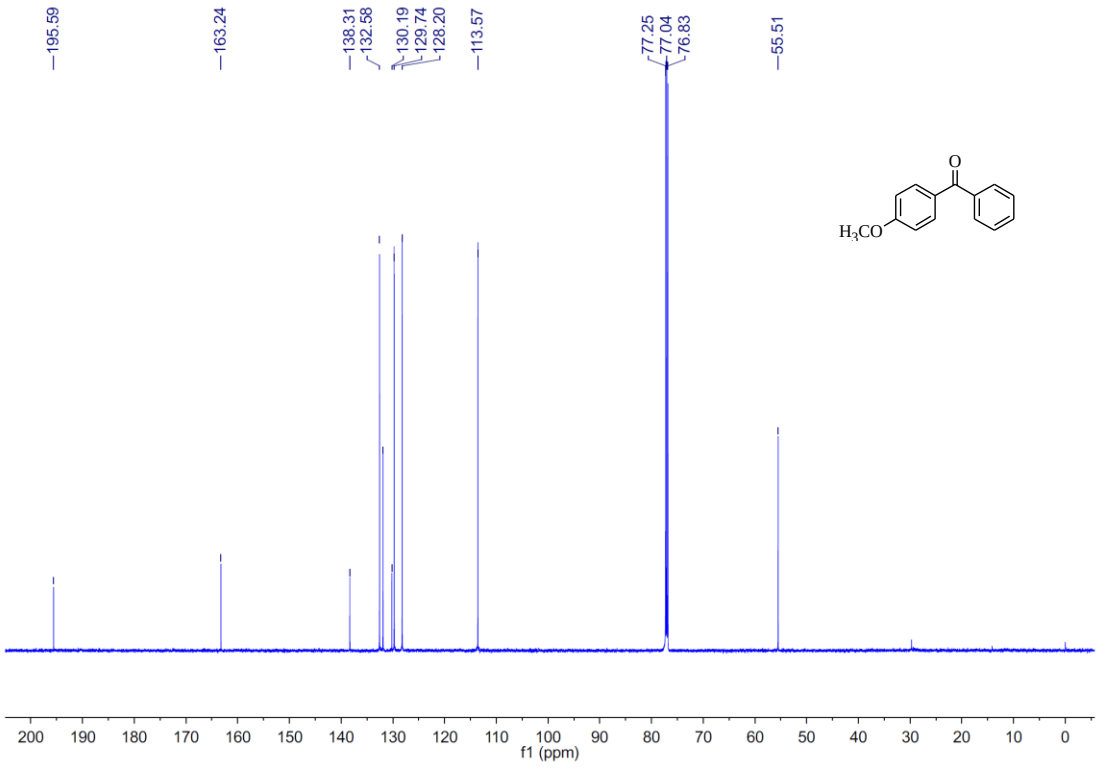
^{13}C NMR of (4-tert-butylphenyl)(phenyl)methanone **3fa**



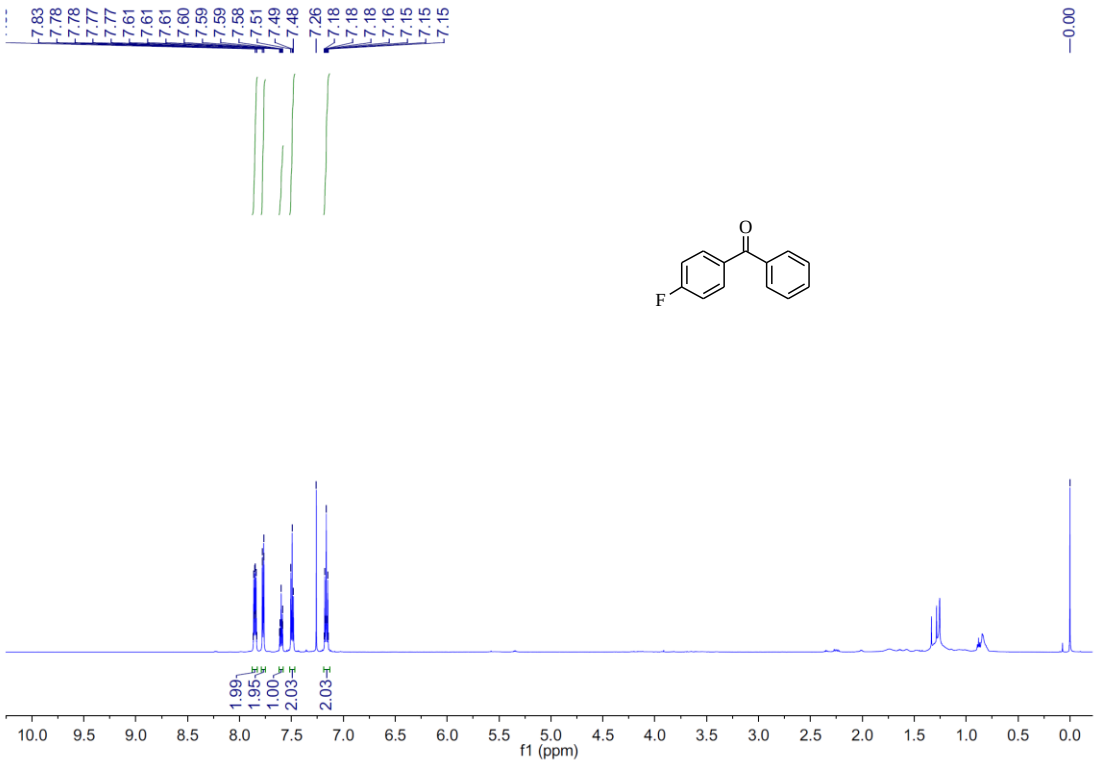
^{1}H NMR of (4-methoxyphenyl)(phenyl)methanone **3ga**



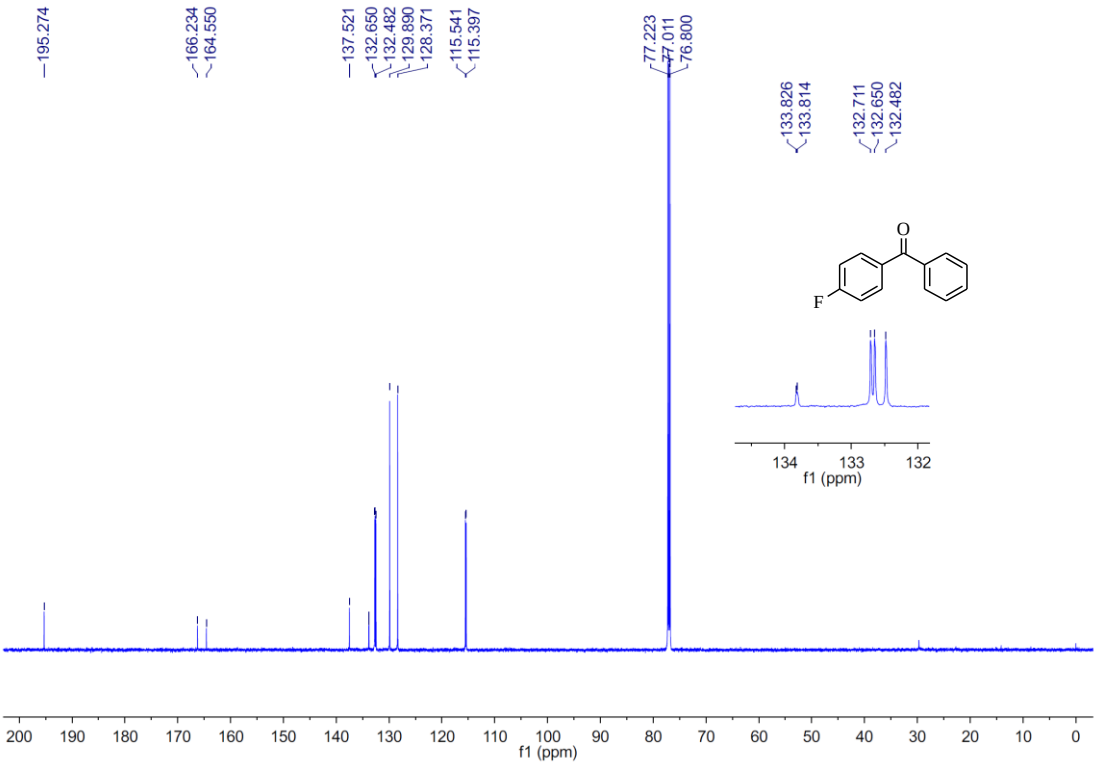
^{13}C NMR of (4-methoxyphenyl)(phenyl)methanone **3ga**



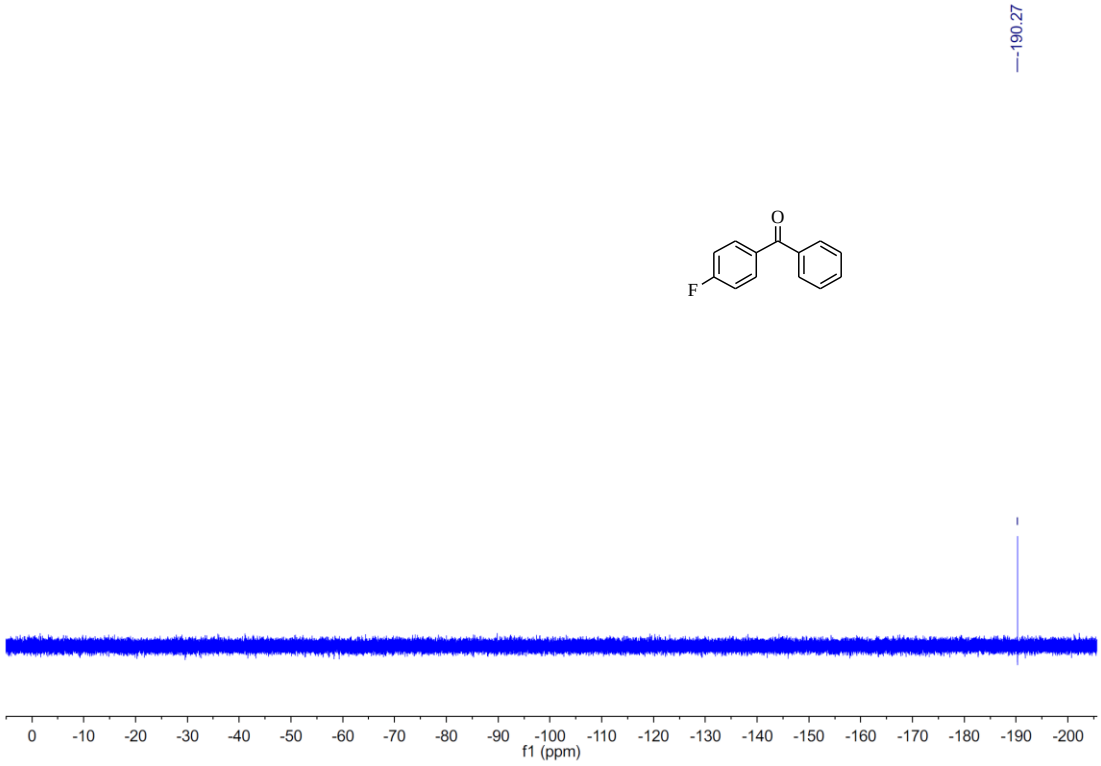
^{1}H NMR of (4-fluorophenyl)(phenyl)methanone **3ha**



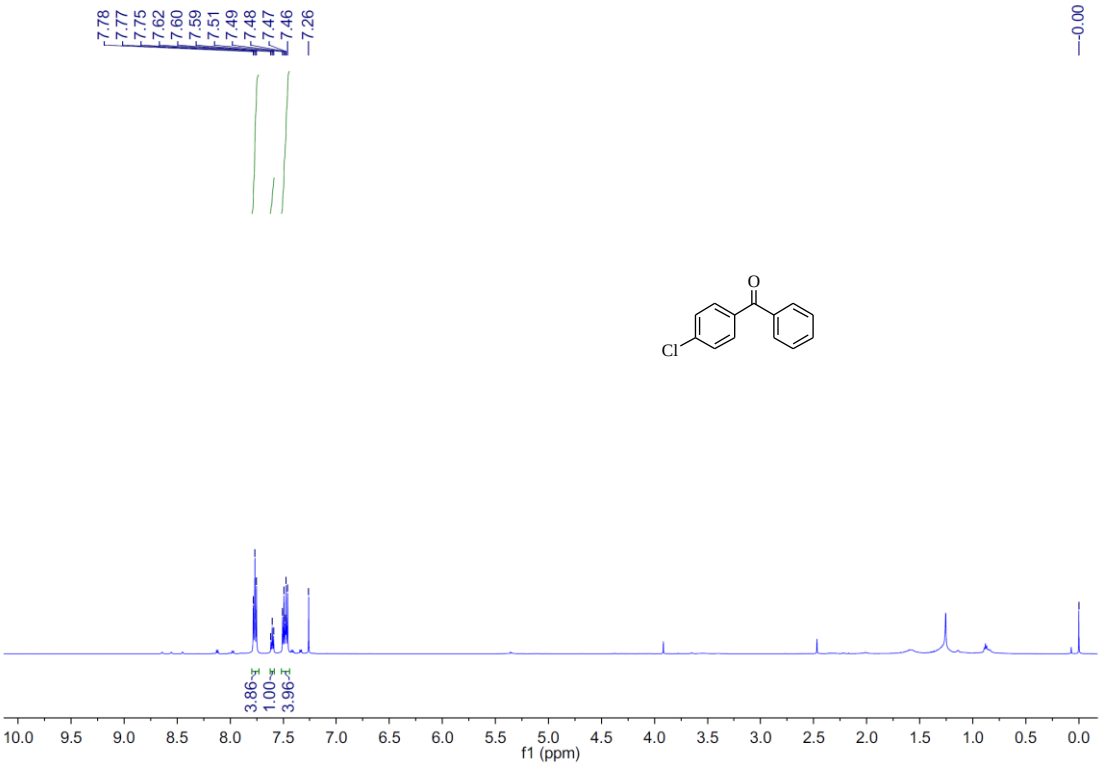
^{13}C NMR of (4-fluorophenyl)(phenyl)methanone **3ha**



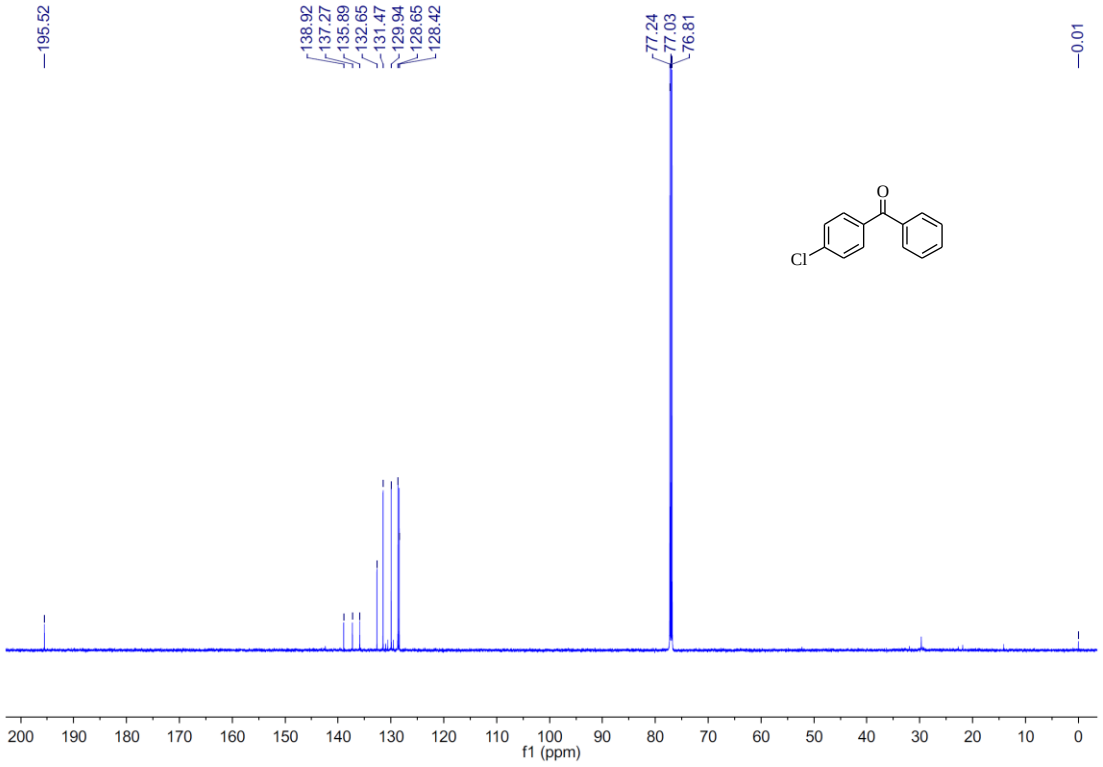
^{19}F NMR of (4-fluorophenyl)(phenyl)methanone **3ha**



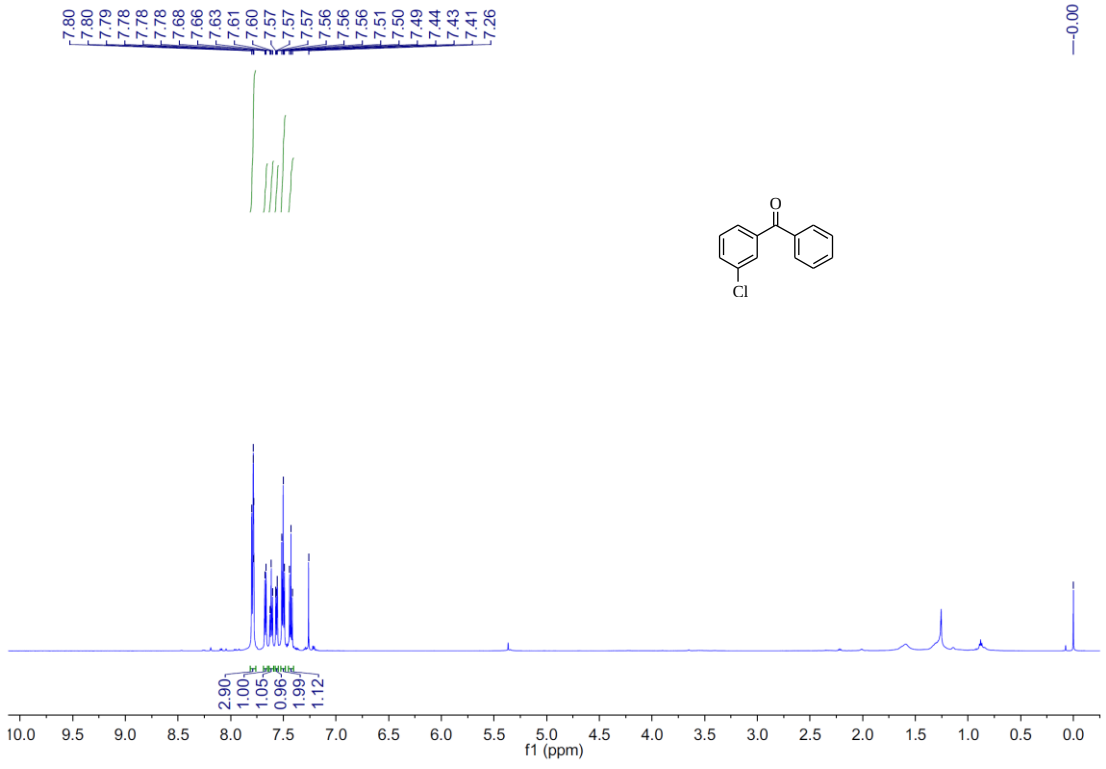
^{1}H NMR of (4-chlorophenyl)(phenyl)methanone **3ia**



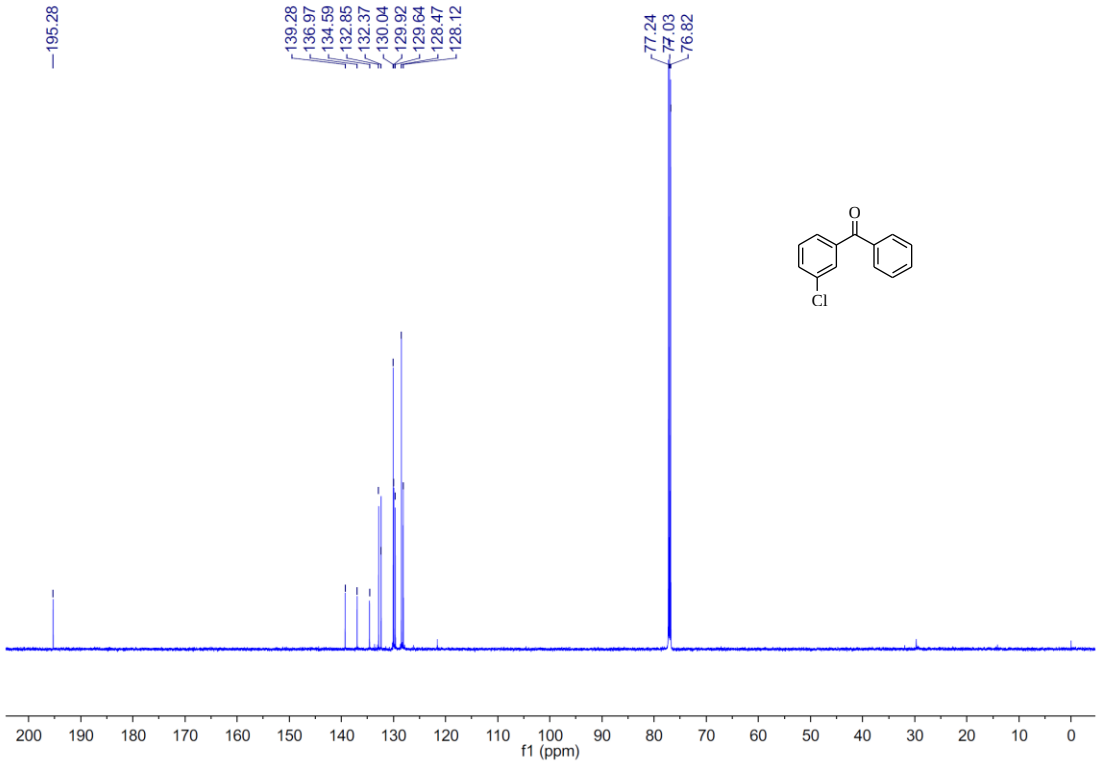
^{13}C NMR of (4-chlorophenyl)(phenyl)methanone **3ia**



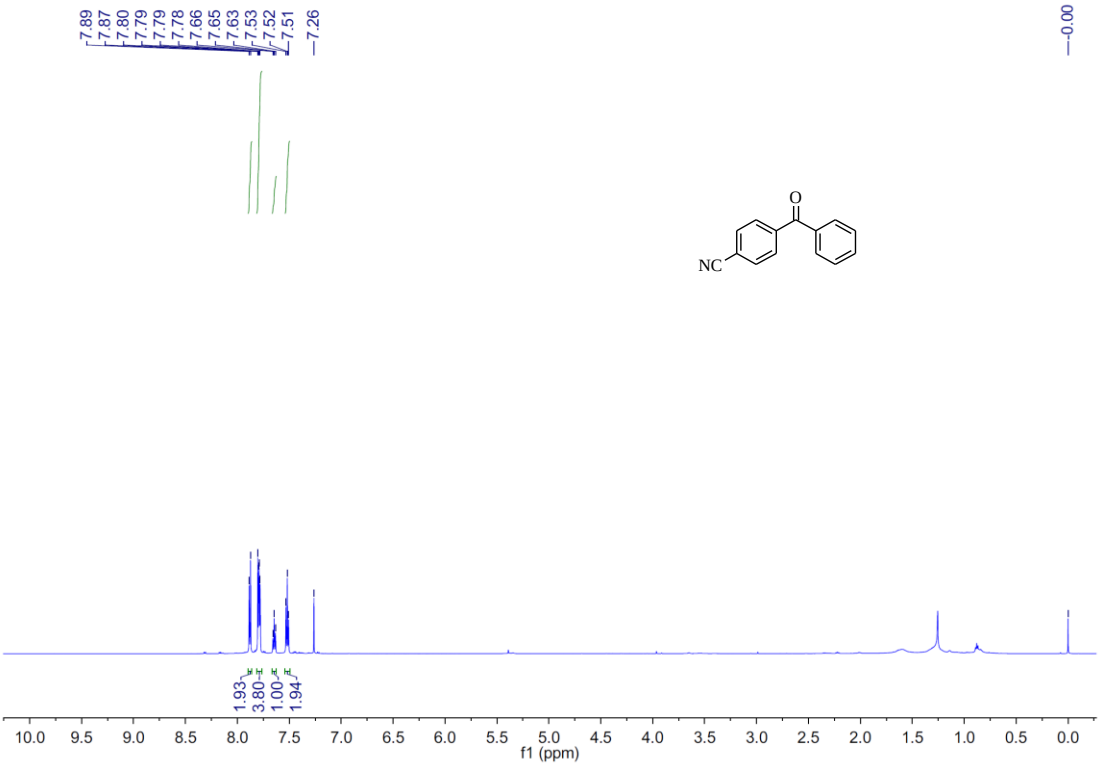
^{1}H NMR of (3-chlorophenyl)(phenyl)methanone **3ja**



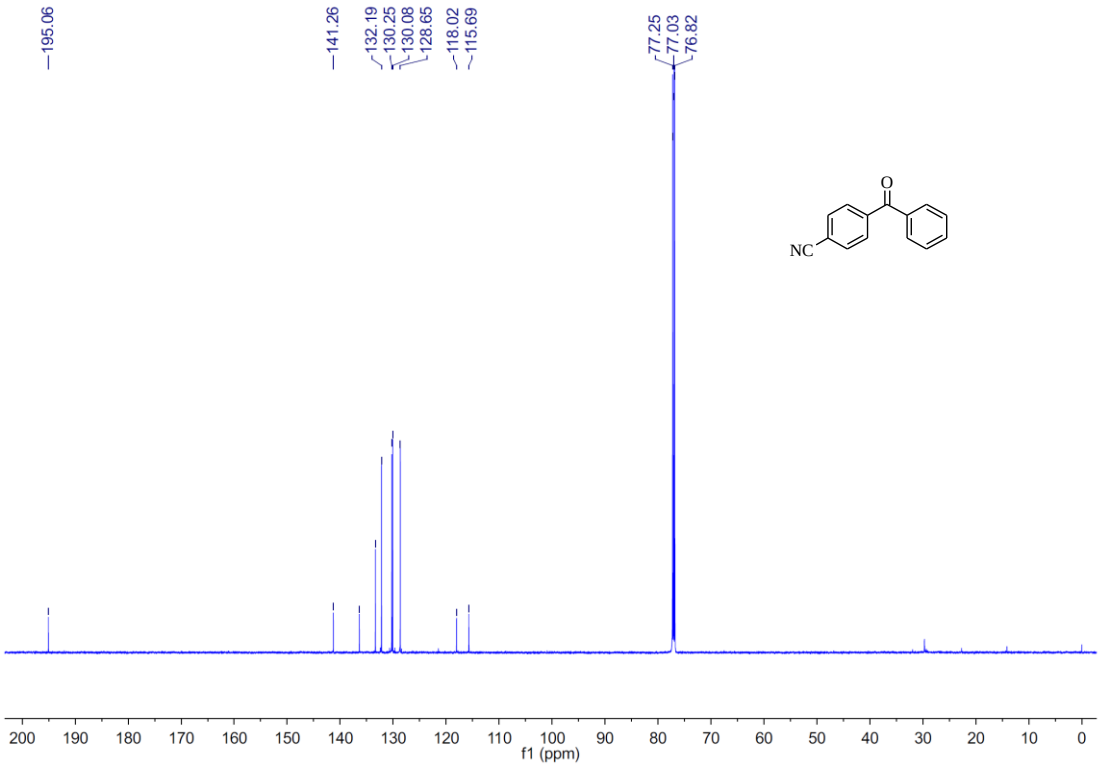
^{13}C NMR of (3-chlorophenyl)(phenyl)methanone **3ja**



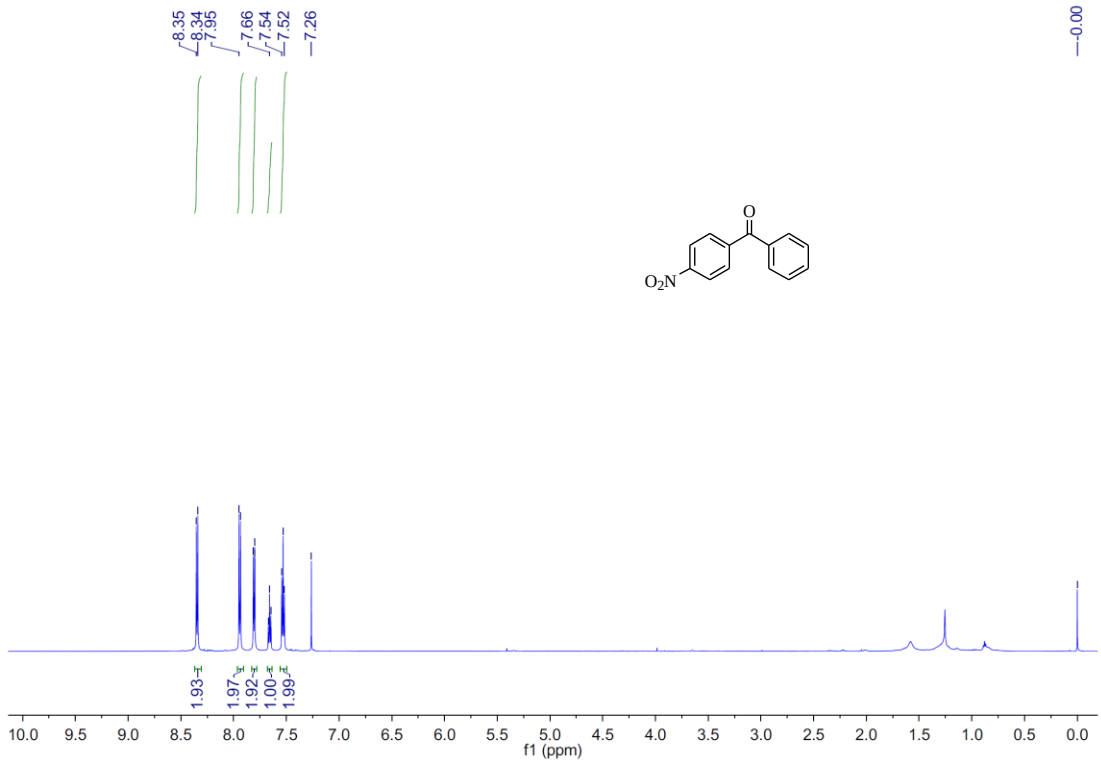
^{1}H NMR of 4-benzoylbenzonitrile **3ka**



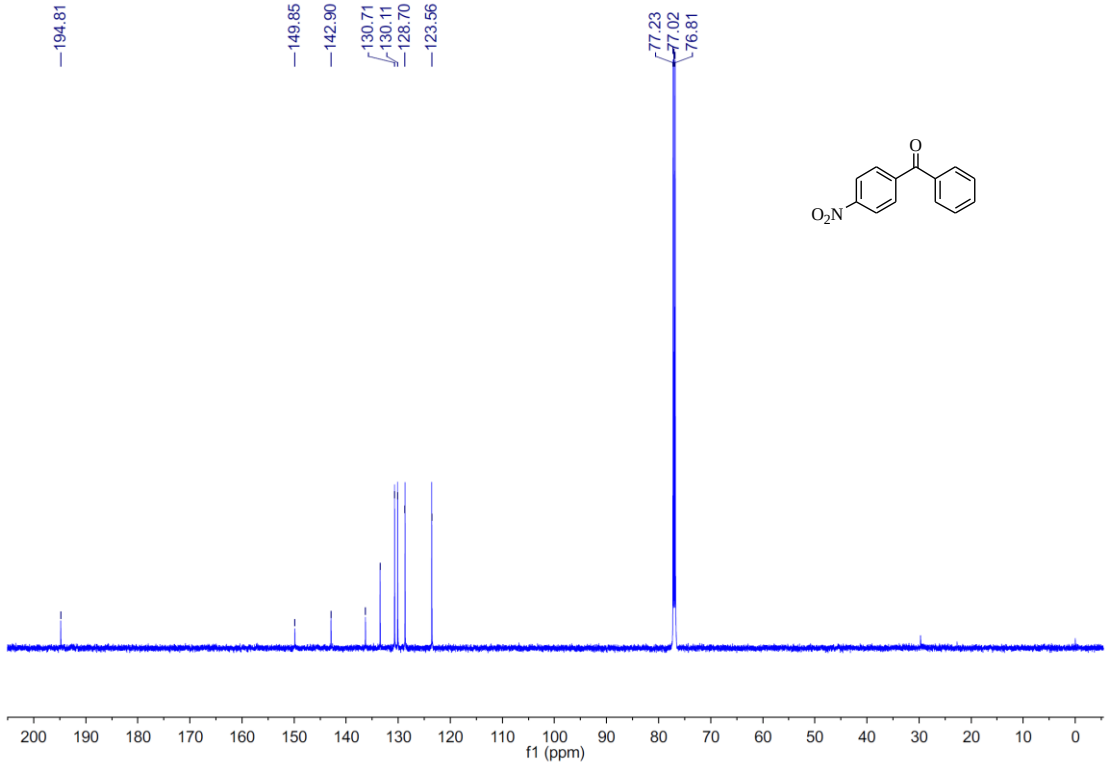
^{13}C NMR of 4-benzoylbenzonitrile **3ka**



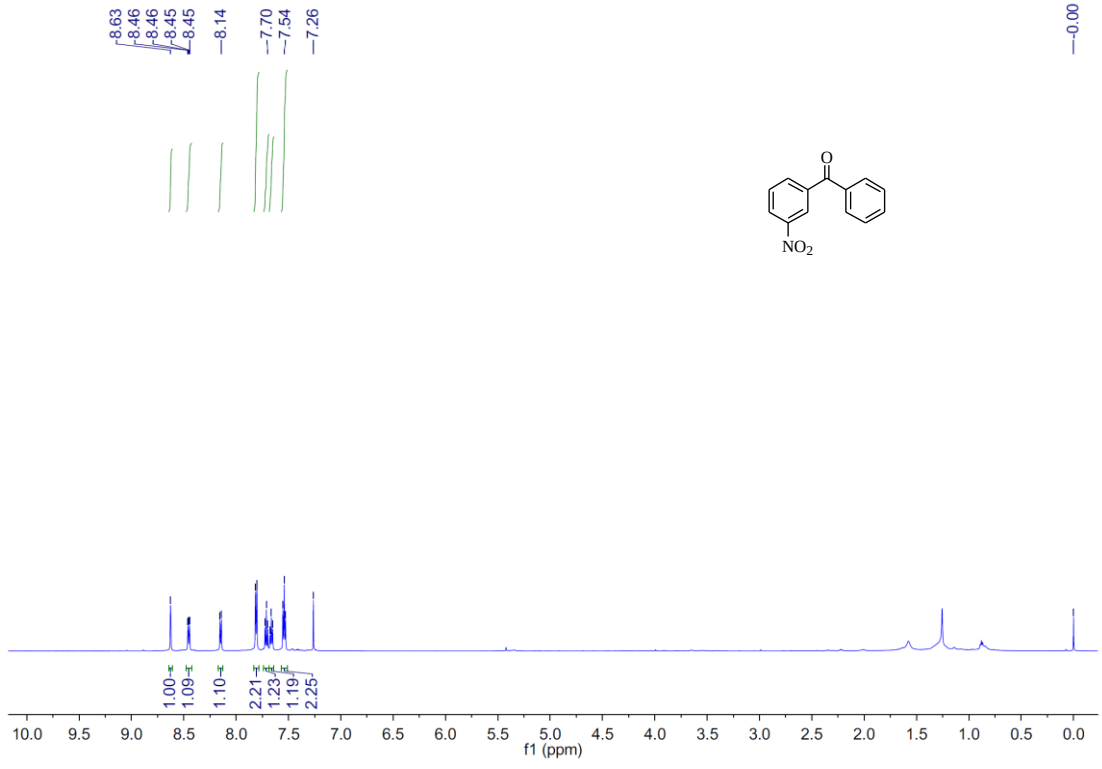
^{1}H NMR of (4-nitrophenyl)(phenyl)methanone **3la**



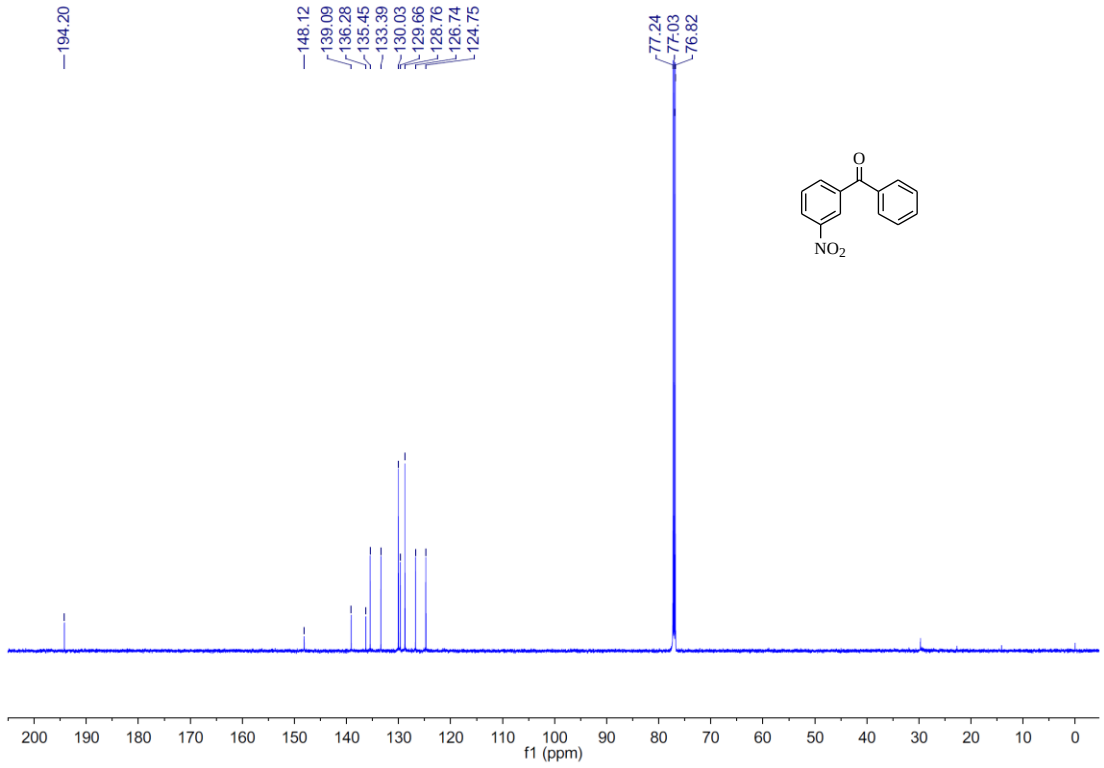
^{13}C NMR of (4-nitrophenyl)(phenyl)methanone **3la**



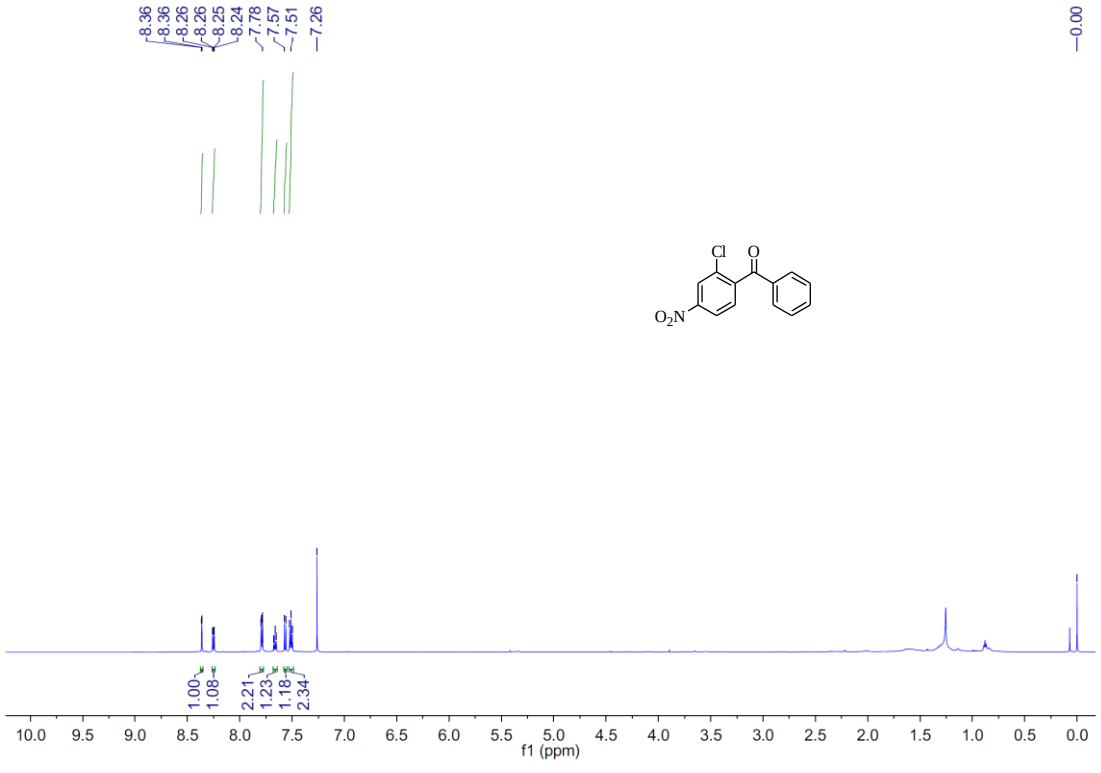
^{1}H NMR of (3-nitrophenyl)(phenyl)methanone **3ma**



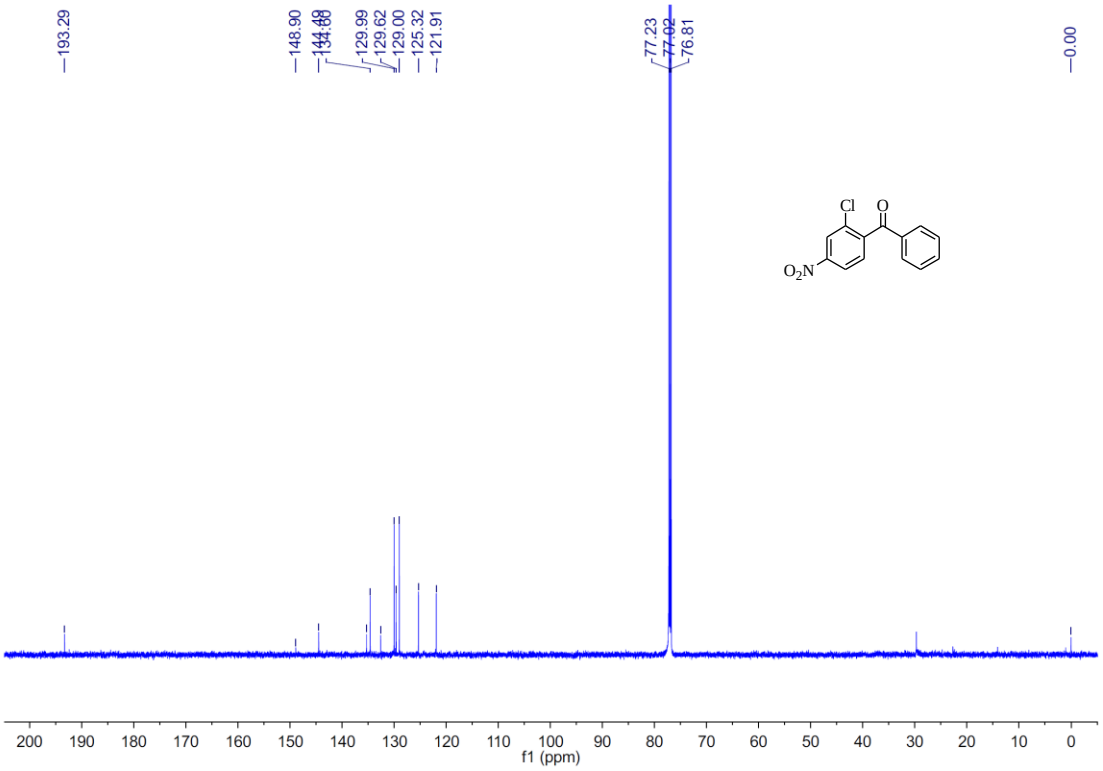
^{13}C NMR of (3-nitrophenyl)(phenyl)methanone **3ma**



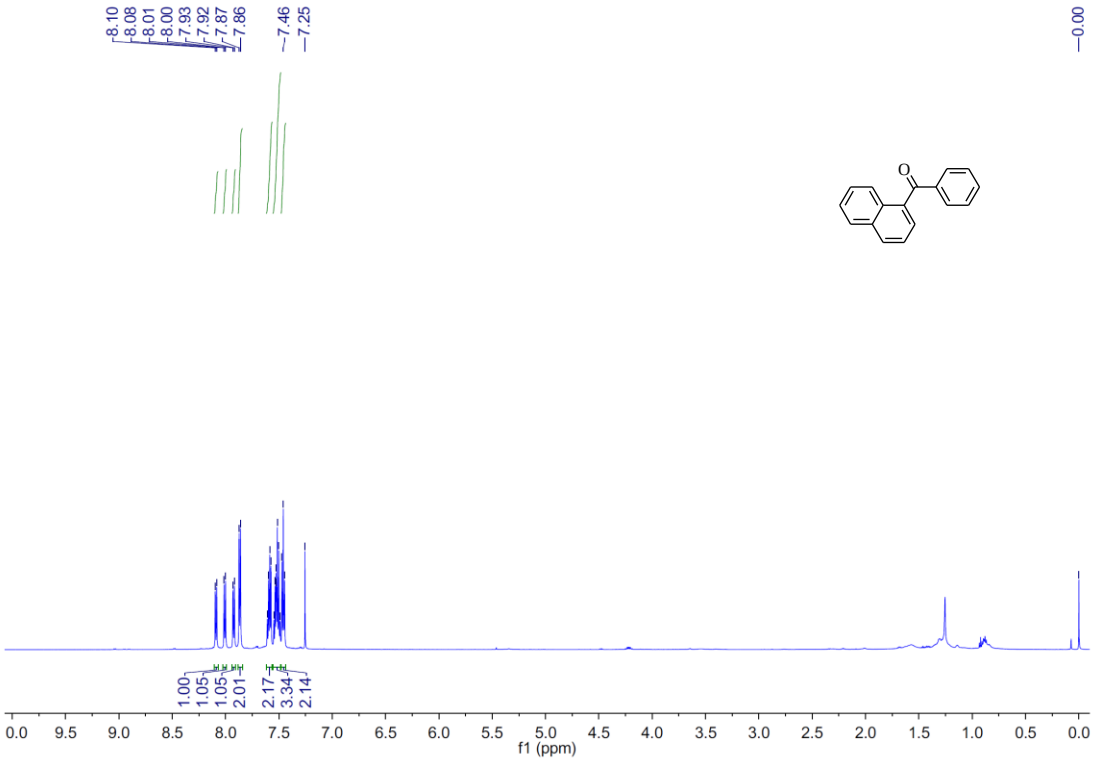
^{1}H NMR of (2-chloro-4-nitrophenyl)(phenyl)methanone **3na**



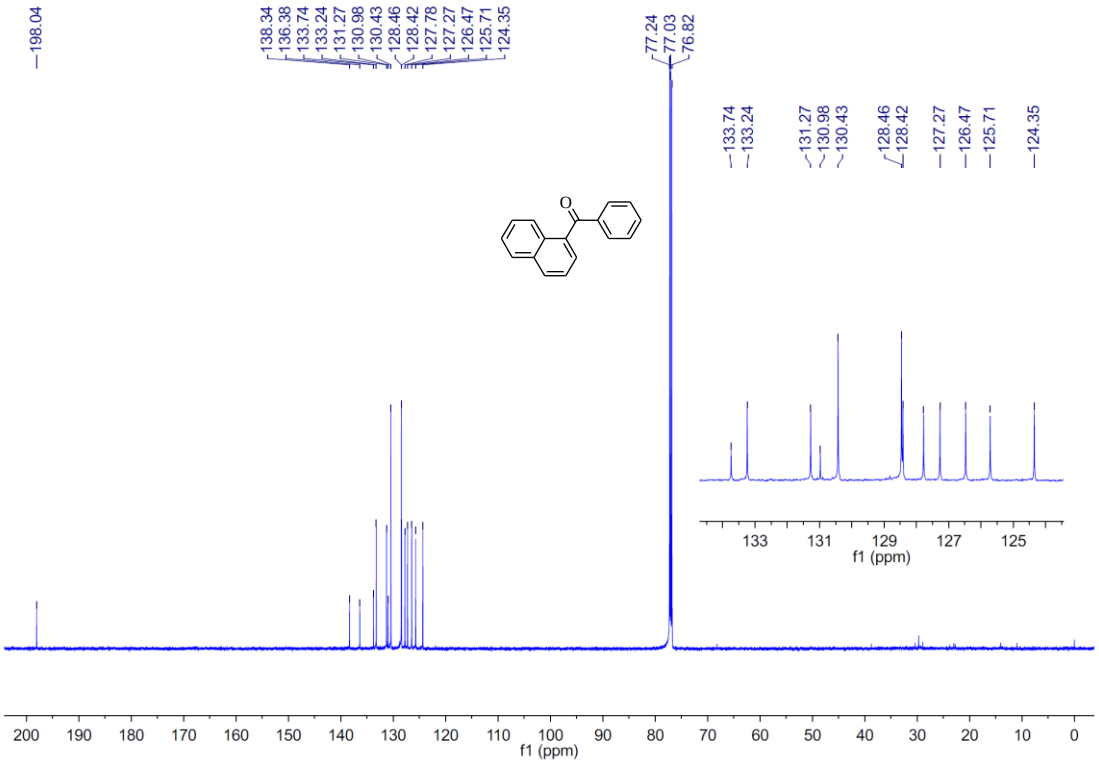
^{13}C NMR of (2-chloro-4-nitrophenyl)(phenyl)methanone **3na**



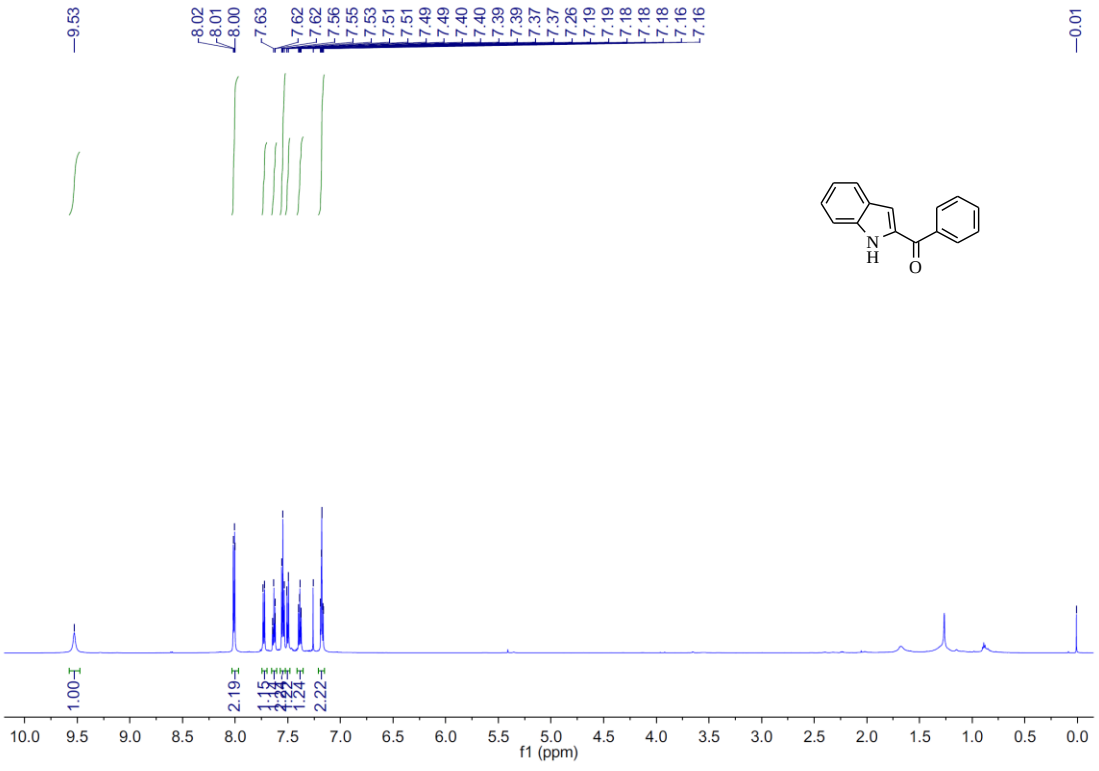
^{1}H NMR of naphthalen-1-yl(phenyl)methanone **3oa**



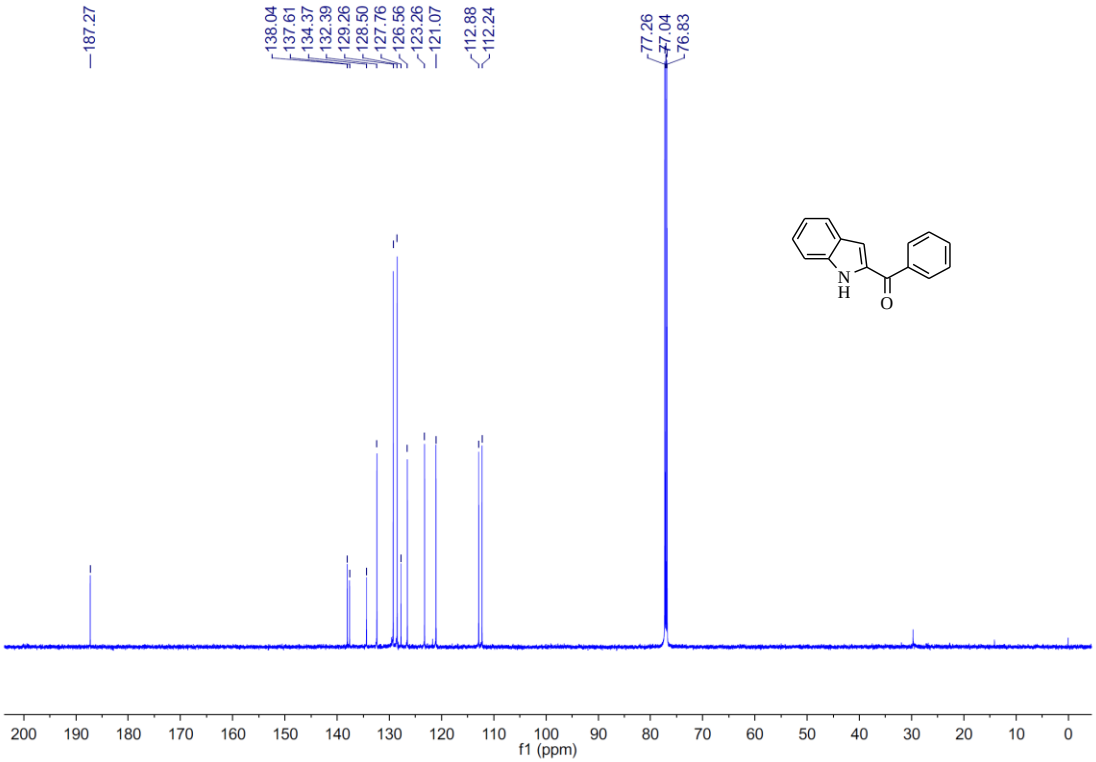
^{13}C NMR of naphthalen-1-yl(phenyl)methanone **3oa**



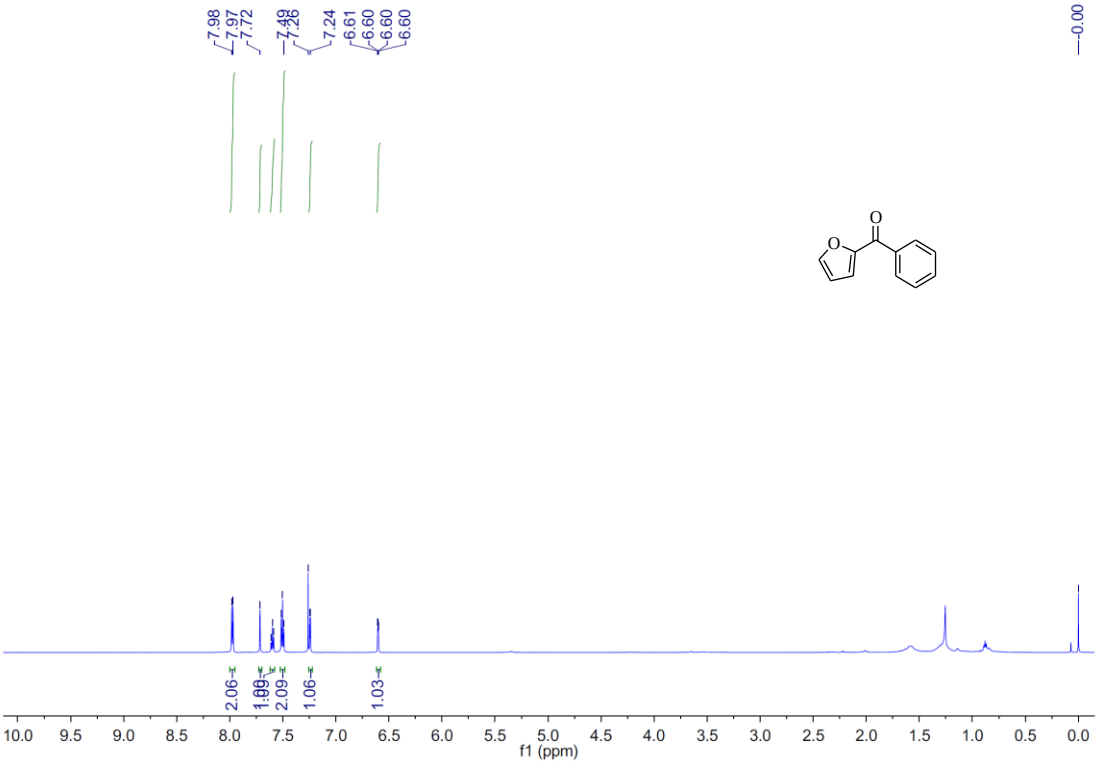
^{1}H NMR of (*1H*-indol-2-yl)(phenyl)methanone **3pa**



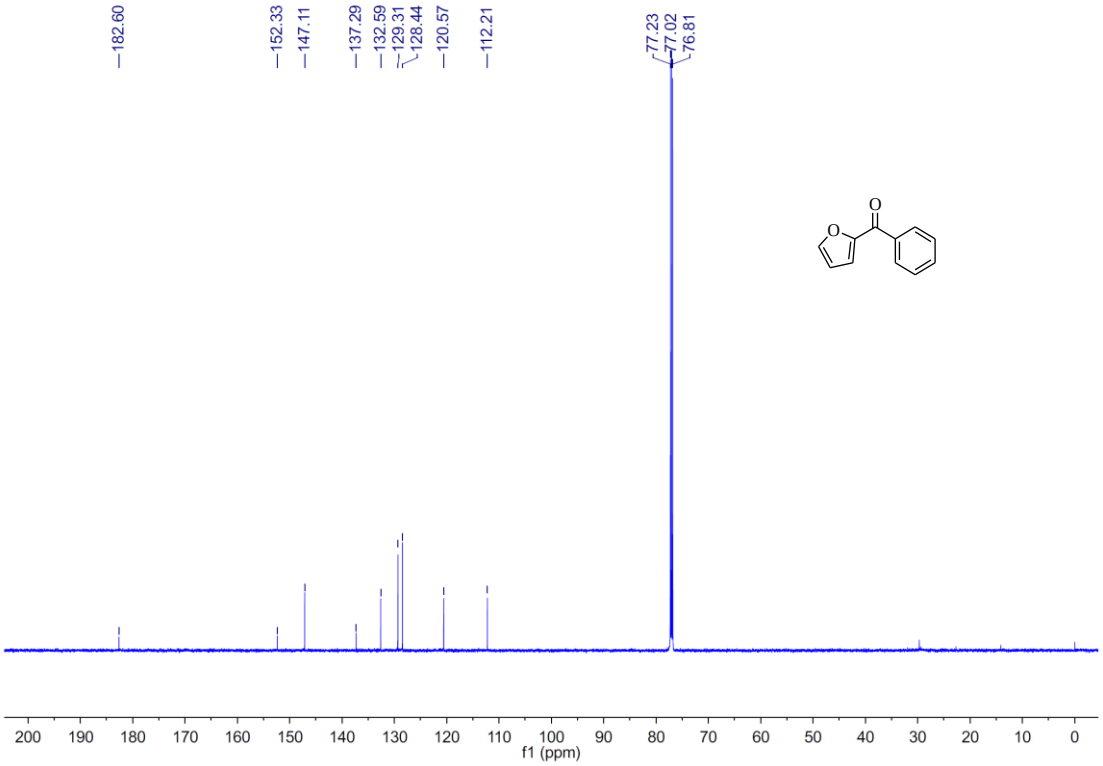
^{13}C NMR of (*1H*-indol-2-yl)(phenyl)methanone **3pa**



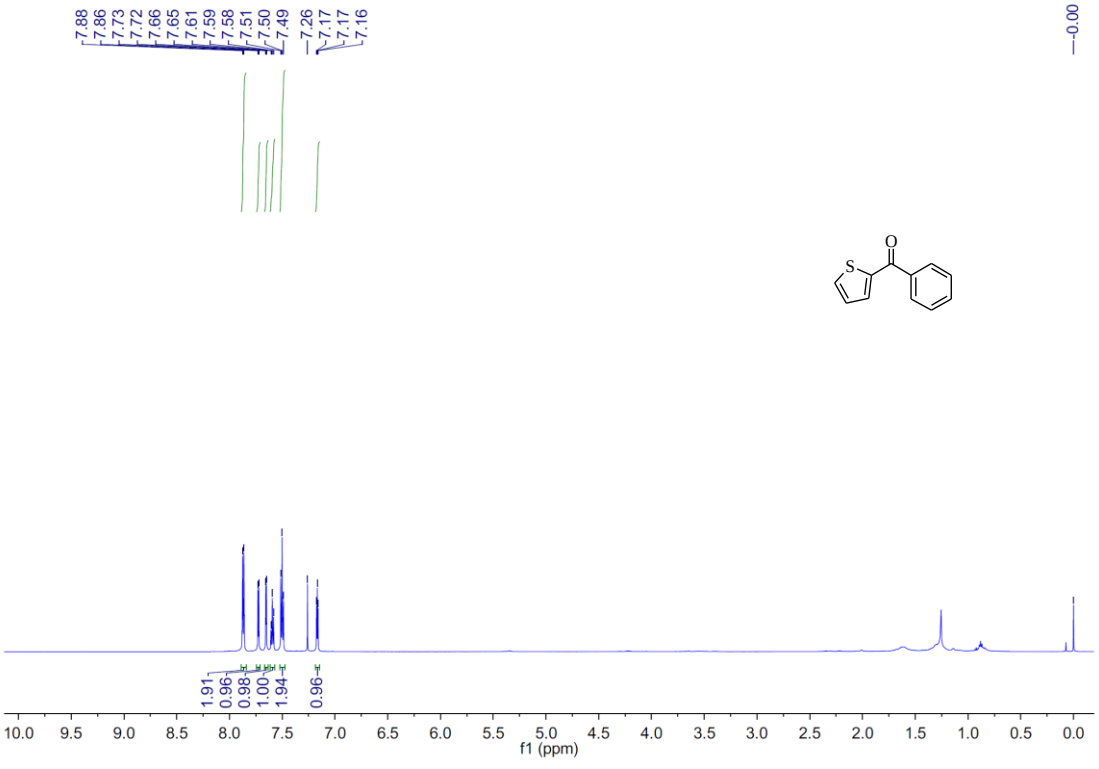
^{1}H NMR of furan-2-yl(phenyl)methanone **3qa**



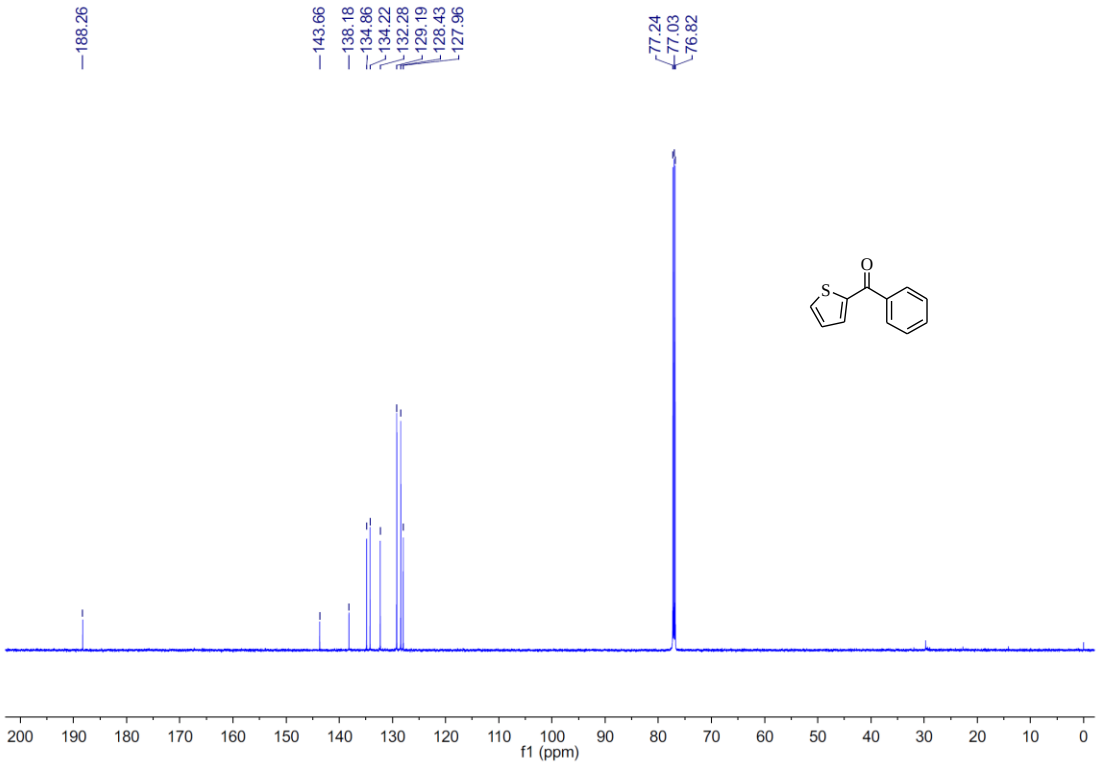
^{13}C NMR of furan-2-yl(phenyl)methanone **3qa**



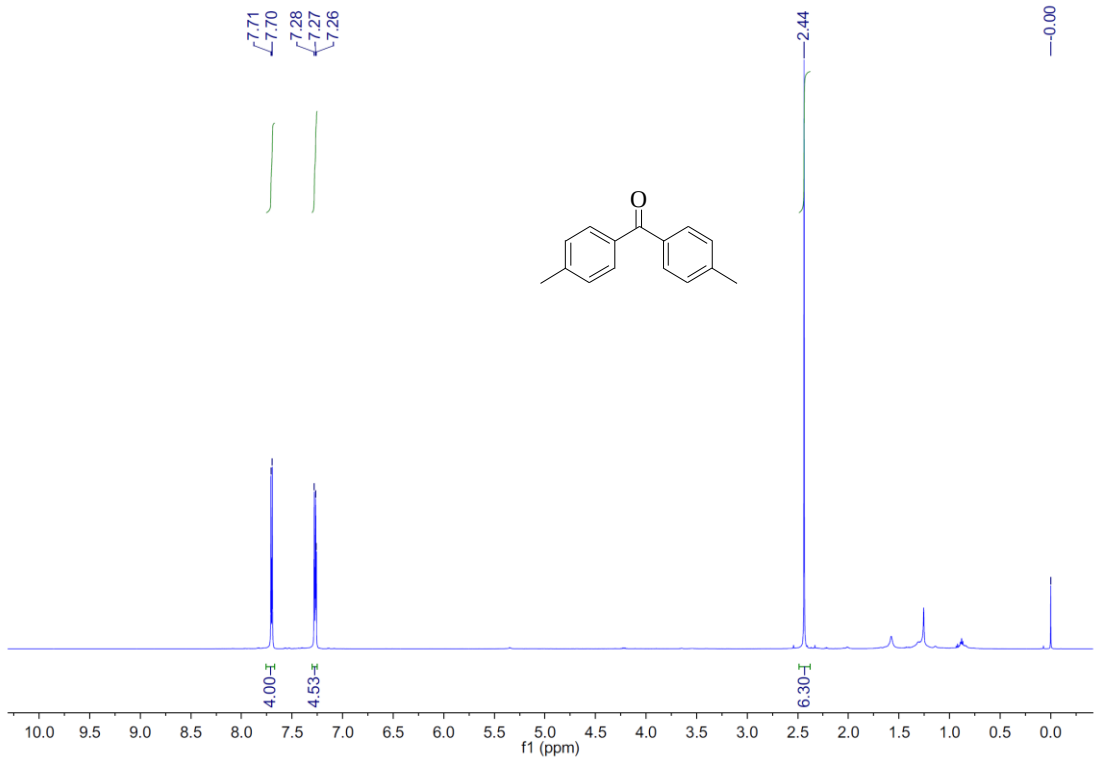
^{1}H NMR of phenyl(thiophen-2-yl)methanone **3ra**



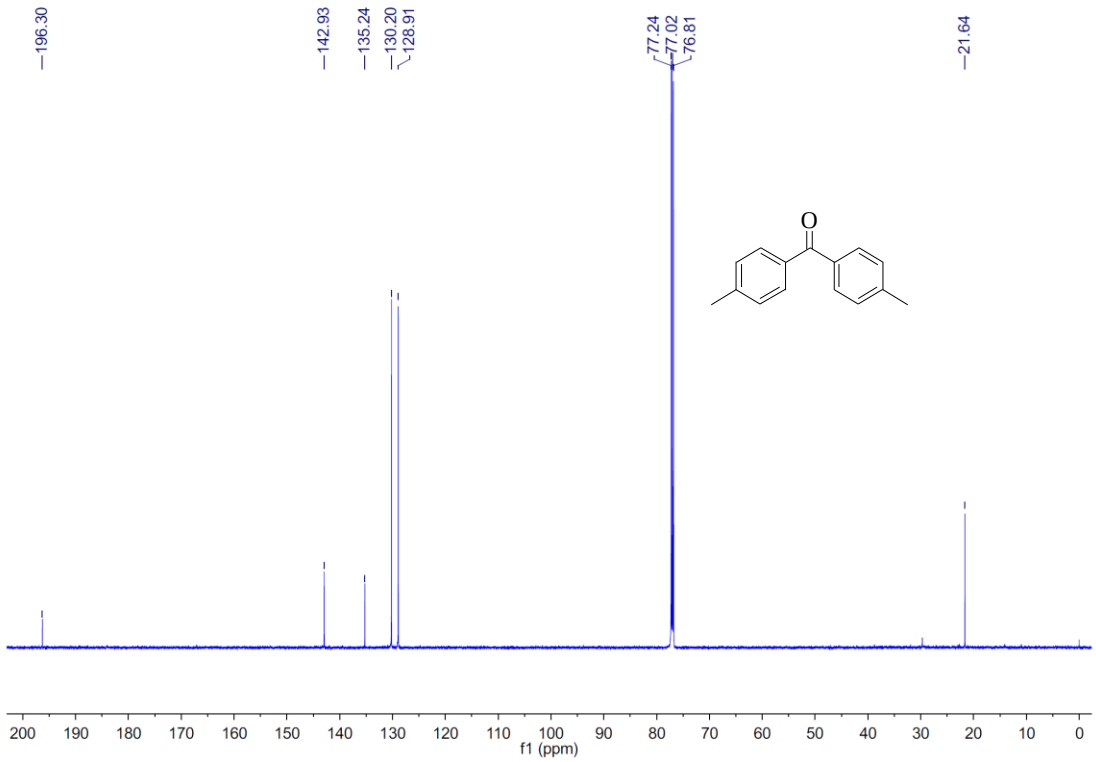
^{13}C NMR of phenyl(thiophen-2-yl)methanone **3ra**



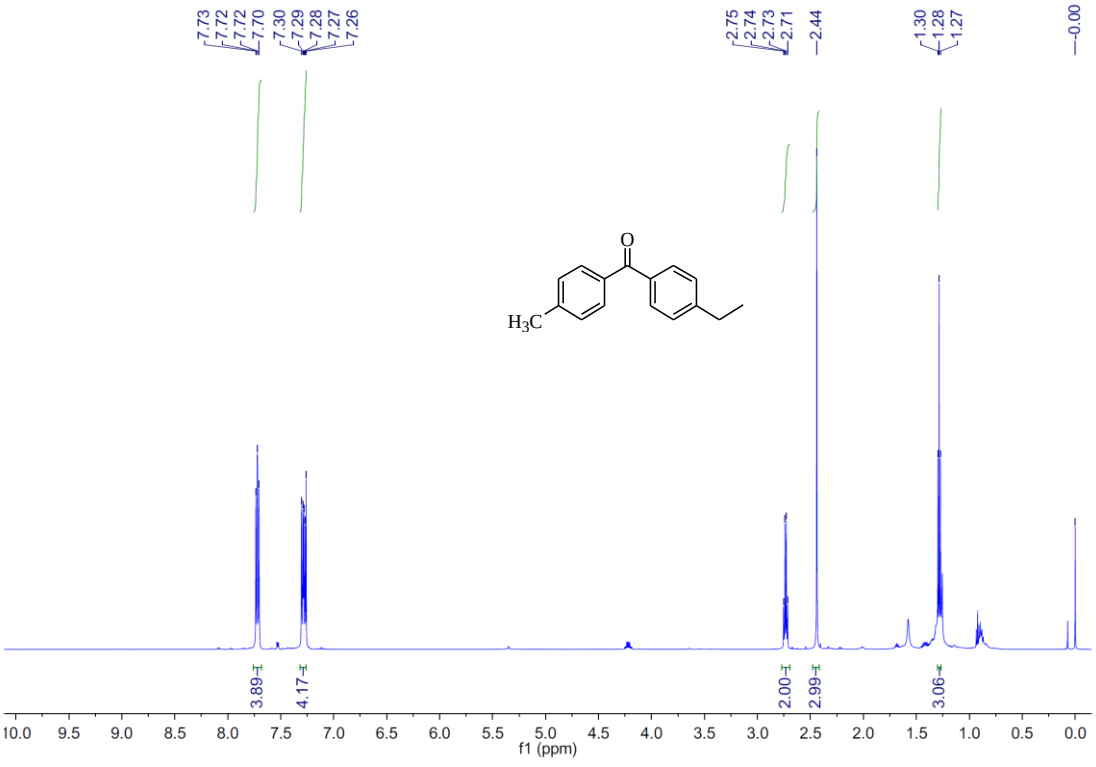
^{1}H NMR of di-p-tolyl-methanone **3ab**



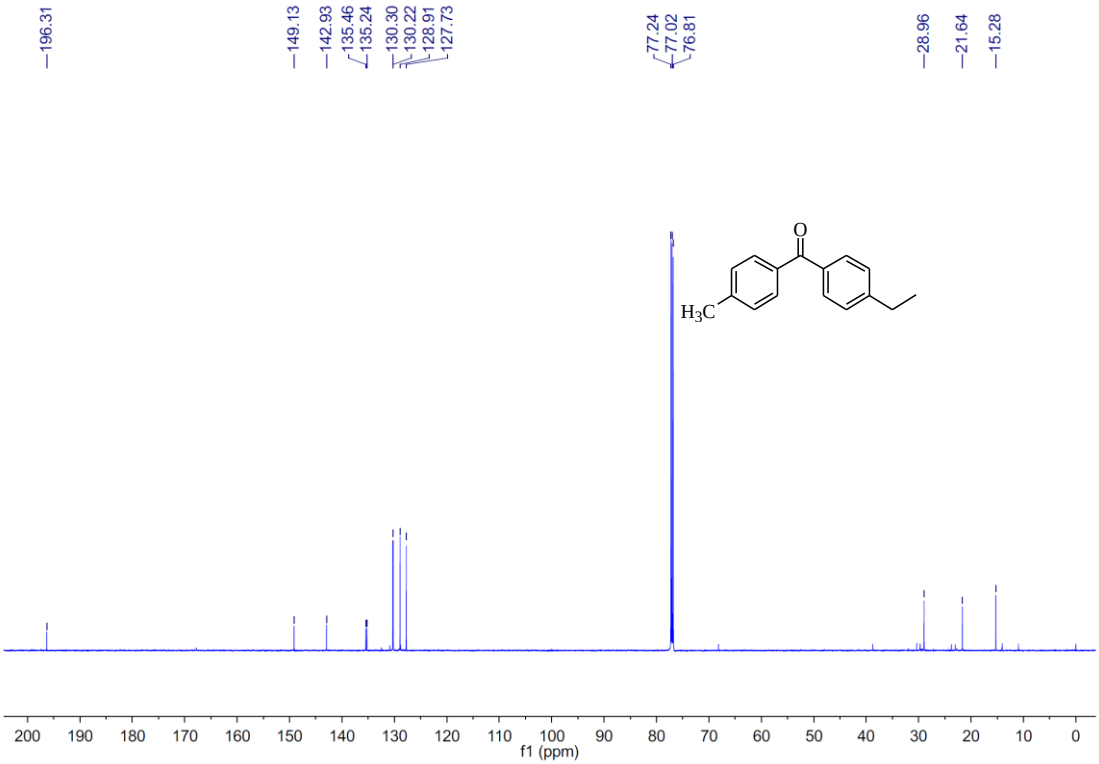
^{13}C NMR of di-p-tolyl-methanone **3ab**



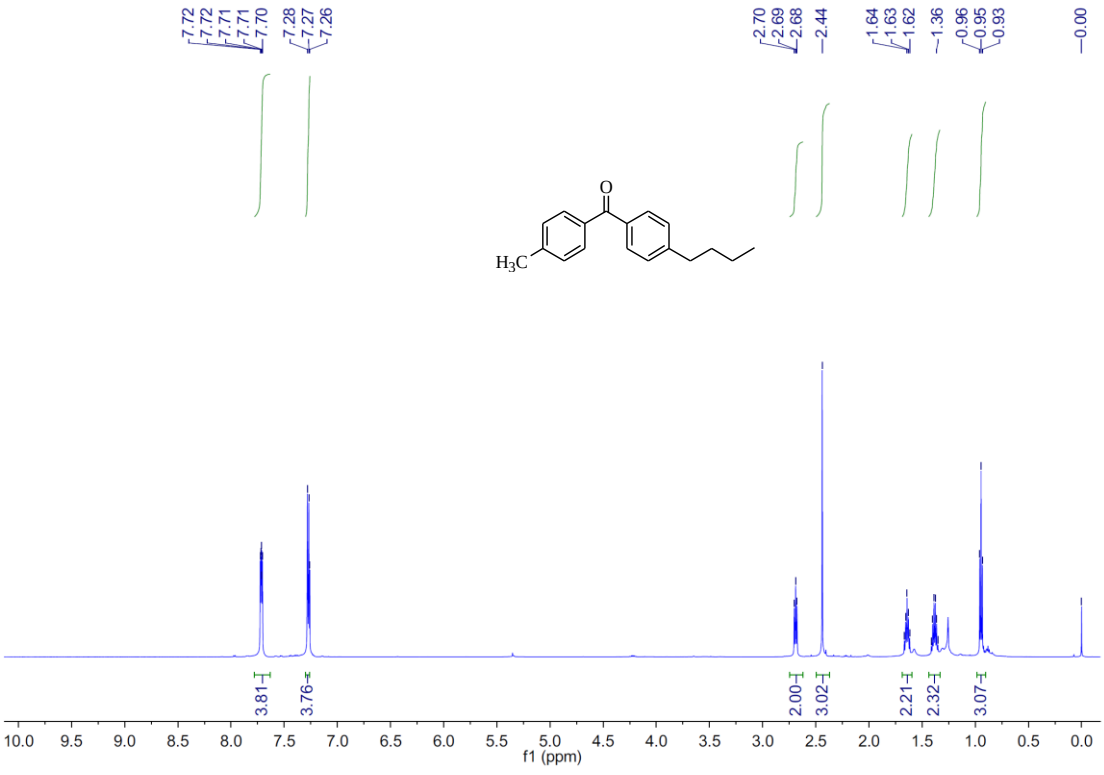
^{1}H NMR of (4-ethylphenyl)(p-tolyl)methanone **3ac**



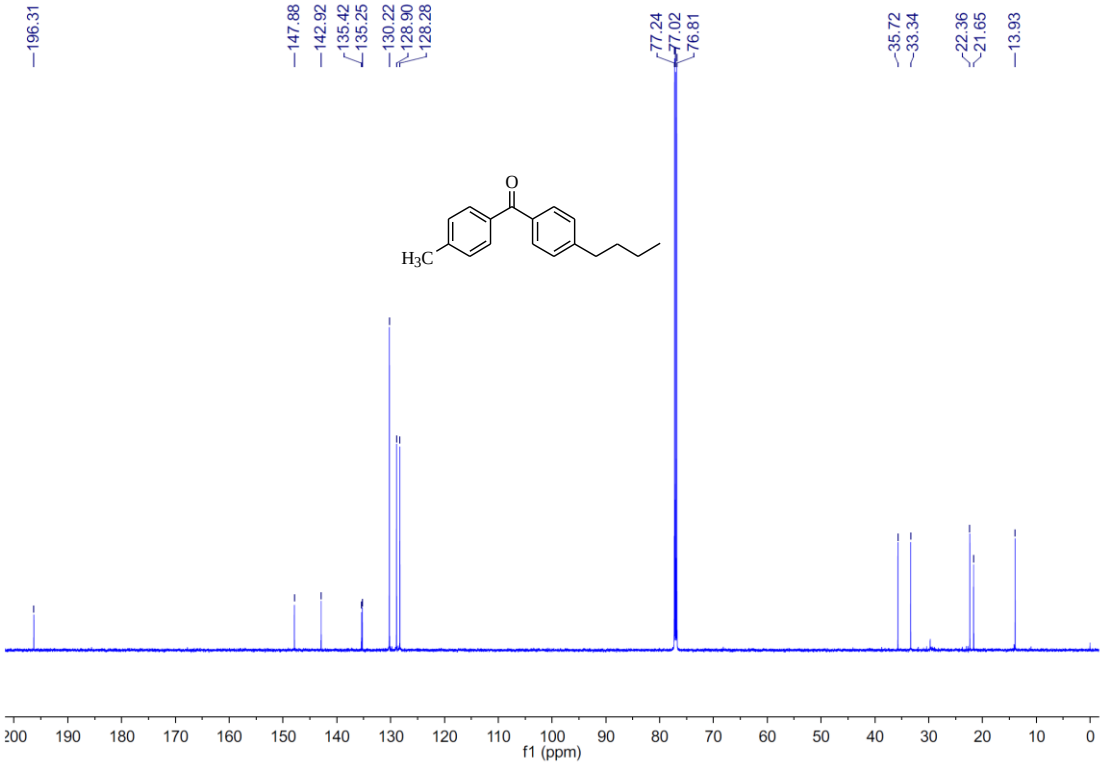
^{13}C NMR of (4-ethylphenyl)(p-tolyl)methanone **3ac**



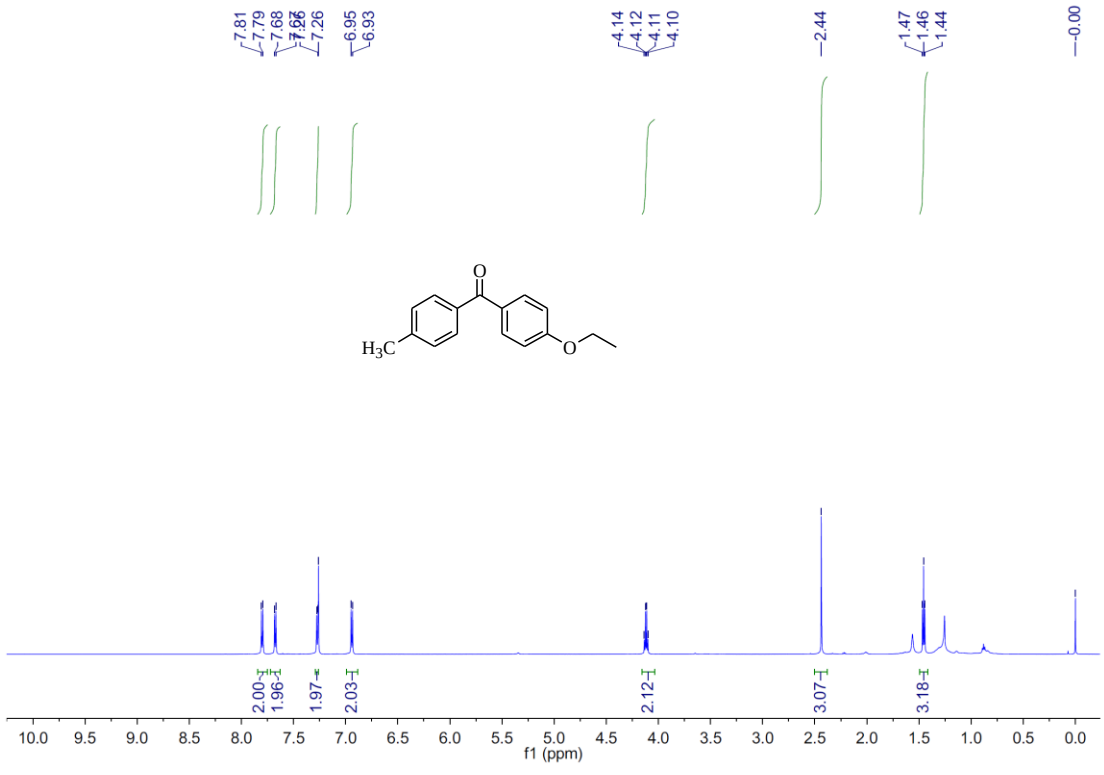
^{1}H NMR of (4-butylphenyl)(p-tolyl)methanone **3ad**



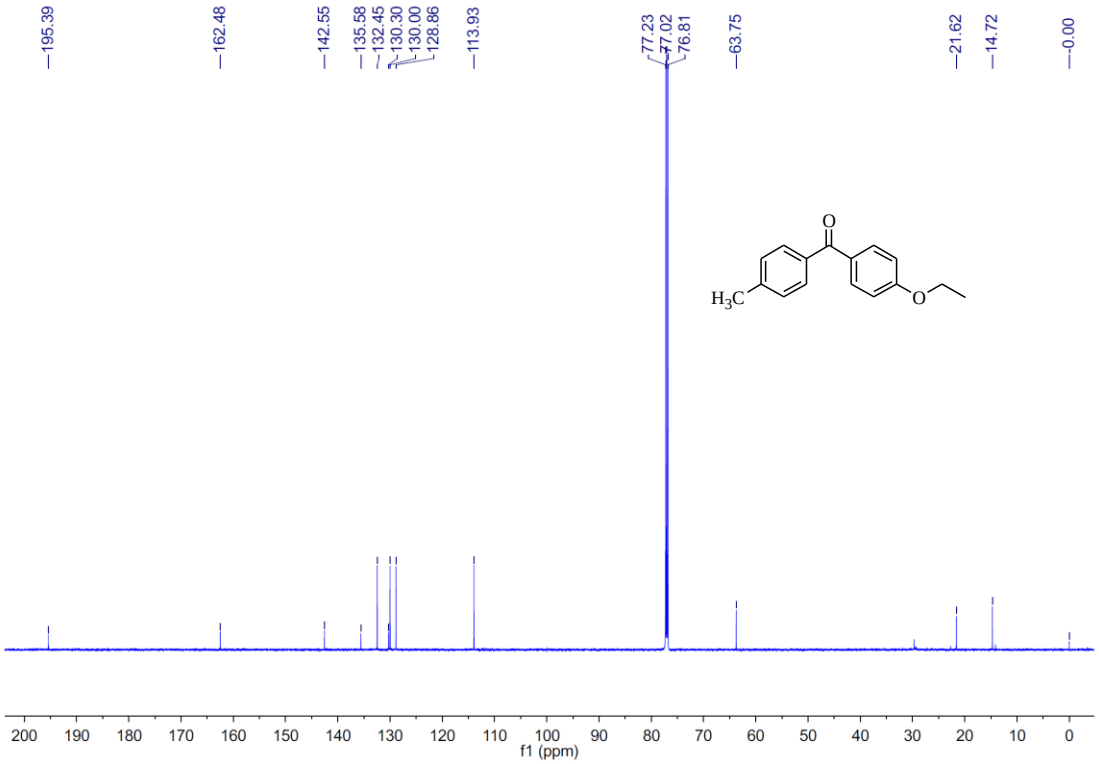
^{13}C NMR of (4-butylphenyl)(p-tolyl)methanone **3ad**



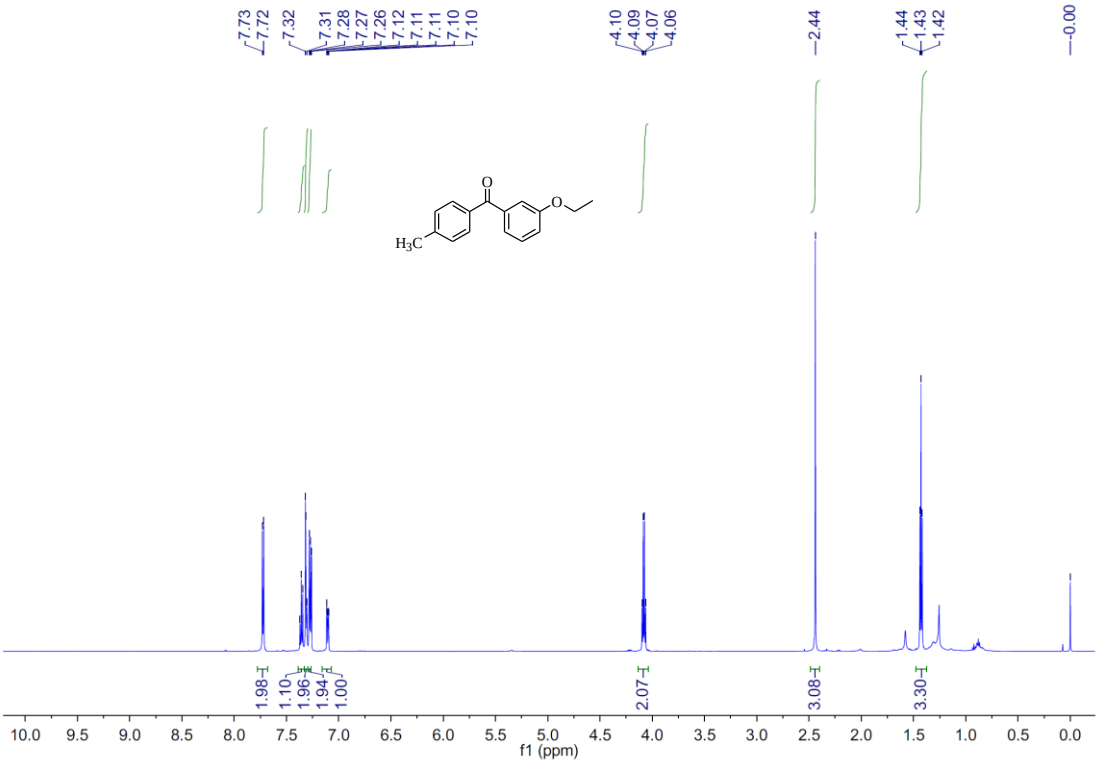
^{1}H NMR of (4-ethoxyphenyl)(p-tolyl)methanone **3ae**



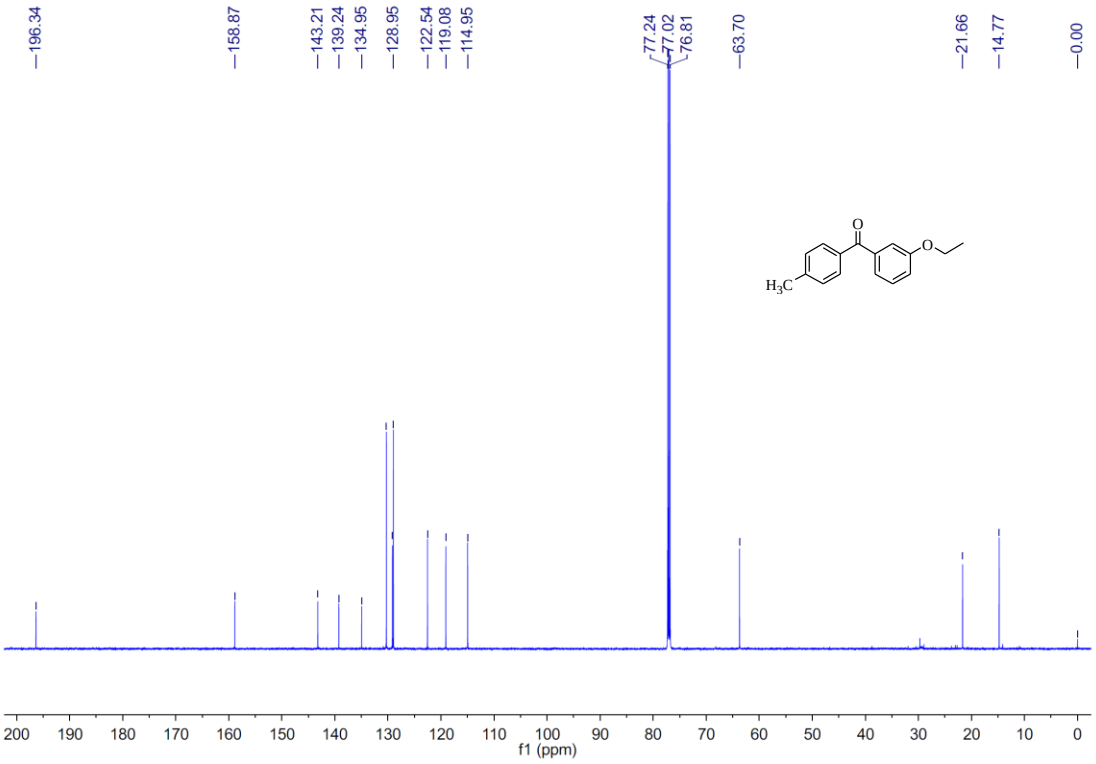
^{13}C NMR of (4-ethoxyphenyl)(p-tolyl)methanone **3ae**



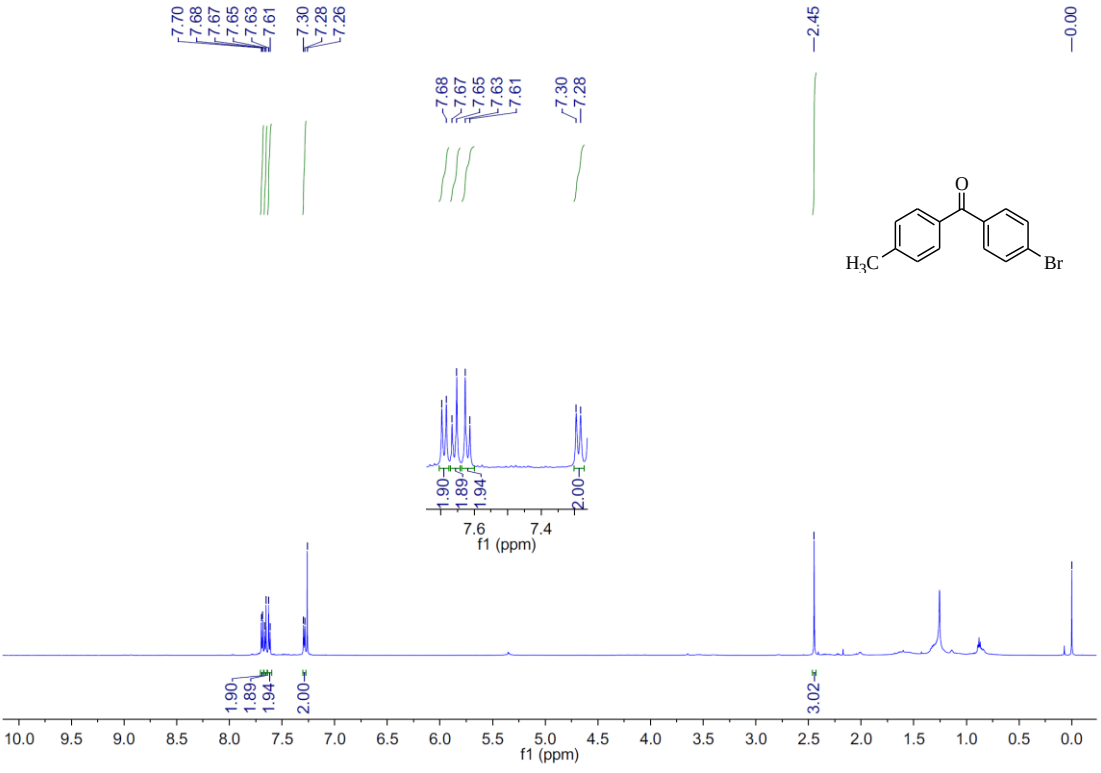
^{1}H NMR of (3-ethoxyphenyl)(p-tolyl)methanone **3af**



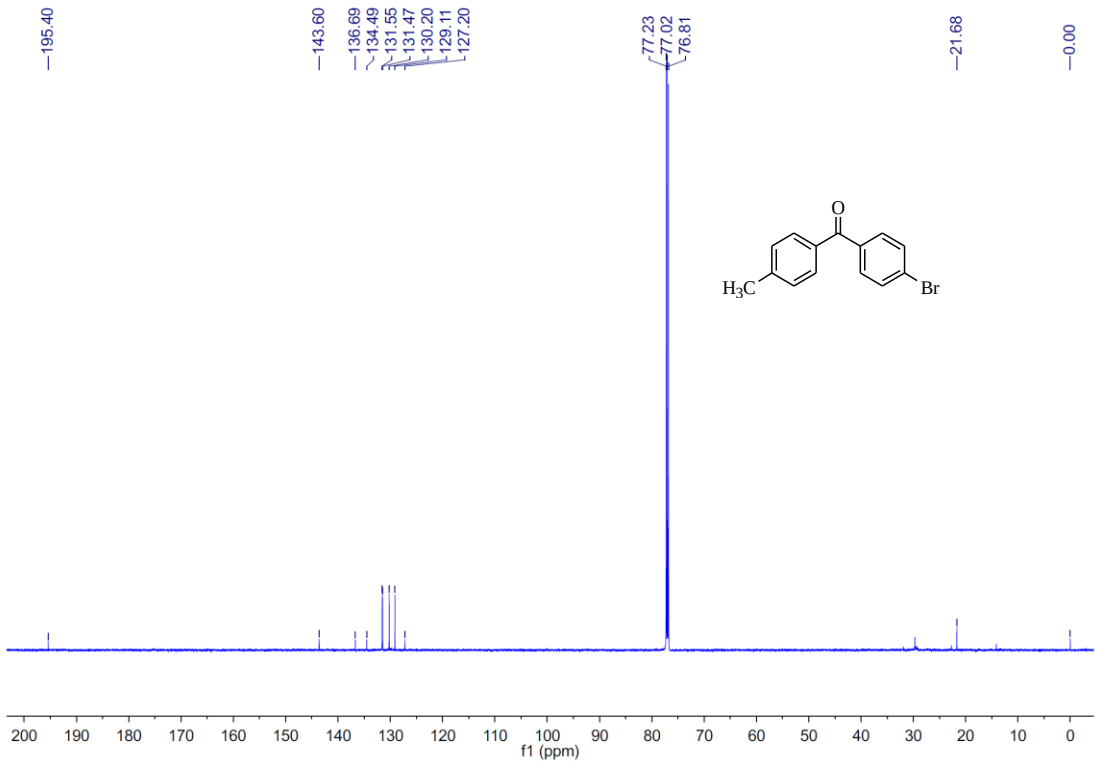
^{13}C NMR of (3-ethoxyphenyl)(p-tolyl)methanone **3af**



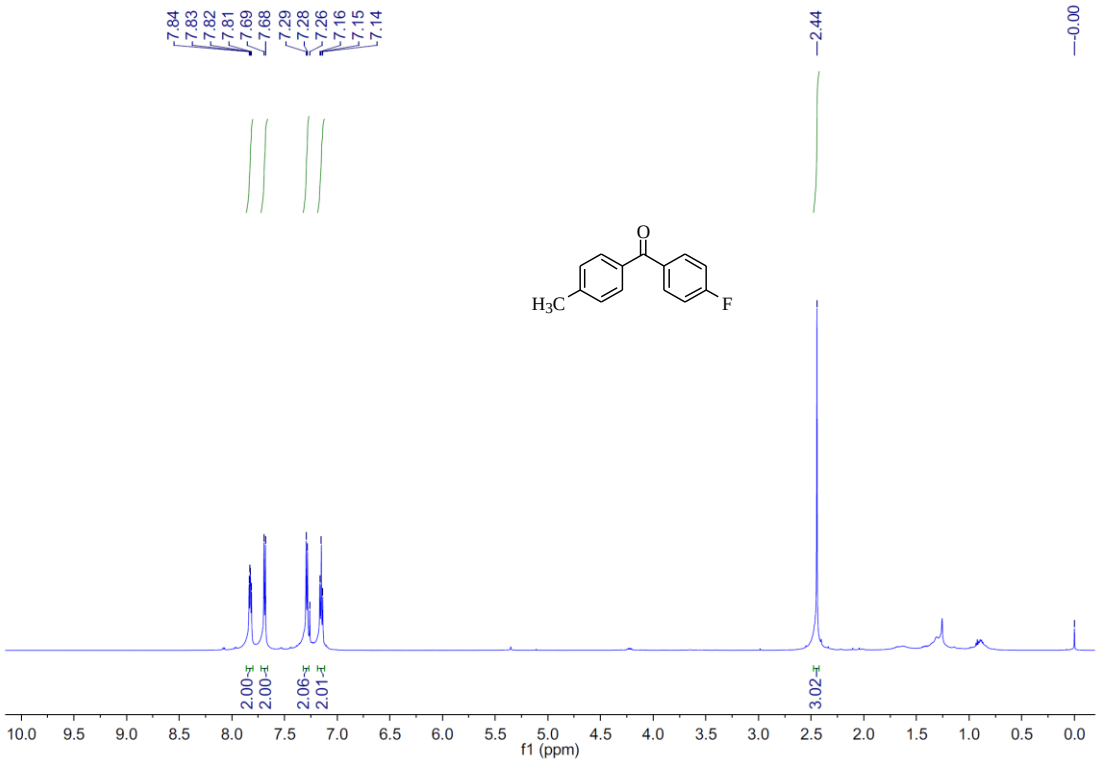
^{1}H NMR of (4-bromophenyl)(p-tolyl)methanone **3ah**



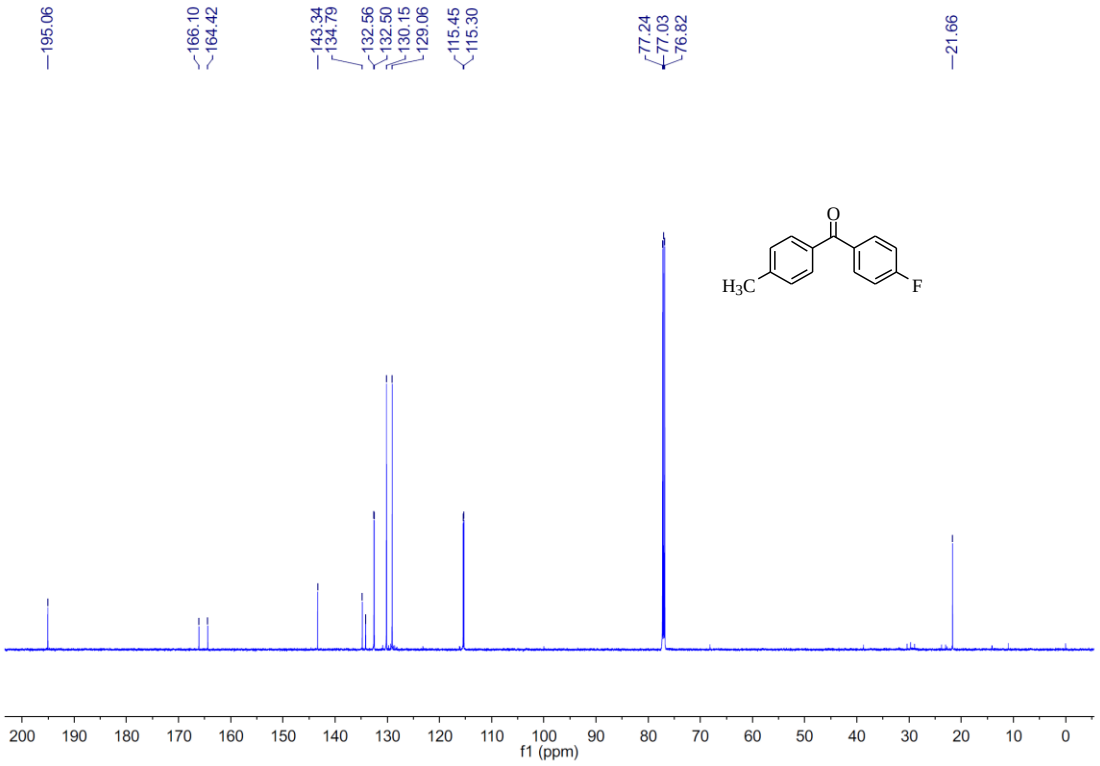
^{13}C NMR of (4-bromophenyl)(p-tolyl)methanone **3ah**



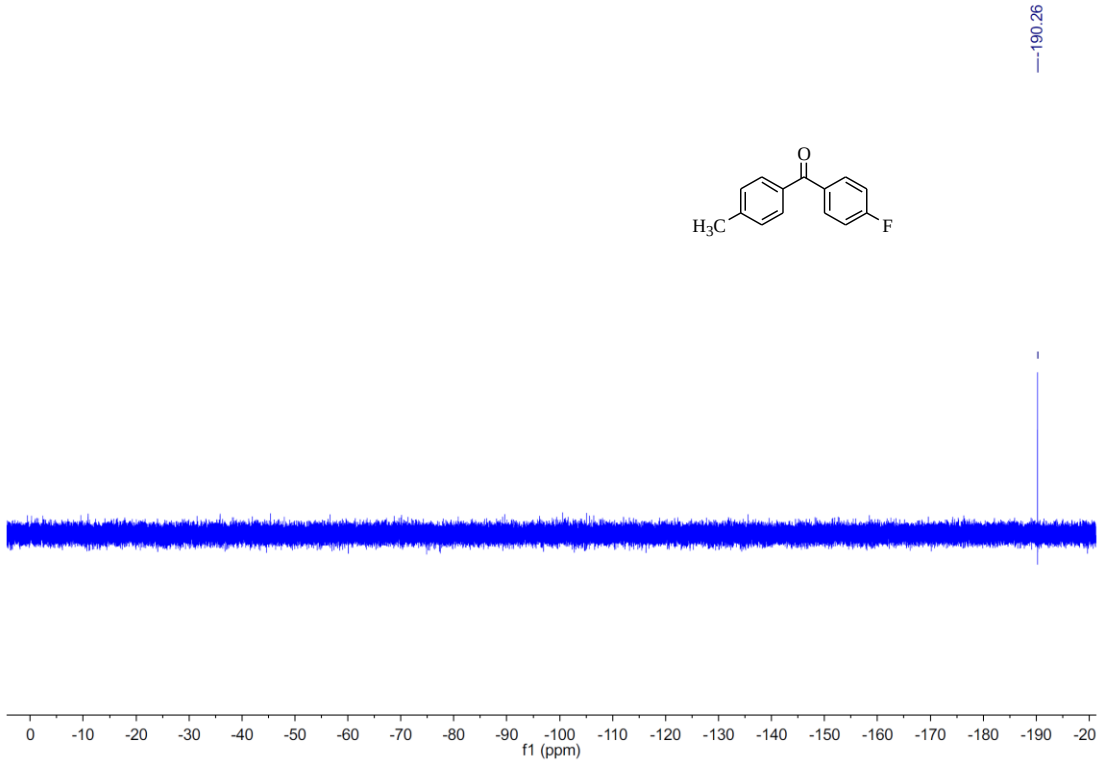
^{1}H NMR of (4-fluorophenyl)(p-tolyl)methanone **3ai**



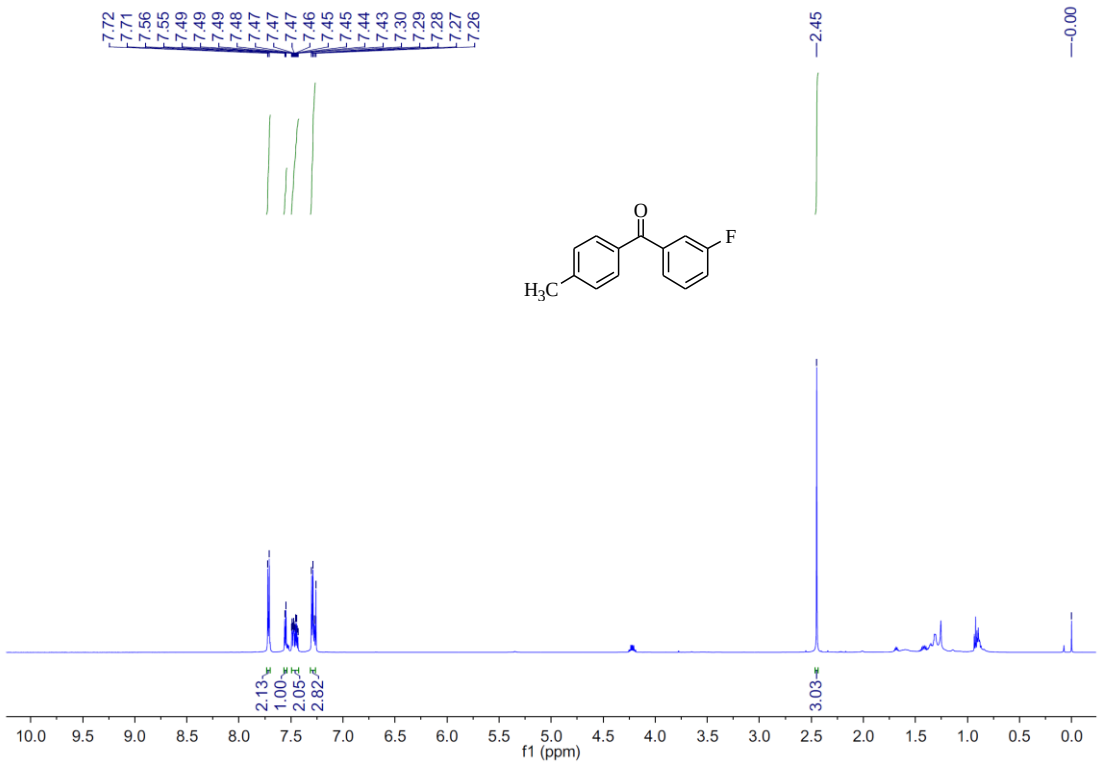
^{13}C NMR of (4-fluorophenyl)(p-tolyl)methanone **3ai**



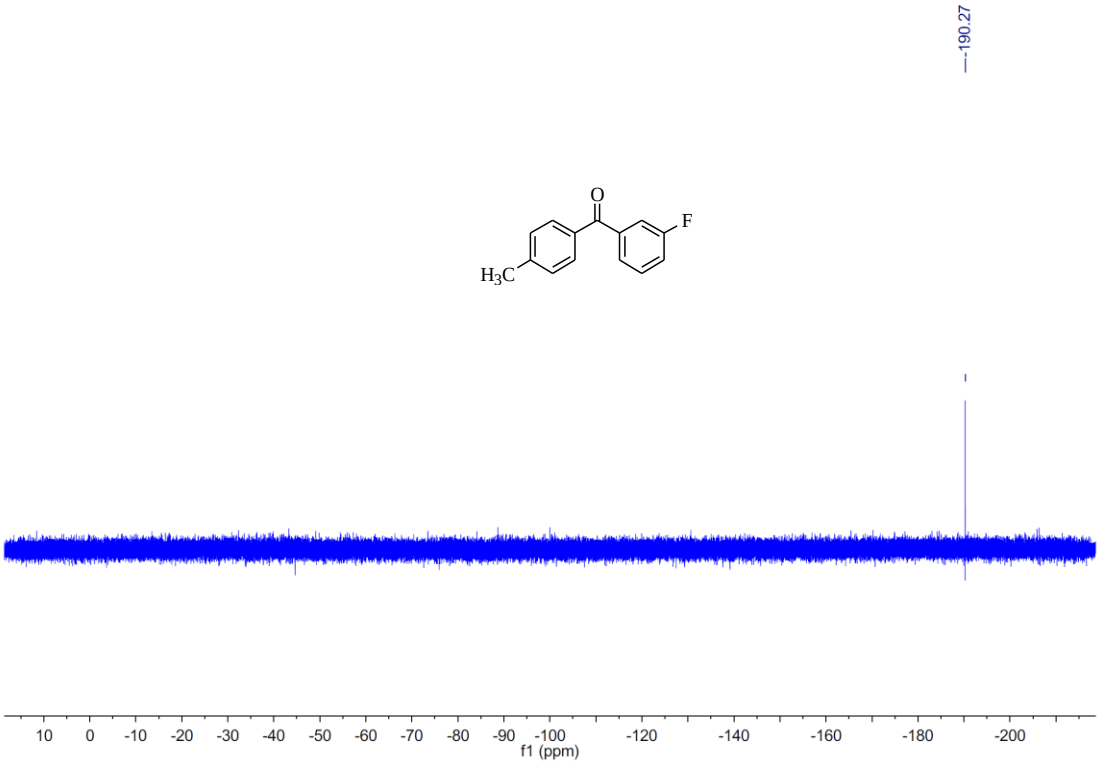
^{19}F NMR of (4-fluorophenyl)(p-tolyl)methanone **3ai**



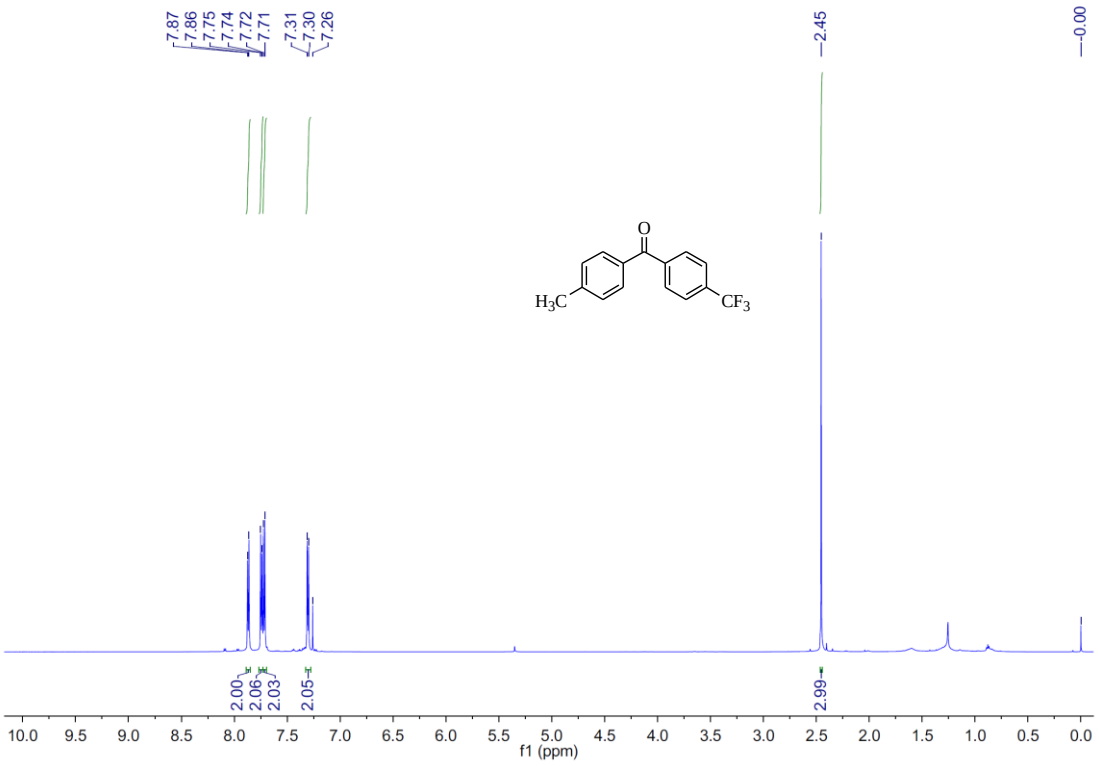
^{1}H NMR of (3-fluorophenyl)(p-tolyl)methanone **3aj**



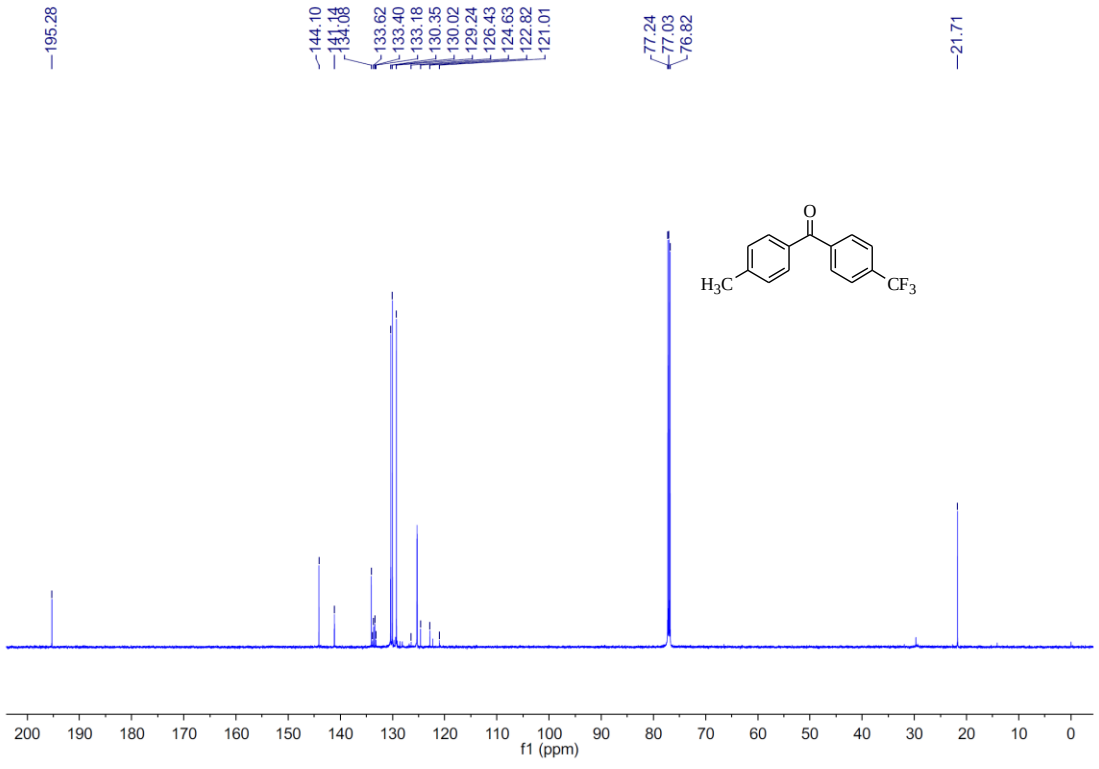
^{19}F NMR of (3-fluorophenyl)(p-tolyl)methanone **3aj**



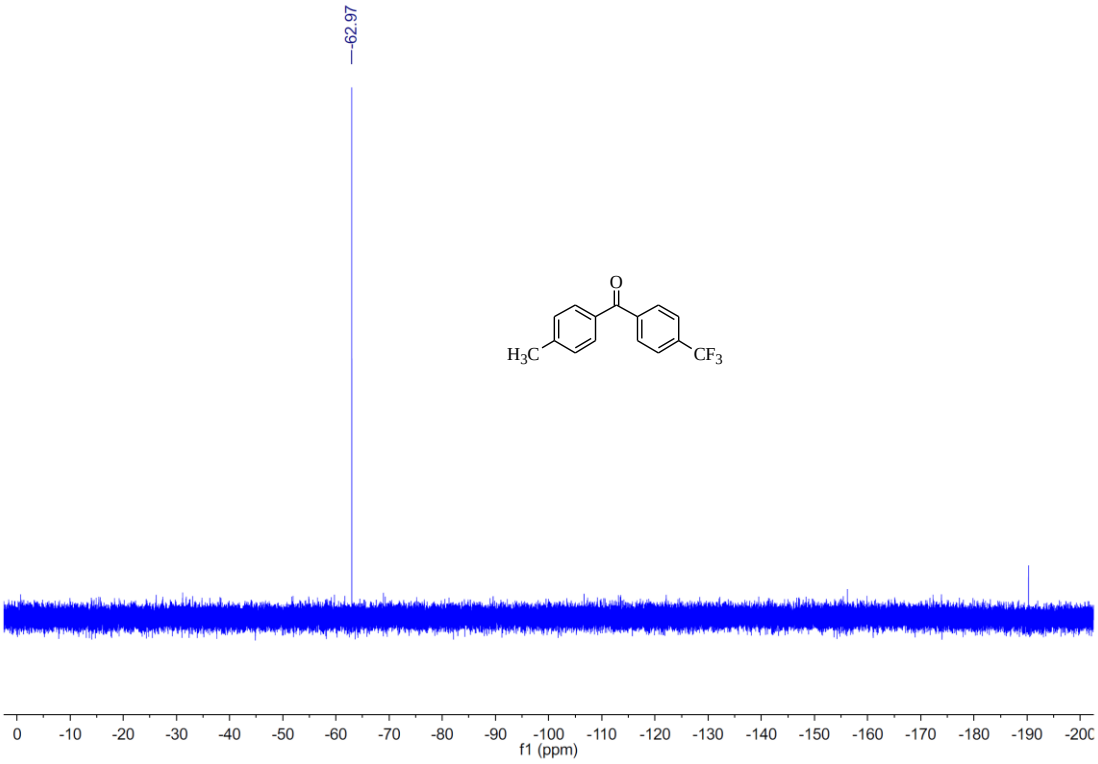
^{1}H NMR of p-tolyl(4-(trifluoromethyl)phenyl)methanone **3ak**



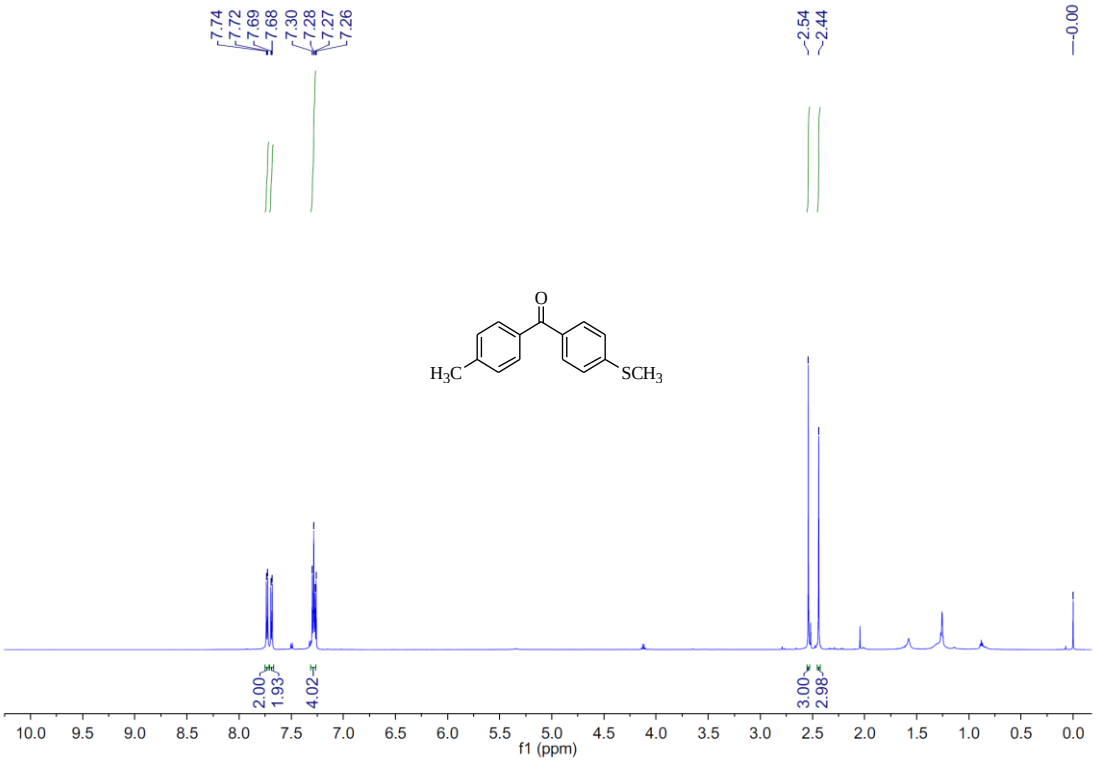
^{13}C NMR of p-tolyl(4-(trifluoromethyl)phenyl)methanone **3ak**



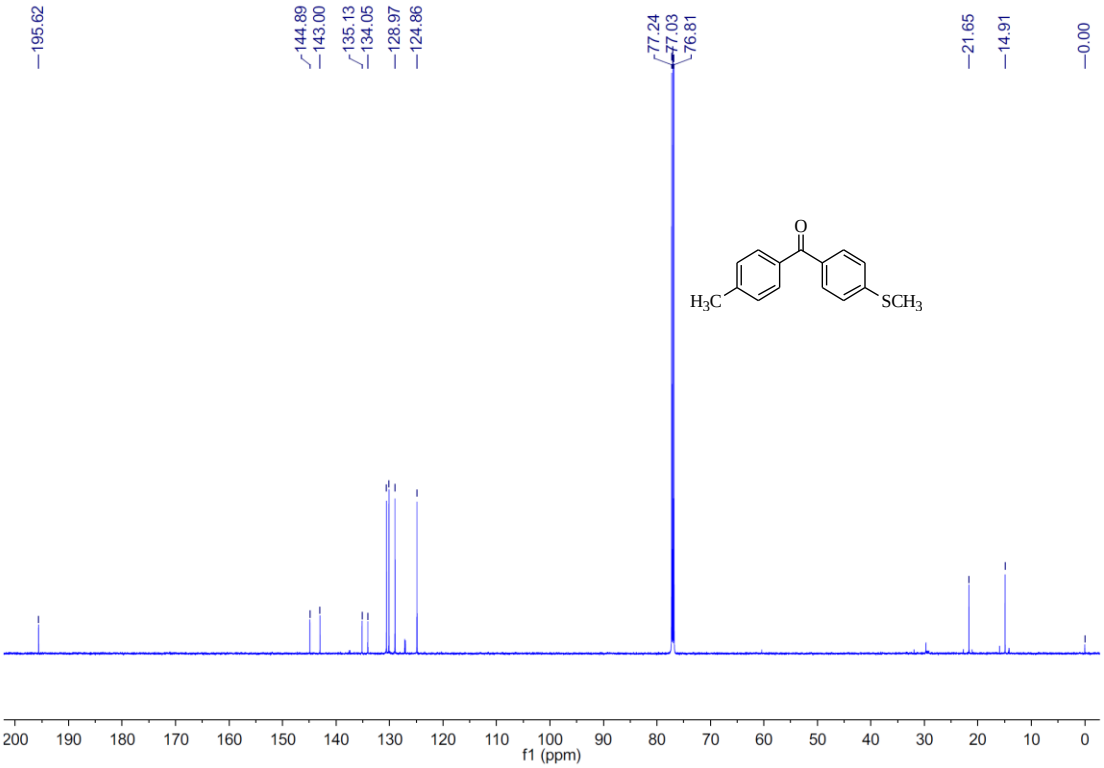
^{19}F NMR of p-tolyl(4-(trifluoromethyl)phenyl)methanone **3ak**



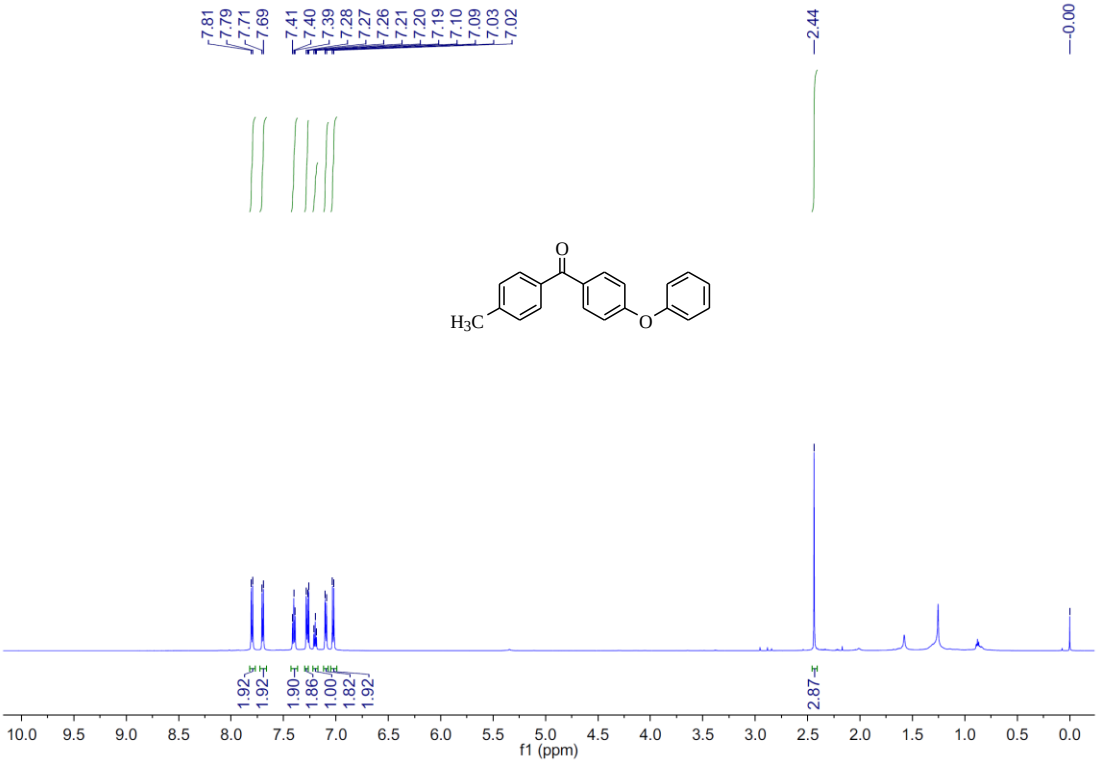
^{1}H NMR of (4-(methylthio)phenyl)(p-tolyl)methanone **3al**



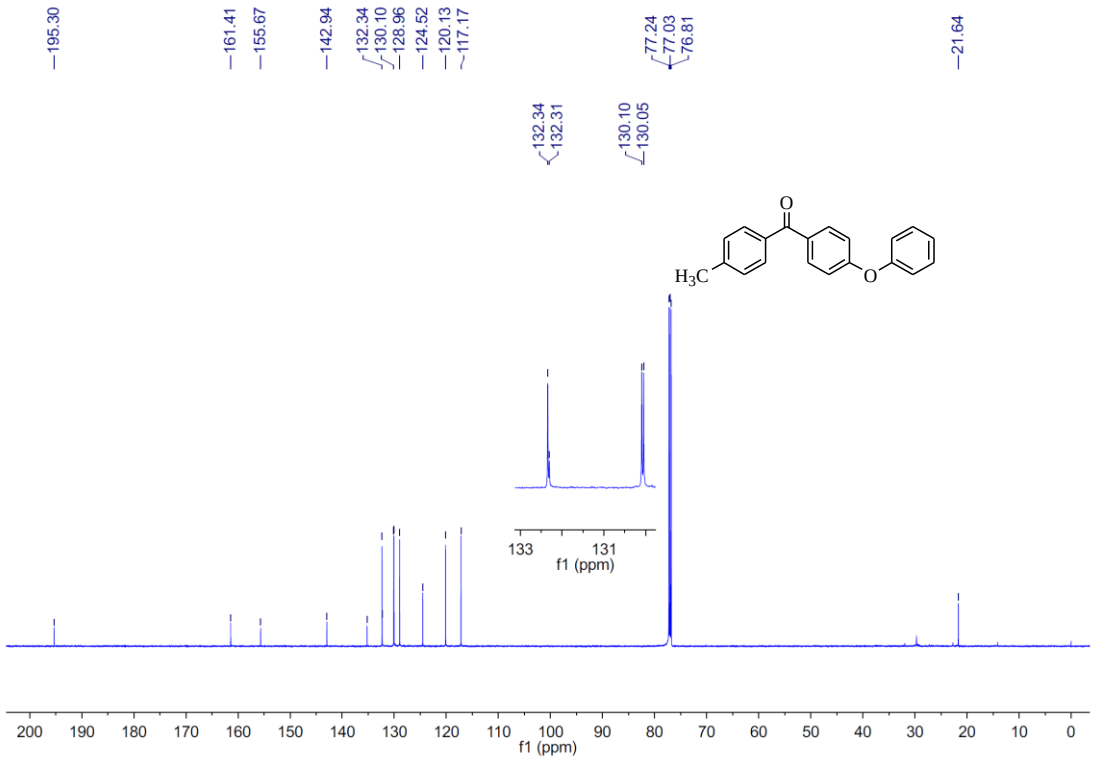
^{13}C NMR of (4-(methylthio)phenyl)(p-tolyl)methanone **3al**



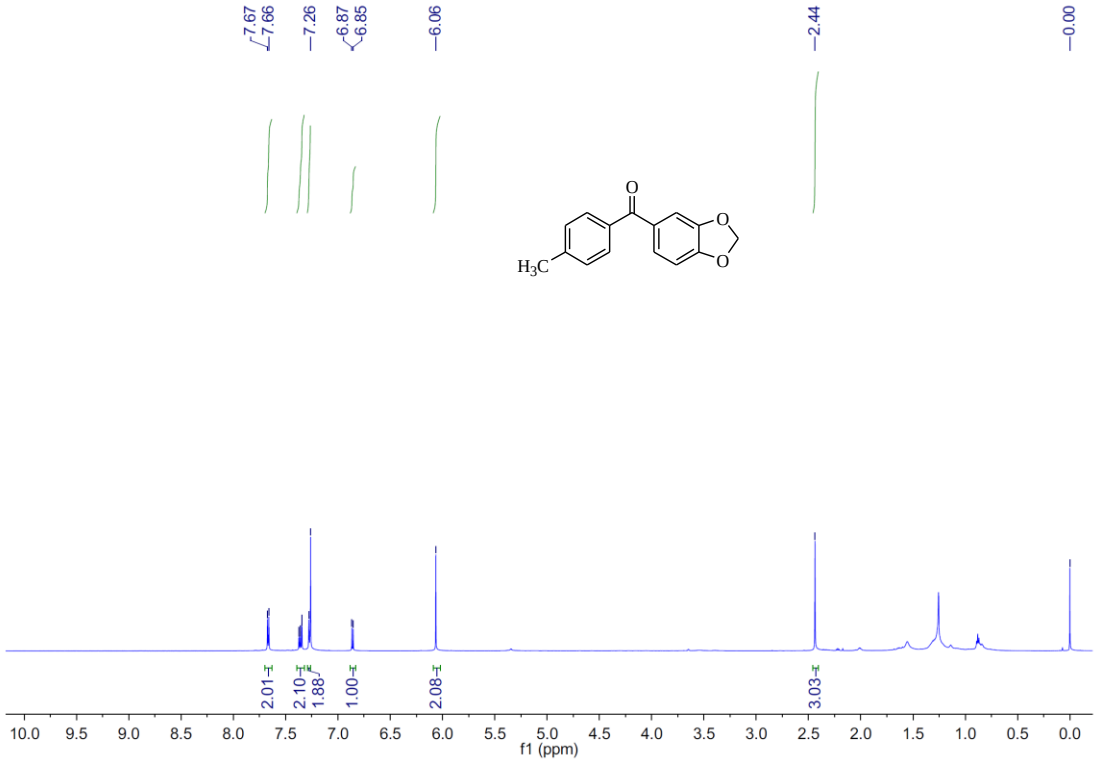
^{1}H NMR of (4-phenoxyphenyl)(p-tolyl)methanone **3am**



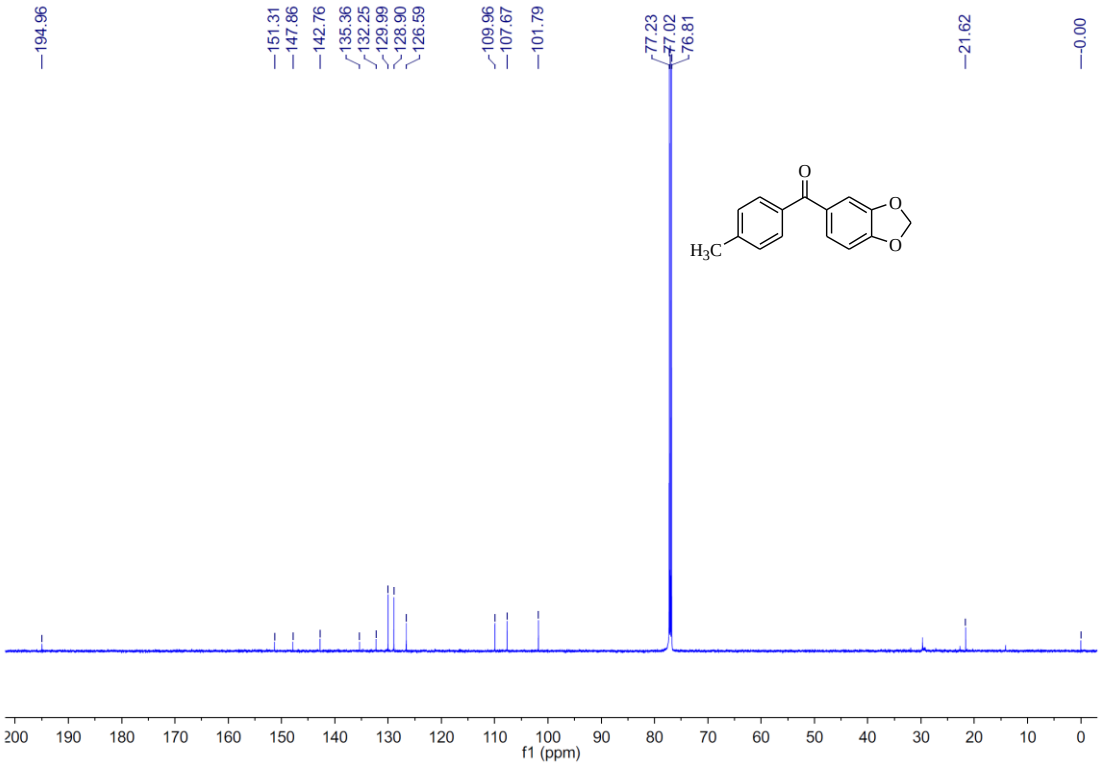
^{13}C NMR of (4-phenoxyphenyl)(p-tolyl)methanone **3am**



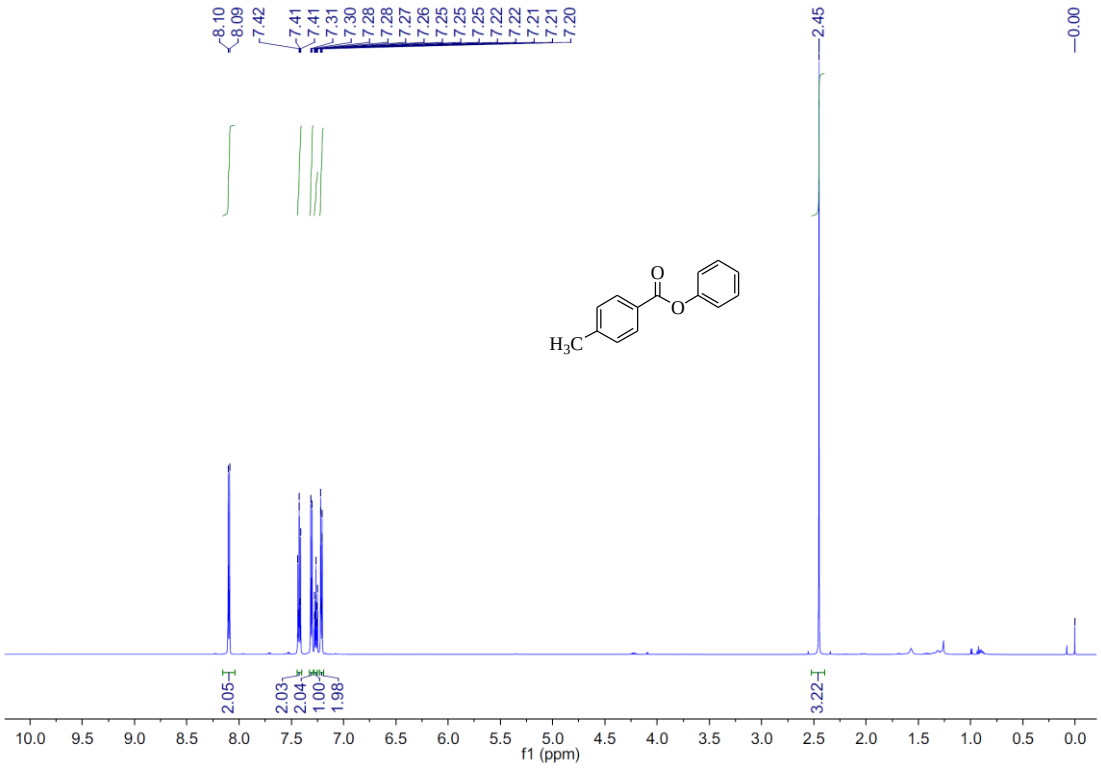
^{1}H NMR of benzo[d][1,3]dioxol-5-yl(p-tolyl)methanone **3an**



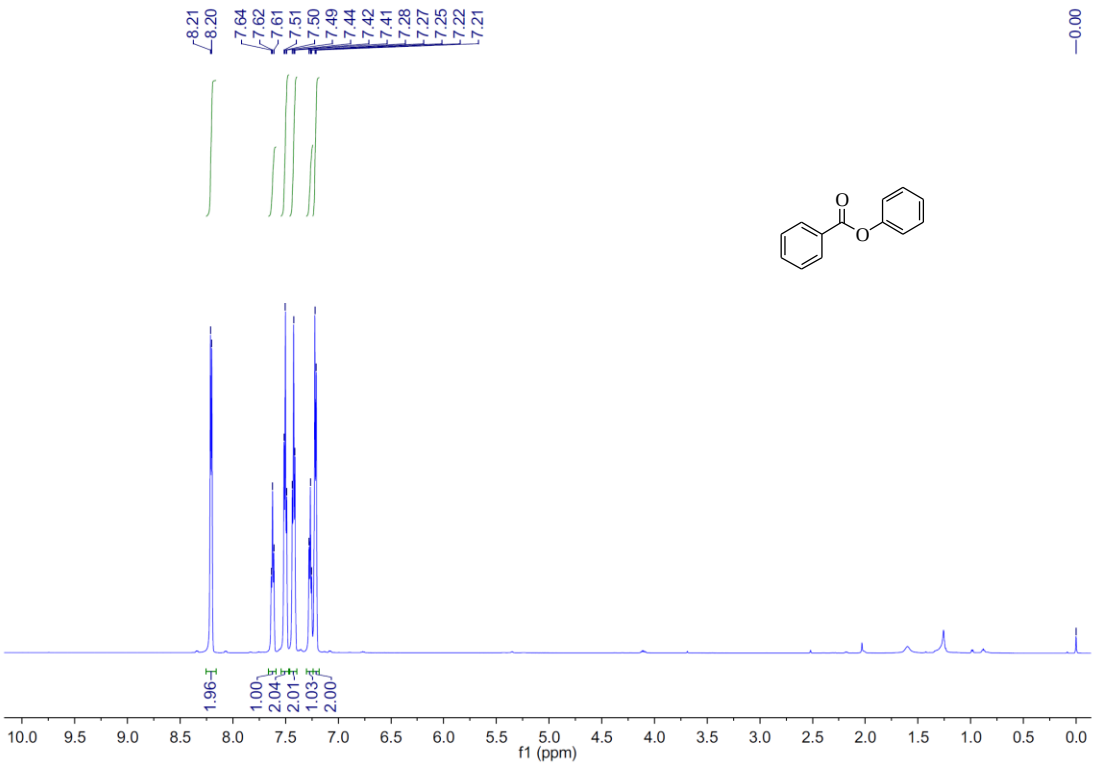
^{13}C NMR of benzo[d][1,3]dioxol-5-yl(p-tolyl)methanone **3an**



^{1}H NMR of 4-methylbenzoic acid phenyl ester **5aa**



^{1}H NMR of benzoic acid phenyl ester **5ga**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8.20
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7.62
7.61
7.51
7.50
7.49
7.44
7.42
7.41
7.28
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7.25
7.22
7.21
0.00
O
O
1.96
1.00
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2.01
1.03
2.00
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f1 (ppm)