

## Supplementary Information

### **One-pot furan synthesis through diethylzinc-mediated coupling reaction between two $\alpha$ -bromocarbonyl compounds**

Ryo Hikima,<sup>‡a</sup> Aika Takeshima<sup>‡a,b</sup> and Taichi Kano<sup>\*a</sup>

<sup>a</sup>Department of Applied Chemistry, Graduate School of Engineering, Tokyo University of Agriculture and Technology, Tokyo 184-8588, Japan

<sup>b</sup>Graduate School of Science, Kyoto University, Kyoto, 606-8502, Japan

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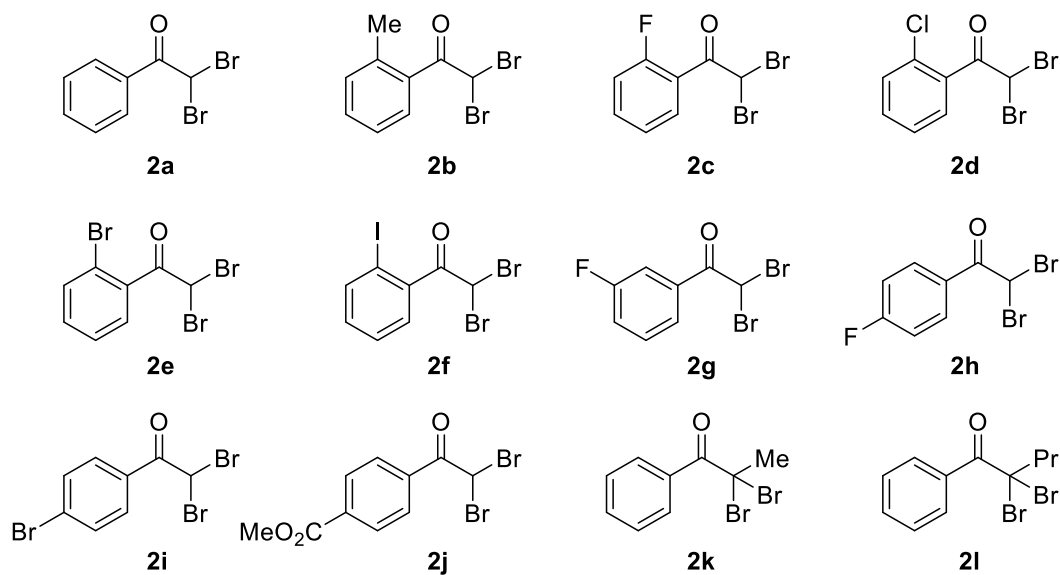
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## General information

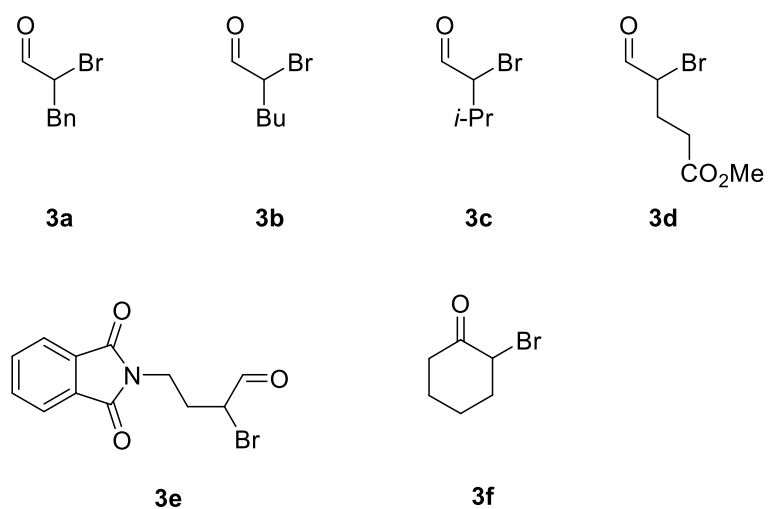
<sup>1</sup>H NMR spectra were measured on JEOL JNM-FX300 (300 MHz) and JEOL JNM-ECX400 (400 MHz) spectrometers. <sup>13</sup>C NMR spectra were measured on JEOL JNM-FX300 (75 MHz) and JEOL JNM-ECX400 (100 MHz) spectrometers. Chemical shifts were reported in ppm from tetramethylsilane (for CDCl<sub>3</sub>) as an internal standard. <sup>19</sup>F NMR spectra were measured on a JEOL JNM-ECX400 (376 MHz) and JEOL JNM-ECA500 (471 MHz) spectrometer. Chemical shifts were reported in ppm from benzotrifluoride as an internal standard. Data were reported as follow: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, quint = quintet, dt = doublet of triplet, td = triplet of doublet, tt = triplet of triplet, m = multiplet, br = broad, and app = apparent), coupling constants (Hz), and integration. For thin layer chromatography (TLC) analysis throughout this work, Merck precoated TLC plates (silica gel 60 GF254, 0.25 mm) were used. The products were purified by flash column chromatography on silica gel 60N (Kanto Chemical Co. Inc., 40-50 μm). HRMS analysis was performed on a Bruker Daltonics micrOTOF-QII instrument. <sup>1</sup>H-NMR yields were determined utilizing 1,1,2,2-tetrachloroethane as internal standard. A 1.0 M hexane solution of diethylzinc (Et<sub>2</sub>Zn) was purchased from Tokyo Kasei, Inc. The commercially available aldehydes were distilled and stored under a nitrogen atmosphere at 5 °C. Toluene, hexane, CH<sub>2</sub>Cl<sub>2</sub>, 1,2-dichloroethane, benzotrifluoride, THF, MeCN, Et<sub>2</sub>O, 1,4-dioxane, DME and AcOEt were dried over appropriate molecular sieves. KBA **5** was prepared according to the literature procedure.<sup>[1]</sup>

## Synthesis of dibromomethyl ketones 2

Dibromomethyl ketones **2a-2l** (except for **2j**) were prepared according to the literature procedure.<sup>[2]</sup> Dibromomethyl ketone **2j** was prepared according to the literature procedure.<sup>[3-5]</sup>



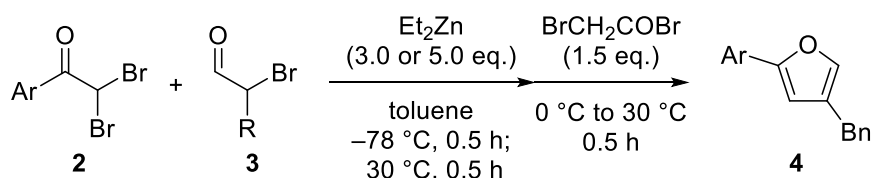
## Synthesis of $\alpha$ -bromoaldehydes and $\alpha$ -bromoketones 3



$\alpha$ -Bromoaldehydes and  $\alpha$ -bromoketone **3a-3f** were prepared according to the literature procedure.<sup>[2]</sup>

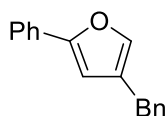
## Synthesis of furans 4

### General procedure (A)



A mixture of dibromomethyl ketone **2** (0.10 mmol, 1.0 eq.) and  $\alpha$ -bromoaldehyde **3** (0.10 mmol, 1.0 eq.) in toluene (0.8 mL or 1.7 mL) was stirred at  $-78\text{ }^\circ\text{C}$  under  $\text{N}_2$  atmosphere. A 1.0 M hexane solution of  $\text{Et}_2\text{Zn}$  (0.3 or 0.5 mL, 0.3 or 0.5 mmol) was slowly added to the mixture. After stirring for 0.5 h at  $-78\text{ }^\circ\text{C}$  and then 0.5 h at  $30\text{ }^\circ\text{C}$ , the reaction mixture was cooled at  $0\text{ }^\circ\text{C}$ , and bromoacetyl bromide (1.5 eq.) was added. After stirring for 0.5 h at  $30\text{ }^\circ\text{C}$ , the reaction mixture was quenched with  $\text{NH}_4\text{Cl}$  aq. and extracted with  $\text{CH}_2\text{Cl}_2$ . The organic layer was dried with  $\text{Na}_2\text{SO}_4$ , and then concentrated. The resulting residue was purified by column chromatography on silica gel (eluting with hexane) to give the corresponding furan **4**.

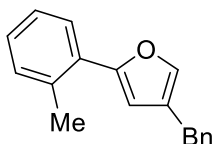
### 4-Benzyl-2-phenylfuran (**4a**)



Following the general procedure (A) using 2,2-dibromo-1-phenylethan-1-one<sup>[1]</sup> (**2a**) (27.8 mg, 0.1 mmol), 2-bromo-3-phenylpropanal<sup>[6]</sup> (**3a**) (21.3 mg, 0.1 mmol) and  $\text{Et}_2\text{Zn}$  (0.3 mL, 0.3 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4a** as a pale yellow solid (11.5 mg, 0.049 mmol, 49% yield). Spectral data matched the literature value.<sup>[7]</sup>

$^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.63-7.60 (m, 2H), 7.37-7.37 (m, 5H), 7.23-7.13 (m, 4H), 6.50 (s, 1H), 3.80 (s, 2H).

#### 4-Benzyl-2-(2-methylphenyl)furan (**4b**)



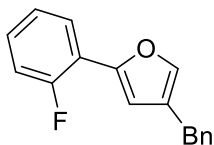
Following the general procedure (A) using 2,2-dibromo-1-(2-methylphenyl)ethan-1-one<sup>[8]</sup> (**2b**) (29.2 mg, 0.1 mmol), 2-bromo-3-phenylpropanal (**3a**) (21.3 mg, 0.1 mmol) and  $\text{Et}_2\text{Zn}$  (0.3 mL, 0.3 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4b** as a pale yellow solid (12.4 mg, 0.050 mmol, 50% yield).

$^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.66 (d,  $J = 7.0$  Hz, 1H), 7.34-7.26 (m, 5H), 7.22-7.18 (m, 4H), 6.40 (s, 1H), 3.83 (s, 2H), 2.46 (s, 3H).

$^{13}\text{C-NMR}$  (100 MHz,  $\text{CDCl}_3$ )  $\delta$  154.0, 140.4, 138.9, 134.6, 131.2, 130.4, 128.7, 128.6, 127.5, 127.0, 126.3, 126.1, 126.0, 110.4, 31.5, 22.1.

HRMS (APCI, positive) Calcd. For  $\text{C}_{18}\text{H}_{17}\text{O}$ : 249.1274 ( $[\text{M} + \text{H}]^+$ ), Found: 249.1272 ( $[\text{M} + \text{H}]^+$ ).

#### 4-Benzyl-2-(2-fluorophenyl)furan (**4c**)



Following the general procedure (A) using 2,2-dibromo-1-(2-fluorophenyl)ethan-1-one<sup>[9]</sup> (**2c**) (29.6 mg, 0.1 mmol), 2-bromo-3-phenylpropanal (**3a**) (21.3 mg, 0.1 mmol) and  $\text{Et}_2\text{Zn}$  (0.5 mL,

0.5 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4c** as colorless oil (13.8 mg, 0.055 mmol, 55% yield).

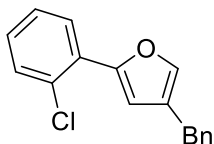
<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.81-7.76 (m, 1H), 7.34-7.29 (m, 3H), 7.25-7.04 (m, 6H), 6.72 (d, *J* = 3.7 Hz, 1H), 3.82 (s, 2H).

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 158.6 (d, *J* = 250.2 Hz), 148.4 (d, *J* = 2.9 Hz), 140.3, 139.2, 128.7, 128.6, 128.3 (d, *J* = 7.7 Hz), 126.7, 126.4, 126.0 (d, *J* = 3.4 Hz), 124.4 (d, *J* = 3.8 Hz), 119.3 (d, *J* = 12.5 Hz), 116.0 (d, *J* = 22.0 Hz), 112.0 (d, *J* = 11.5 Hz), 31.5.

<sup>19</sup>F-NMR (471 MHz, CDCl<sub>3</sub>) δ -115.4 (app s, 1F).

HRMS (APCI, positive) Calcd. For C<sub>17</sub>H<sub>14</sub>FO: 253.1023 ([M + H]<sup>+</sup>), Found: 253.1016 ([M + H]<sup>+</sup>).

#### 4-Benzyl-2-(2-chlorophenyl)furan (4d)



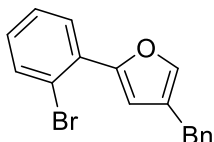
Following the general procedure (A) using 2,2-dibromo-1-(2-chlorophenyl)ethan-1-one<sup>[10]</sup> (**2d**) (31.2 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol) and Et<sub>2</sub>Zn (0.3 mL, 0.3 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4d** as pale yellow oil (17.3 mg, 0.064 mmol, 64% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.83 (d, *J* = 8.1 Hz, 1H), 7.41 (d, *J* = 8.1 Hz, 1H), 7.34-7.28 (m, 5H), 7.22-7.15 (m, 3H), 7.01 (s, 1H), 3.84 (s, 2H).

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 150.5, 140.2, 139.4, 130.8, 130.1, 129.4, 128.7, 128.6, 128.1, 127.9, 127.0, 126.5, 126.4, 112.8, 31.5.

HRMS (APCI, positive) Calcd. For C<sub>17</sub>H<sub>14</sub>ClO: 269.0728, 271.0699 ([M + H]<sup>+</sup>), Found: 269.0729, 271.0698 ([M + H]<sup>+</sup>).

#### 4-Benzyl-2-(2-bromophenyl)furan (4e)



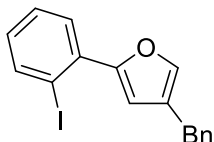
Following the general procedure (A) using 2,2-dibromo-1-(2-bromophenyl)ethan-1-one<sup>[9]</sup> (**2e**) (35.6 mg, 0.1 mmol), 2-bromo-3-phenylpropanal (**3a**) (21.3 mg, 0.1 mmol) and Et<sub>2</sub>Zn (0.5 mL, 0.5 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4e** as pale yellow oil (20.0 mg, 0.064 mmol, 64% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.77 (dd, *J* = 7.9, 1.6 Hz, 1H), 7.62 (dd, *J* = 8.1, 1.1 Hz, 1H), 7.36-7.26 (m, 6H), 7.23-7.18 (m, 1H), 7.13-7.07 (m, 1H), 7.06 (s, 1H), 3.84 (s, 2H).

<sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) δ 151.6, 140.2, 139.5, 134.2, 131.4, 128.75, 128.73, 128.6, 128.5, 127.5, 126.4, 126.2, 119.6, 112.5, 31.6.

HRMS (APCI, positive) Calcd. For C<sub>17</sub>H<sub>14</sub>BrO: 313.0223, 315.0203 ([M + H]<sup>+</sup>), Found: 313.0214, 315.0174 ([M + H]<sup>+</sup>).

#### 4-Benzyl-2-(2-iodophenyl)furan (4f)



Following the general procedure (A) using 2,2-dibromo-1-(2-iodophenyl)ethan-1-one<sup>[11]</sup> (**2f**)

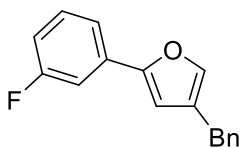
(40.3 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol) and Et<sub>2</sub>Zn (0.5 mL, 0.5 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4f** as pale yellow oil (18.4 mg, 0.051 mmol, 51% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.94 (dd, *J* = 8.0, 1.0 Hz, 1H), 7.60 (dd, *J* = 7.9, 1.6 Hz, 1H), 7.39-7.27 (m, 6H), 7.23-7.20 (m, 1H), 6.98-6.93 (m, 2H), 3.84 (s, 2H).

<sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) δ 153.9, 140.9, 140.2, 139.6, 135.5, 129.3, 129.0, 128.7, 128.6, 128.2, 126.4, 125.9, 111.6, 94.3, 31.6.

HRMS (APCI, positive) Calcd. For C<sub>17</sub>H<sub>14</sub>IO: 361.0084 ([M + H]<sup>+</sup>), Found: 361.0076 ([M + H]<sup>+</sup>).

#### 4-Benzyl-2-(3-fluorophenyl)furan (**4g**)



Following the general procedure (A) using 2,2-dibromo-1-(3-fluorophenyl)ethan-1-one<sup>[12]</sup> (**2g**) (29.6 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol) and Et<sub>2</sub>Zn (0.3 mL, 0.3 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4g** as pale yellow oil (10.6 mg, 0.042 mmol, 42% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.39-7.29 (m, 7H), 7.24-7.20 (m, 2H), 6.95-6.88 (m, 1H), 6.52 (s, 1H), 3.80 (s, 2H).

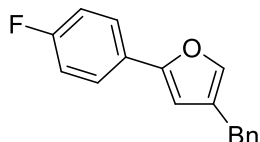
<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 163.2 (d, *J* = 245.4 Hz), 153.2 (d, *J* = 2.9 Hz), 140.2, 139.7, 133.1 (d, *J* = 8.6 Hz), 130.3 (d, *J* = 8.6 Hz), 128.73, 128.68, 126.7, 126.5, 119.5 (d, *J* = 2.9 Hz), 114.1 (d, *J* = 22.0 Hz), 110.7 (d, *J* = 24.0 Hz), 107.8, 31.4.



$^{19}\text{F}$ -NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  -114.3 (app s, 1F).

HRMS (APCI, positive) Calcd. For  $\text{C}_{17}\text{H}_{14}\text{FO}$ : 253.1023 ( $[\text{M} + \text{H}]^+$ ), Found: 253.1022 ( $[\text{M} + \text{H}]^+$ ).

#### 4-Benzyl-2-(4-fluorophenyl)furan (4h)



Following the general procedure (A) using 2,2-dibromo-1-(4-fluorophenyl)ethan-1-one<sup>[13]</sup> (**2h**) (29.6 mg, 0.1 mmol) and 2-bromo-3-phenylpropanal (**3a**) (21.3 mg, 0.1 mmol) and  $\text{Et}_2\text{Zn}$  (0.5 mL, 0.5 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4h** as pale yellow oil (11.6 mg, 0.046 mmol, 46% yield).

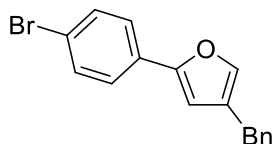
$^1\text{H}$ -NMR (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.60-7.55 (m, 2H), 7.34-7.28 (m, 3H), 7.25-7.22 (m, 3H), 7.08-7.00 (m, 2H), 6.43 (s, 1H), 3.79 (s, 2H).

$^{13}\text{C}$ -NMR (100 MHz,  $\text{CDCl}_3$ )  $\delta$  162.2 (d,  $J = 246.3$  Hz), 153.6, 140.3, 139.2, 128.74, 128.66, 127.4 (d,  $J = 2.9$  Hz), 126.5, 126.4, 125.6 (d,  $J = 7.6$  Hz), 115.8 (d,  $J = 22.0$  Hz), 106.5, 31.5.

$^{19}\text{F}$ -NMR (376 MHz,  $\text{CDCl}_3$ )  $\delta$  -115.7 (tt,  $J = 8.7, 5.1$  Hz, 1F).

HRMS (APCI, positive) Calcd. For  $\text{C}_{17}\text{H}_{14}\text{FO}$ : 253.1023 ( $[\text{M} + \text{H}]^+$ ), Found: 253.1025 ( $[\text{M} + \text{H}]^+$ ).

#### 4-Benzyl-2-(4-bromophenyl)furan (4i)



Following the general procedure (A) using 2,2-dibromo-1-(4-bromophenyl)ethan-1-one<sup>[9]</sup> (**2i**)

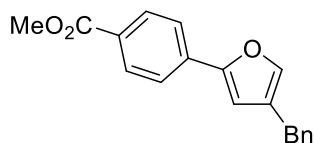
(35.6 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol) and Et<sub>2</sub>Zn (0.3 mL, 0.3 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4i** as a yellow solid (15.7 mg, 0.052 mmol, 52% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.53-7.40 (m, 4H), 7.36-7.29 (m, 4H), 7.23-7.20 (m, 2H), 6.50 (s, 1H), 3.79 (s, 2H).

<sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>) δ 153.3, 140.2, 139.5, 131.9, 129.9, 128.73, 128.67, 126.7, 126.4, 125.3, 121.1, 107.4, 31.4.

HRMS (APCI, positive) Calcd. For C<sub>17</sub>H<sub>14</sub>BrO: 313.0223, 315.0203 ([M + H]<sup>+</sup>), Found: 313.0224, 315.0225 ([M + H]<sup>+</sup>).

#### Methyl 4-(4-benzylfuran-2-yl)benzoate (**4j**)



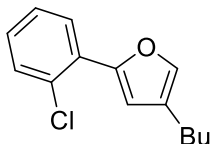
Following the general procedure (A) using methyl 4-(2,2-dibromoacetyl)benzoate<sup>[51]</sup> (**2j**) (33.6 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol) and Et<sub>2</sub>Zn (0.3 mL, 0.3 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4j** as white solid (21.8 mg, 0.075 mmol, 75% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 8.02 (d, *J* = 8.6 Hz, 2H), 7.66 (d, *J* = 8.6 Hz, 2H), 7.35-7.30 (m, 4H), 7.25-7.18 (m, 2H), 6.64 (s, 1H), 3.91 (s, 3H), 3.81 (s, 2H).

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 166.9, 153.3, 140.3, 140.1, 134.9, 130.2, 128.72, 128.69, 128.6, 126.9, 126.5, 123.4, 109.0, 52.2, 31.4.

HRMS (APCI, positive) Calcd. For C<sub>19</sub>H<sub>17</sub>O<sub>3</sub>: 293.1172 ([M + H]<sup>+</sup>), Found: 293.1180 ([M + H]<sup>+</sup>).

#### 4-Butyl-2-(2-chlorophenyl)furan (4k)



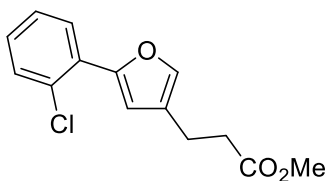
Following the general procedure (A) using 2,2-dibromo-1-(2-chlorophenyl)ethan-1-one (**2d**) (31.2 mg, 0.1 mmol) and 2-bromohexanal (**3b**)<sup>[14]</sup> (17.8 mg, 0.1 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4k** as colorless oil (11.7 mg, 0.049 mmol, 49% yield).

<sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>)  $\delta$  7.84 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.41 (dd, *J* = 8.0, 1.1 Hz, 1H), 7.31-7.27 (m, 2H), 7.19-7.14 (m, 1H), 7.03 (s, 1H), 2.47 (t, *J* = 7.8 Hz, 2H), 1.63-1.55 (m, 2H), 1.44-1.35 (m, 2H), 0.94 (t, *J* = 7.3 Hz, 3H).

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)  $\delta$  150.0, 138.5, 130.8, 129.9, 129.5, 127.9, 127.8, 127.6, 127.0, 112.8, 32.3, 24.8, 22.5, 14.1.

HRMS (APCI, positive) Calcd. For C<sub>14</sub>H<sub>16</sub>ClO: 235.0885, 237.0855 ([M + H]<sup>+</sup>), Found: 235.0879, 237.0837 ([M + H]<sup>+</sup>).

#### Methyl 3-(5-(2-chlorophenyl)furan-3-yl)propanoate (4l)



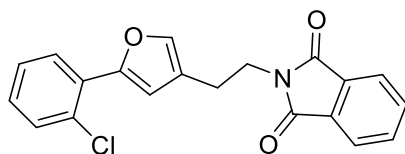
A mixture of 2,2-dibromo-1-(2-chlorophenyl)ethan-1-one (**2d**) (31.2 mg, 0.1 mmol) and methyl 4-bromo-5-oxopentanoate (**3d**)<sup>[15]</sup> (20.8 mg, 0.1 mmol) in toluene (0.8 mL) was stirred at  $-78\text{ }^{\circ}\text{C}$  under  $\text{N}_2$  atmosphere. A 1.0 M hexane solution of  $\text{Et}_2\text{Zn}$  (0.3 mL, 0.3 mmol) was slowly added to the mixture. After stirring for 0.5 h at  $-78\text{ }^{\circ}\text{C}$  and then 1 h at  $30\text{ }^{\circ}\text{C}$ , the reaction mixture was cooled at  $0\text{ }^{\circ}\text{C}$ , and bromoacetyl bromide (1.5 eq.) was added. After stirring for 0.5 h at  $30\text{ }^{\circ}\text{C}$ , the reaction mixture was quenched with  $\text{NH}_4\text{Cl}$  aq. and extracted with  $\text{CH}_2\text{Cl}_2$ . The organic layer was dried with  $\text{Na}_2\text{SO}_4$ , and then concentrated. The resulting residue was purified by column chromatography on silica gel (eluting with hexane/ $\text{CH}_2\text{Cl}_2 = 2/1$ ) to give the title compound **4l** as colorless oil (12.5 mg, 0.047 mmol, 47% yield).

$^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.83 (dd,  $J = 8.0, 1.6$  Hz, 1H), 7.42 (dd,  $J = 8.0, 1.1$  Hz, 1H), 7.32-7.27 (m, 2H), 7.21-7.15 (m, 1H), 7.03 (s, 1H), 3.70 (s, 3H), 2.83 (t,  $J = 7.6$  Hz, 2H), 2.63 (t,  $J = 7.4$  Hz, 2H).

$^{13}\text{C-NMR}$  (100 MHz,  $\text{CDCl}_3$ )  $\delta$  173.5, 138.8, 130.8, 130.1, 129.3, 128.1, 127.9, 127.0, 125.7 (two peaks overlap), 112.3, 51.8, 34.7, 20.6.

HRMS (APCI, positive) Calcd. For  $\text{C}_{14}\text{H}_{14}\text{ClO}_3$ : 265.0626, 267.0597 ( $[\text{M} + \text{H}]^+$ ), Found: 265.0625, 267.0599 ( $[\text{M} + \text{H}]^+$ ).

#### 2-(2-(5-(2-Chlorophenyl)furan-3-yl)ethyl)isoindoline-1,3-dione (**4m**)



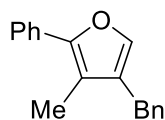
A mixture of 2,2-dibromo-1-(2-chlorophenyl)ethan-1-one (**2d**) (21.6 mg, 0.069 mmol) and 2-bromo-4-(1,3-dioxisoindolin-2-yl)butanal (**3e**)<sup>[16]</sup> (20.5 mg, 0.069 mmol) in toluene (0.55 mL) was stirred at  $-78\text{ }^{\circ}\text{C}$  under  $\text{N}_2$  atmosphere. A 1.0 M hexane solution of  $\text{Et}_2\text{Zn}$  (0.21 mL, 0.21 mmol) was slowly added to the mixture. After stirring for 15 min at  $-78\text{ }^{\circ}\text{C}$  and then 1 h at  $30\text{ }^{\circ}\text{C}$ , the reaction mixture was cooled at  $0\text{ }^{\circ}\text{C}$ , and bromoacetyl bromide (1.5 eq.) was added. After stirring for 0.5 h at  $30\text{ }^{\circ}\text{C}$ , the reaction mixture was quenched with  $\text{NH}_4\text{Cl}$  aq. and extracted with  $\text{CH}_2\text{Cl}_2$ . The organic layer was dried with  $\text{Na}_2\text{SO}_4$ , and then concentrated. The resulting residue was purified by column chromatography on silica gel (eluting with hexane/ $\text{CH}_2\text{Cl}_2 = 1/2$ ) to give the title compound **4m** as white solid (9.6 mg, 0.027 mmol, 39% yield).

$^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.86-7.79 (m, 3H), 7.74-7.70 (m, 2H), 7.42-7.37 (m, 2H), 7.31-7.28 (m, 1H), 7.20-7.14 (m, 1H), 7.06 (s, 1H), 3.94 (t,  $J = 7.6\text{ Hz}$ , 2H), 2.91 (t,  $J = 7.6\text{ Hz}$ , 2H).

$^{13}\text{C-NMR}$  (100 MHz,  $\text{CDCl}_3$ )  $\delta$  168.4, 150.5, 139.4, 134.1, 132.2, 130.8, 130.2, 129.3, 128.1, 127.9, 126.9, 123.4, 123.2, 112.4, 38.3, 24.2.

HRMS (APCI, positive) Calcd. For  $\text{C}_{20}\text{H}_{15}\text{ClINO}_3$ : 352.0735, 354.0706 ( $[\text{M} + \text{H}]^+$ ), Found: 352.0735, 354.0733 ( $[\text{M} + \text{H}]^+$ ).

#### 4-Benzyl-3-methyl-2-phenylfuran (**4n**)



Following the general procedure (A) using 2,2-dibromo-1-phenylpropan-1-one<sup>[12]</sup> (**2k**) (29.2 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol) and  $\text{Et}_2\text{Zn}$  (0.3 mL, 0.3

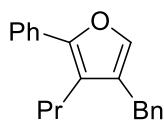
mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4n** as a white solid (11.7 mg, 0.047 mmol, 47% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.62-7.59 (m, 2H), 7.42-7.37 (m, 2H), 7.33-7.28 (m, 3H), 7.25-7.19 (m, 3H), 7.17 (s, 1H), 3.77 (s, 2H), 2.12 (s, 3H).

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 149.4, 139.9, 138.8, 132.1, 128.7, 128.60, 128.57, 126.8, 126.7, 126.3, 125.6, 116.6, 30.2, 10.0.

HRMS (APCI, positive) Calcd. For C<sub>18</sub>H<sub>17</sub>O: 249.1274 ([M + H]<sup>+</sup>), Found: 249.1275 ([M + H]<sup>+</sup>).

#### 4-Benzyl-2-phenyl-3-propylfuran (4o)



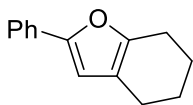
Following the general procedure (A) using 2,2-dibromo-1-phenylpentan-1-one<sup>[17]</sup> (**2l**) (32.0 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol) and Et<sub>2</sub>Zn (0.3 mL, 0.3 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **4o** as colorless oil (13.8 mg, 0.050 mmol, 50% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.59 (d, *J* = 7.5 Hz, 2H), 7.42-7.28 (m, 5H), 7.24-7.16 (m, 3H), 7.11 (s, 1H), 3.77 (s, 2H), 2.50 (t, *J* = 8.1 Hz, 2H), 1.53-1.43 (m, 2H), 0.93 (t, *J* = 7.3 Hz, 3H).

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 149.4, 140.0, 139.1, 132.1, 128.8, 128.6, 128.5, 126.9, 126.6, 126.3, 125.5, 121.6, 30.3, 26.4, 23.3, 14.4.

HRMS (APCI, positive) Calcd. For C<sub>20</sub>H<sub>21</sub>O: 277.1587 ([M + H]<sup>+</sup>), Found: 277.1594 ([M + H]<sup>+</sup>).

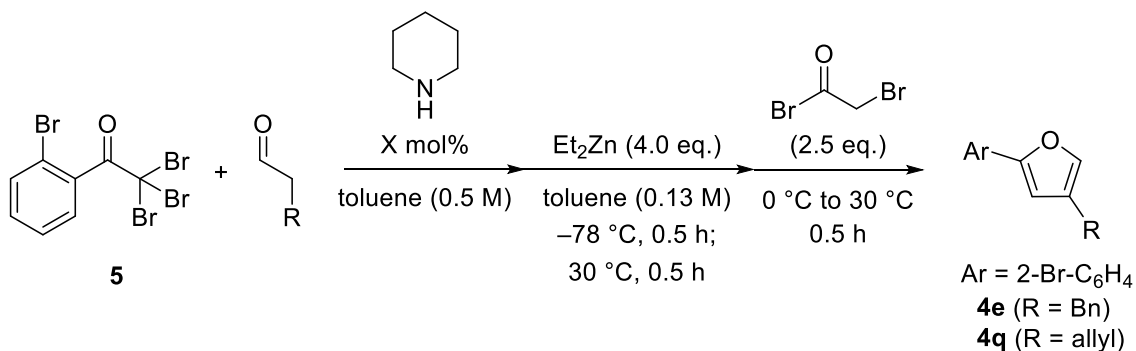
## 2-Phenyl-4,5,6,7-tetrahydrobenzofuran (4p)



A mixture of dibromomethyl ketone **2a** (27.8 mg, 0.10 mmol) and 2-bromocyclohexan-1-one<sup>[18]</sup> (**3f**) (19.5 mg, 0.11 mmol) in DME (0.80 mL, 0.13 M) was stirred at  $-78\text{ }^{\circ}\text{C}$ . A 1.0 M hexane solution of  $\text{Et}_2\text{Zn}$  (0.3 mL, 0.3 mmol) was slowly added to the mixture at  $-78\text{ }^{\circ}\text{C}$ . After stirring for 0.5 h at  $-78\text{ }^{\circ}\text{C}$  and then 2 h at  $30\text{ }^{\circ}\text{C}$ , 47% HBr aq. (120  $\mu\text{L}$ , 1 mmol) was added to the mixture at  $0\text{ }^{\circ}\text{C}$ . After stirring for 2 h at reflux, the reaction mixture was quenched with  $\text{NaHCO}_3$  aq. and extracted with  $\text{CH}_2\text{Cl}_2$ . The organic layer was dried with  $\text{Na}_2\text{SO}_4$ , and then concentrated. The resulting residue was purified by column chromatography on silica gel (eluting with hexane) to give the title compound **4p** as pale yellow oil (10.9 mg, 0.055 mmol, 55% yield). Spectral data matched the literature value.<sup>[19]</sup>

$^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.63-7.60 (m, 2H), 7.37-7.31 (m, 2H), 7.22-7.17 (m, 1H), 6.47 (s, 1H), 2.68-2.64 (m, 2H), 2.48-2.44 (m, 2H), 1.91-1.83 (m, 2H), 1.79-1.71 (m, 2H).

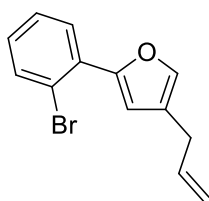
## One-pot synthesis of furan **4e** from 3-phenylpropanal and KBA **5**



#### 4-Benzyl-2-(2-bromophenyl)furan (4e)

A mixture of piperidine (0.49  $\mu\text{L}$ , 5  $\mu\text{mol}$ , 5 mol%), 3-phenylpropanal (13.4 mg, 0.1 mmol) and **5** (43.6 mg, 0.1 mmol) in toluene (0.2 mL, 0.5 M) was stirred at 0  $^{\circ}\text{C}$  under  $\text{N}_2$  atmosphere for 5 h. To the mixture was added additional piperidine (0.49  $\mu\text{L}$ , 5  $\mu\text{mol}$ , 5 mol%). After stirring for 2 h at room temperature, the reaction mixture was diluted with toluene (0.6 mL, 0.17 M) at  $-78$   $^{\circ}\text{C}$ . A 1.0 M hexane solution of  $\text{Et}_2\text{Zn}$  (0.4 mL, 0.4 mmol, 4.0 eq.) was slowly added to the mixture at  $-78$   $^{\circ}\text{C}$ . After stirring for 0.5 h at  $-78$   $^{\circ}\text{C}$  and then 0.5 h at 30  $^{\circ}\text{C}$ , the reaction mixture was cooled to 0  $^{\circ}\text{C}$ , and bromoacetyl bromide (21.8  $\mu\text{L}$ , 0.25 mmol, 2.5 eq.) was added. After stirring for 0.5 h at 30  $^{\circ}\text{C}$ , the reaction mixture was quenched with  $\text{NH}_4\text{Cl}$  aq. and extracted with  $\text{CH}_2\text{Cl}_2$ . The organic layer was dried with  $\text{Na}_2\text{SO}_4$ , and then concentrated. The resulting residue was purified by column chromatography on silica gel (eluting with hexane) to give the title compound **4e** as pale yellow oil (15.9 mg, 0.051 mmol, 51% yield).

#### 4-Allyl-2-(2-bromophenyl)furan (4q)



A mixture of piperidine (0.49  $\mu\text{L}$ , 5  $\mu\text{mol}$ , 5 mol%), 4-pentenal (9.9 mL, 0.1 mmol) and **5** (43.6 mg, 0.1 mmol) in toluene (0.2 mL, 0.5 M) was stirred at 0  $^{\circ}\text{C}$  under  $\text{N}_2$  atmosphere. After stirring for 4 h, the reaction mixture was diluted with toluene (0.6 mL, 0.17 M) at  $-78$   $^{\circ}\text{C}$ . A 1.0 M hexane solution of  $\text{Et}_2\text{Zn}$  (0.4 mL, 0.4 mmol, 4.0 eq.) was slowly added to the mixture at  $-78$   $^{\circ}\text{C}$ . After



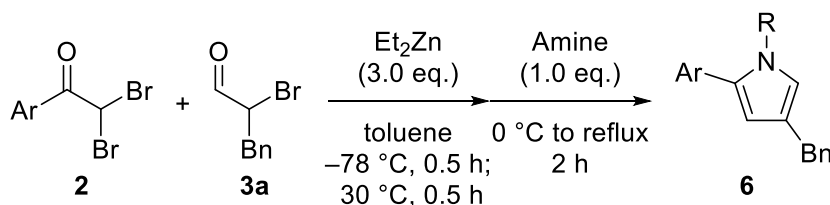
stirring for 0.5 h at  $-78\text{ }^{\circ}\text{C}$  and then 0.5 h at  $30\text{ }^{\circ}\text{C}$ , the reaction mixture was cooled to  $0\text{ }^{\circ}\text{C}$ , and bromoacetyl bromide ( $21.8\text{ }\mu\text{L}$ ,  $0.25\text{ mmol}$ ,  $2.5\text{ eq.}$ ) was added. After stirring for 0.5 h at  $30\text{ }^{\circ}\text{C}$ , the reaction mixture was quenched with  $\text{NH}_4\text{Cl aq.}$  and extracted with  $\text{CH}_2\text{Cl}_2$ . The organic layer was dried with  $\text{Na}_2\text{SO}_4$ , and then concentrated. The resulting residue was purified by column chromatography on silica gel (eluting with hexane) to give the title compound **4q** as pale yellow oil ( $10.2\text{ mg}$ ,  $0.039\text{ mmol}$ ,  $39\%$  yield).

$^1\text{H-NMR}$  ( $300\text{ MHz}$ ,  $\text{CDCl}_3$ )  $\delta$  7.77 (dd,  $J = 7.9, 1.6\text{ Hz}$ ,  $1\text{H}$ ), 7.63 (dd,  $J = 8.1, 0.7\text{ Hz}$ ,  $1\text{H}$ ), 7.37-7.30 (m,  $2\text{H}$ ), 7.13-7.08 (m,  $1\text{H}$ ), 7.06 (s,  $1\text{H}$ ), 6.05-5.91 (m,  $1\text{H}$ ), 5.19-5.08 (m,  $2\text{H}$ ), 3.24 (d,  $J = 6.4\text{ Hz}$ ,  $2\text{H}$ ).

$^{13}\text{C-NMR}$  ( $100\text{ MHz}$ ,  $\text{CDCl}_3$ )  $\delta$  151.5, 139.1, 136.4, 134.2, 131.5, 128.8, 128.4, 127.5, 125.1, 119.6, 116.1, 112.4, 29.6.

HRMS (APCI, positive) Calcd. For  $\text{C}_{13}\text{H}_{12}\text{BrO}$ : 263.0067, 265.0046 ( $[\text{M} + \text{H}]^+$ ), Found: 263.0066, 265.0050 ( $[\text{M} + \text{H}]^+$ ).

### Synthesis of pyrroles **6**

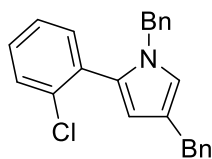


#### General procedure (B)

A mixture of dibromomethyl ketone **2** ( $0.10\text{ mmol}$ ,  $1.0\text{ eq.}$ ) and 2-bromo-3-phenylpropanal (**3a**)

(0.10 mmol, 1.0 eq.) in toluene (0.80 mL, 0.13 M) was stirred at  $-78\text{ }^{\circ}\text{C}$  under  $\text{N}_2$  atmosphere. A 1.0 M hexane solution of  $\text{Et}_2\text{Zn}$  (0.3 mL, 0.3 mmol) was slowly added to the mixture at  $-78\text{ }^{\circ}\text{C}$ . After stirring for 0.5 h at  $-78\text{ }^{\circ}\text{C}$  and then 0.5 h at  $30\text{ }^{\circ}\text{C}$ , the reaction mixture was cooled at  $0\text{ }^{\circ}\text{C}$ . To the mixture was added an amine (0.10 mmol, 1.0 eq.). After stirring for 2 h at reflux, the reaction mixture was quenched with  $\text{NaHCO}_3$  aq. and extracted with  $\text{CH}_2\text{Cl}_2$ . The organic layer was dried with  $\text{Na}_2\text{SO}_4$ , and then concentrated. The resulting residue was purified by column chromatography on silica gel (eluting with hexane/ethyl acetate = 50/1) to give the corresponding pyrrole **6**.

#### 1,4-Dibenzyl-2-(2-chlorophenyl)-1H-pyrrole (**6a**)



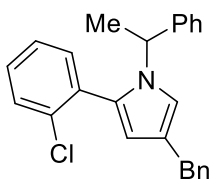
Following the general procedure (B) using **2d** (31.2 mg, 0.1 mmol), 2-bromo-3-phenylpropanal (**3a**) (21.3 mg, 0.1 mmol), and benzylamine (10.8 mg, 0.10 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **6a** as pale yellow oil (22.1 mg, 0.062 mmol, 62% yield).

$^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.41 (d,  $J = 7.7$  Hz, 1H), 7.29-7.27 (m, 4H), 7.23-7.17 (m, 7H), 6.90 (d,  $J = 5.9$  Hz, 2H), 6.49 (s, 1H), 6.06 (d,  $J = 1.5$  Hz, 1H), 4.87 (s, 2H), 3.86 (s, 2H).

$^{13}\text{C-NMR}$  (100 MHz,  $\text{CDCl}_3$ )  $\delta$  142.3, 138.7, 134.9, 133.1, 132.6, 131.3, 129.6, 129.2, 128.8, 128.5, 128.4, 127.3, 127.0, 126.5, 125.8, 123.0, 120.3, 110.8, 51.0, 33.6.

HRMS (APCI, positive) Calcd. For C<sub>24</sub>H<sub>21</sub>ClN: 358.1358, 360.1328 ([M + H]<sup>+</sup>), Found: 358.1362, 360.1350 ([M + H]<sup>+</sup>).

**4-Benzyl-2-(2-chlorophenyl)-1-(1-phenylethyl)-1H-pyrrole (6b)**



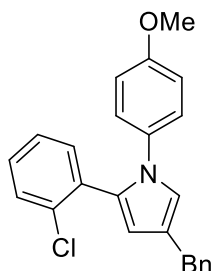
Following the general procedure (B) using **2d** (31.2 mg, 0.1 mmol), 2-bromo-3-phenylpropanal (**3a**) (21.3 mg, 0.1 mmol), and 1-phenylethylamine (12.2 mg, 0.10 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **6b** as pale yellow oil (22.1 mg, 0.059 mmol, 59% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.41 (d, *J* = 8.2 Hz, 1H), 7.29-7.28 (m, 4H), 7.24-7.12 (m, 7H), 6.89 (d, *J* = 6.4 Hz, 2H), 6.63 (s, 1H), 6.01 (d, *J* = 1.8 Hz, 1H), 5.05 (q, *J* = 7.0 Hz, 1H), 3.89 (s, 2H), 1.75 (d, *J* = 7.0 Hz, 3H).

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 142.5, 135.1, 133.3, 132.9, 131.4, 129.5, 129.2, 128.8, 128.4, 128.3, 127.1, 126.5, 126.0 (two peaks overlap), 125.7, 122.7, 116.5, 110.6, 55.1, 33.8, 21.8.

HRMS (APCI, positive) Calcd. For C<sub>25</sub>H<sub>23</sub>ClN: 372.1514, 374.1485 ([M + H]<sup>+</sup>), Found: 372.1516, 374.1486 ([M + H]<sup>+</sup>).

#### 4-Benzyl-2-(2-chlorophenyl)-1-(4-methoxyphenyl)-1H-pyrrole (6c)



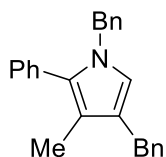
Following the general procedure (B) using **2d** (31.2 mg, 0.1 mmol), 2-bromo-3-phenylpronapal (**3a**) (21.3 mg, 0.1 mmol), and 4-methoxyaniline (12.3 mg, 0.10 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **6c** as pale yellow oil (24.2 mg, 0.065 mmol, 65% yield).

$^1\text{H-NMR}$  (300 MHz,  $\text{CDCl}_3$ )  $\delta$  7.36-7.28 (m, 5H), 7.24-7.08 (m, 4H), 6.98-6.95 (m, 2H), 6.75-6.72 (m, 2H), 6.66-6.65 (m, 1H), 6.28 (d,  $J = 1.8$  Hz, 1H), 3.92 (s, 2H), 3.75 (s, 3H).

$^{13}\text{C-NMR}$  (100 MHz,  $\text{CDCl}_3$ )  $\delta$  157.8, 141.9, 134.2, 133.8, 132.8, 132.7, 130.3, 129.8, 129.0, 128.6, 128.4, 126.3, 125.97, 125.94, 123.6, 121.4, 114.0, 112.7, 55.5, 33.6.

HRMS (APCI, positive) Calcd. For  $\text{C}_{24}\text{H}_{21}\text{ClNO}$ : 374.1307, 376.1277 ( $[\text{M} + \text{H}]^+$ ), Found: 374.1302, 376.1277 ( $[\text{M} + \text{H}]^+$ ).

#### 1,4-Dibenzyl-3-methyl-2-phenyl-1H-pyrrole (6d)



Following the general procedure (B) using **2k** (29.2 mg, 0.1 mmol), 2-bromo-3-phenylpronapal

(**3a**) (21.3 mg, 0.1 mmol), and benzylamine (10.8 mg, 0.10 mmol) gave the crude product. Purification by flash column chromatography gave the title compound **6d** as pale yellow oil (18.2 mg, 0.054 mmol, 54% yield).

<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>) δ 7.36-7.27 (m, 6H), 7.25-7.16 (m, 7H), 6.93 (d, *J* = 6.4 Hz, 2H), 6.39 (s, 1H), 4.94 (s, 2H), 3.83 (s, 2H), 1.95 (s, 3H)

<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>) δ 141.9, 139.4, 132.9, 131.8, 130.5, 128.8, 128.6, 128.4, 128.3, 127.2, 127.0, 126.6, 125.7, 122.4, 119.9, 116.2, 50.6, 32.2, 10.2.

HRMS (APCI, positive) Calcd. For C<sub>25</sub>H<sub>24</sub>N: 338.1903 ([M + H]<sup>+</sup>), Found: 338.1906 ([M + H]<sup>+</sup>).

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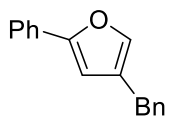
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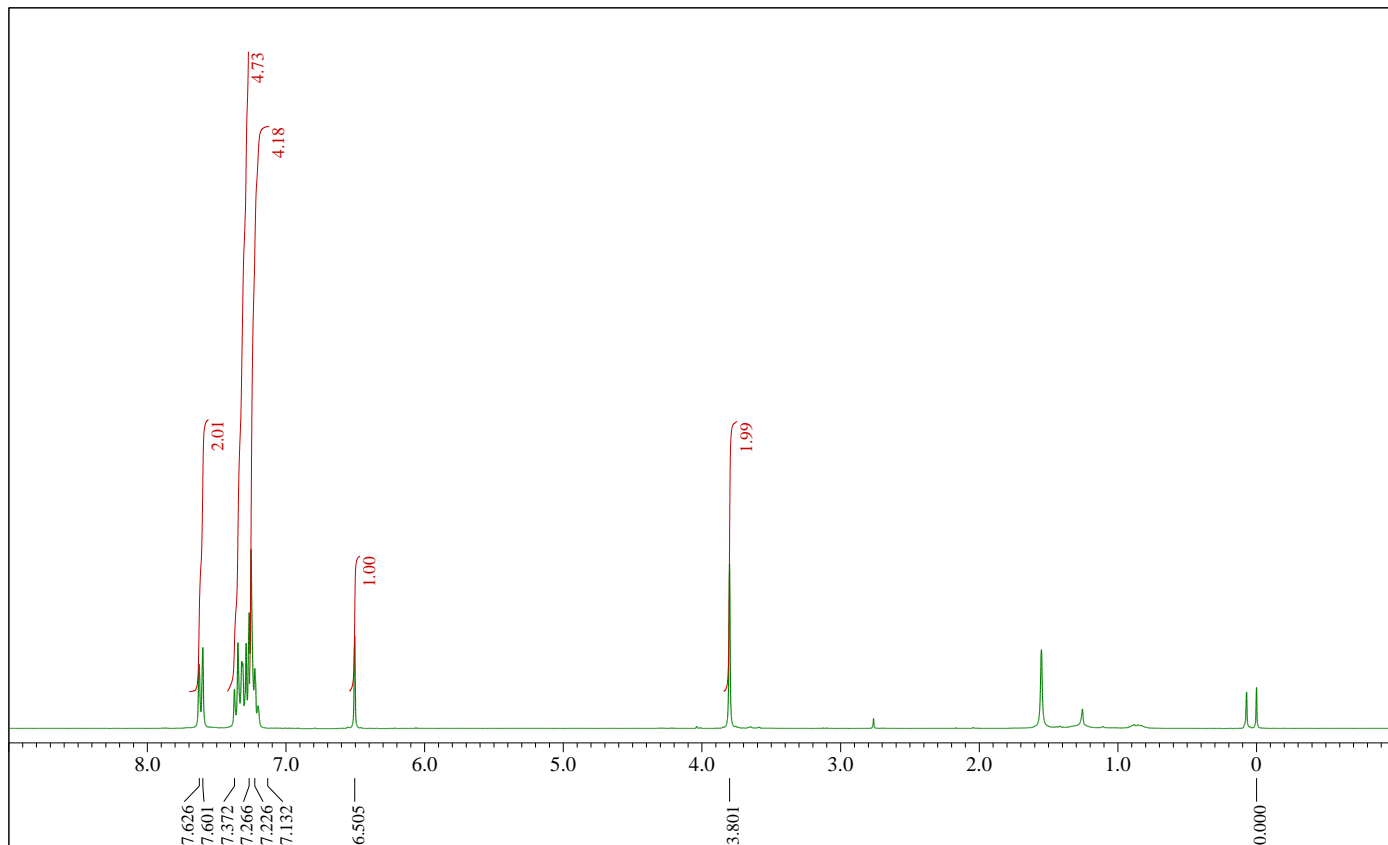
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$^1\text{H}$ ,  $^{13}\text{C}$ ,  $^{19}\text{F}$  NMR spectra

4-Benzyl-2-phenylfuran (4a)

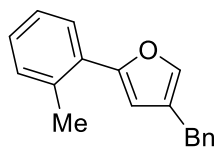


$^1\text{H}$ -NMR (300 MHz,  $\text{CDCl}_3$ )

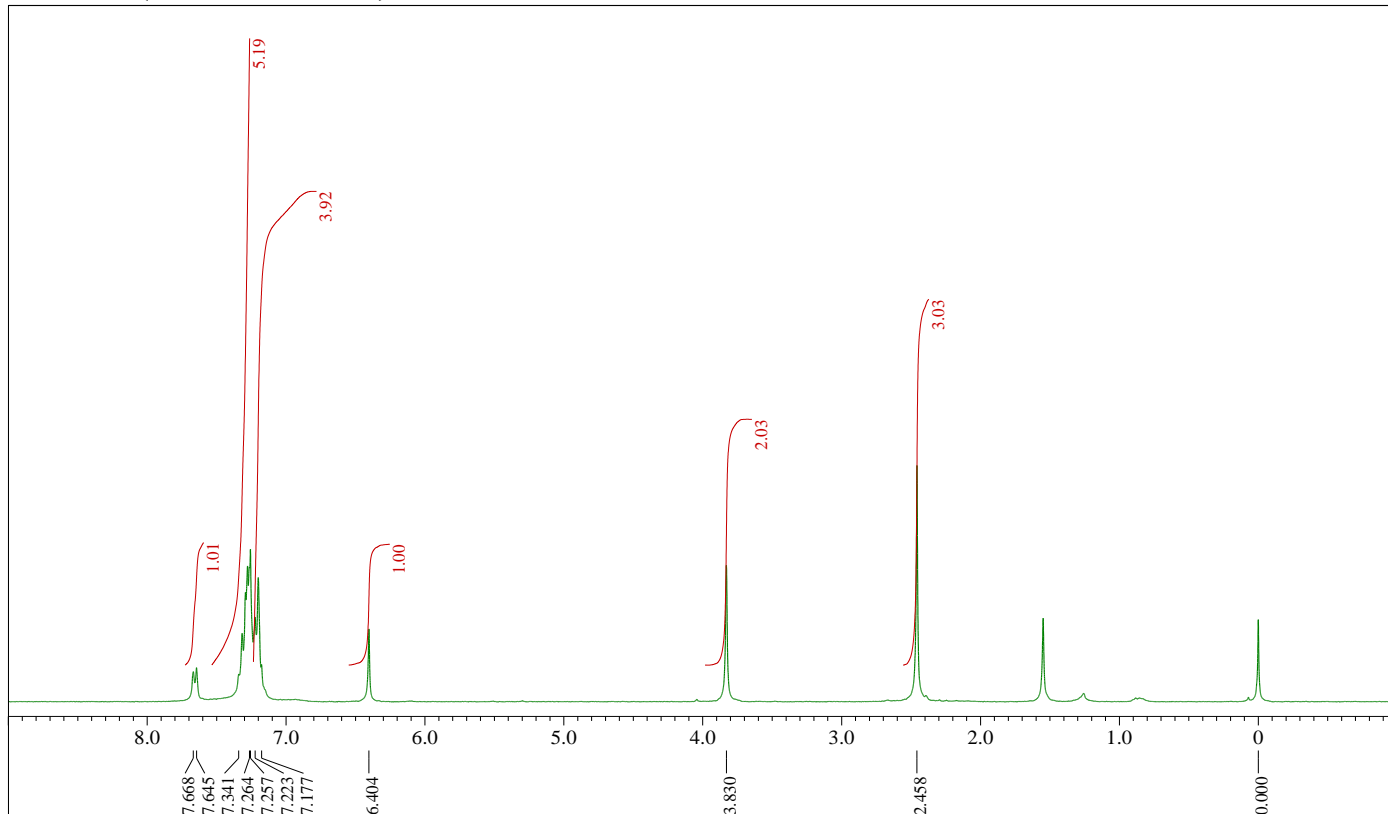




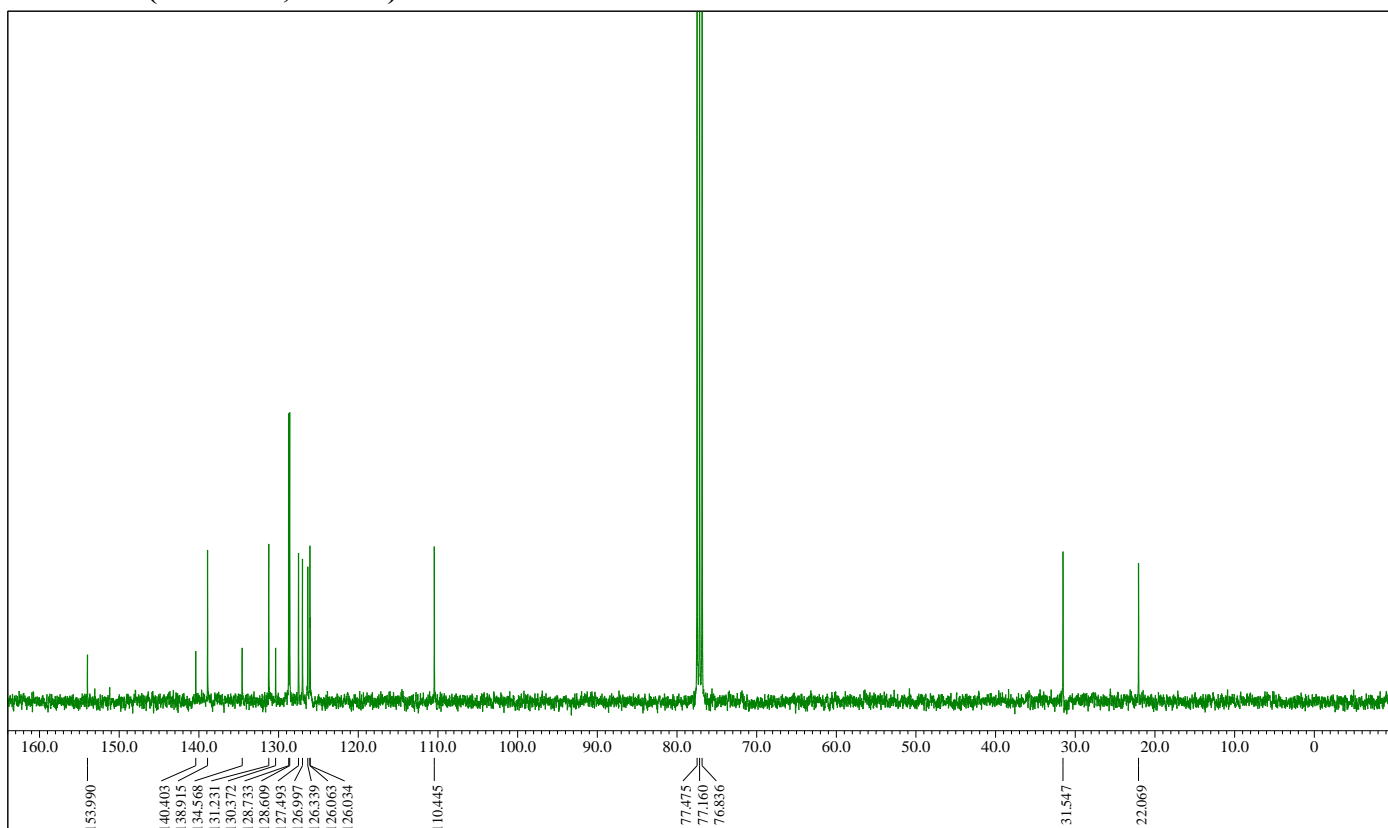
### 4-Benzyl-2-(2-methylphenyl)furan (4b)



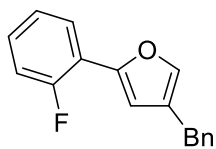
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



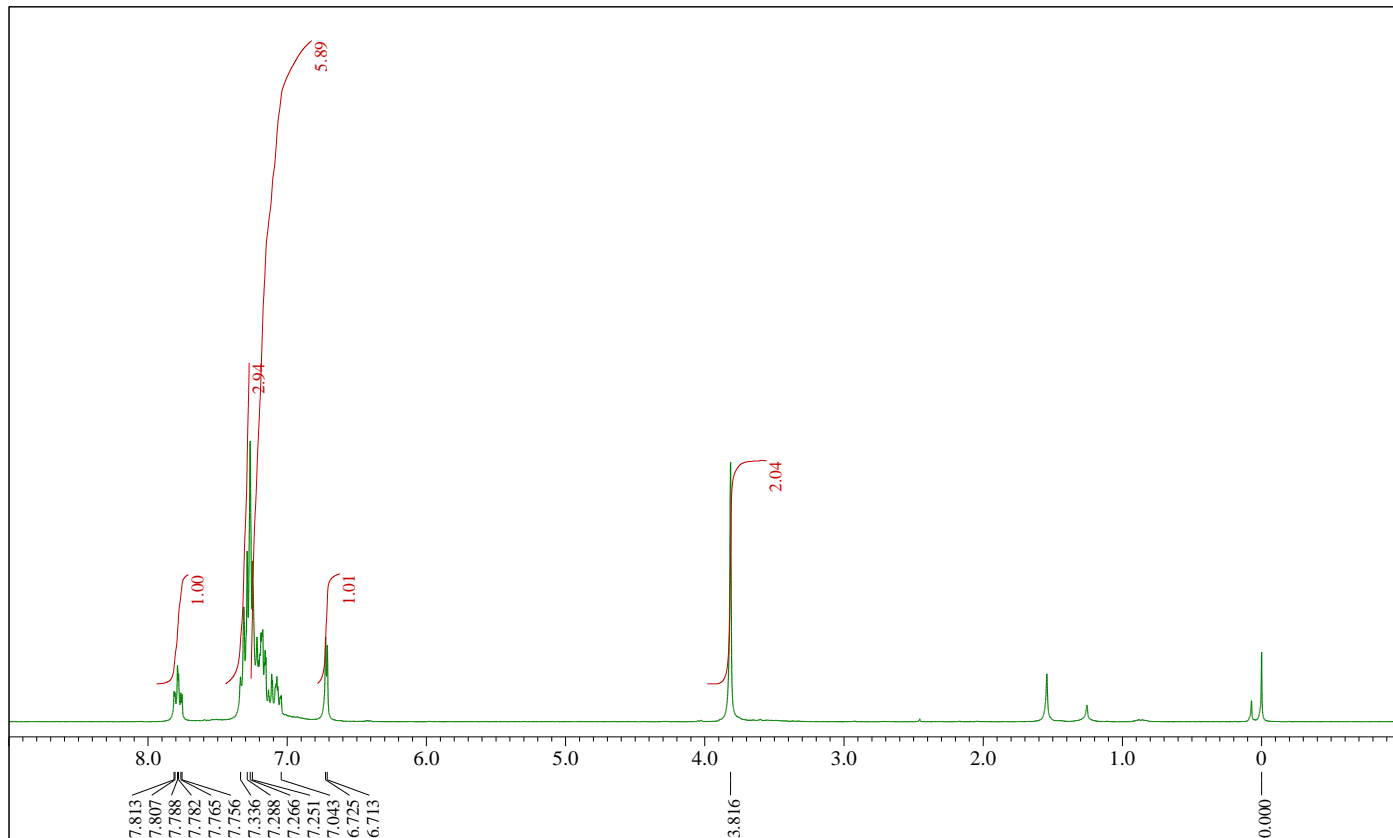
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



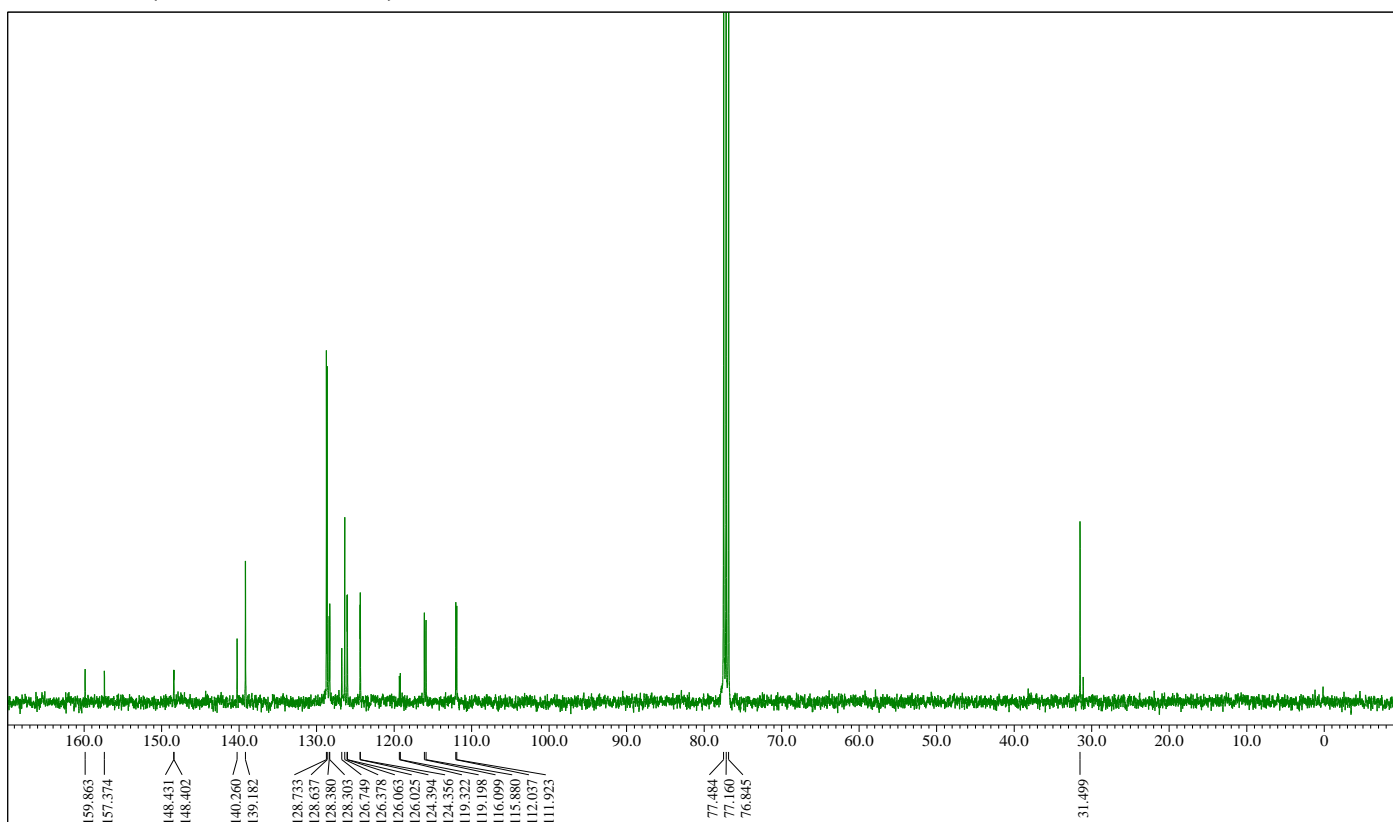
### 4-Benzyl-2-(2-fluorophenyl)furan (4c)



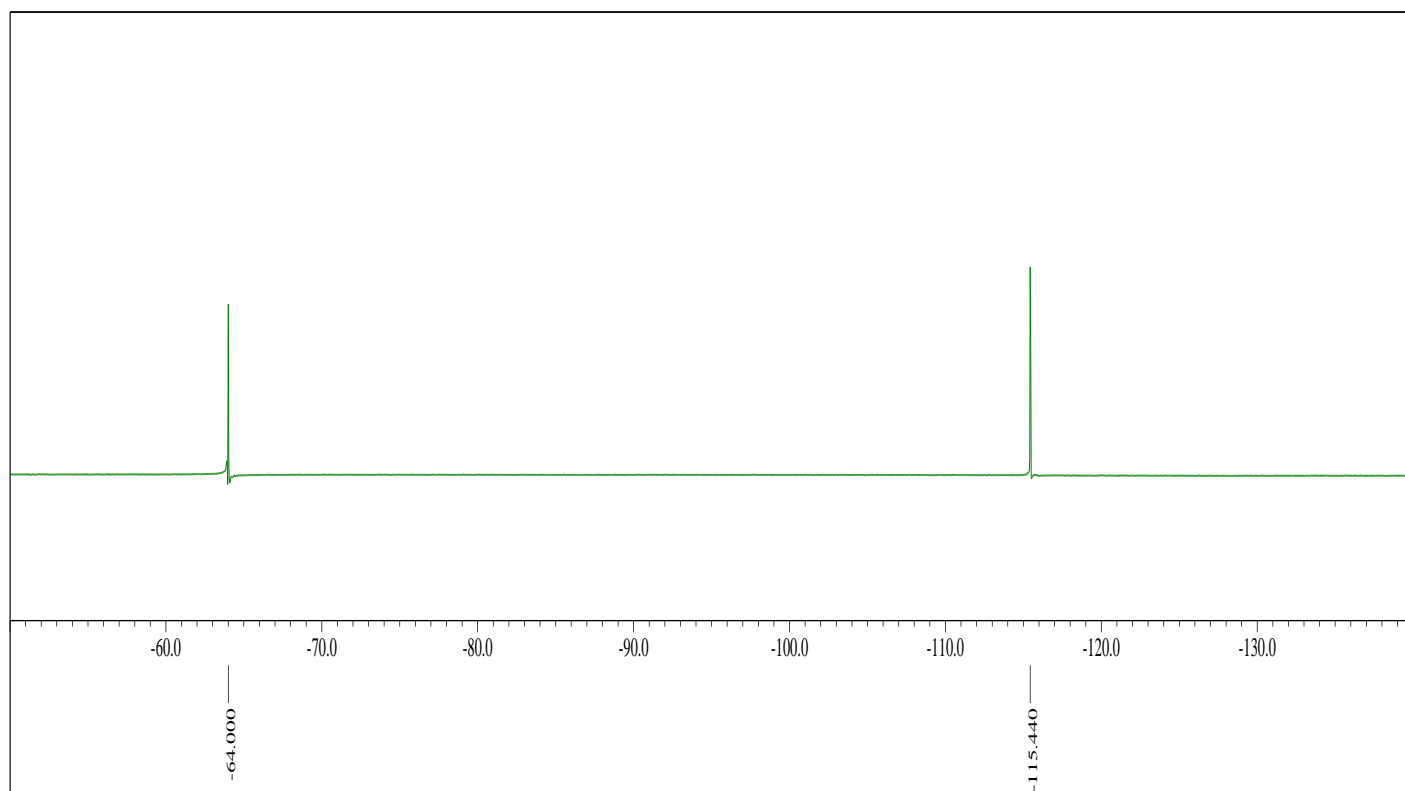
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



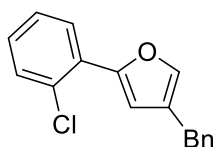
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



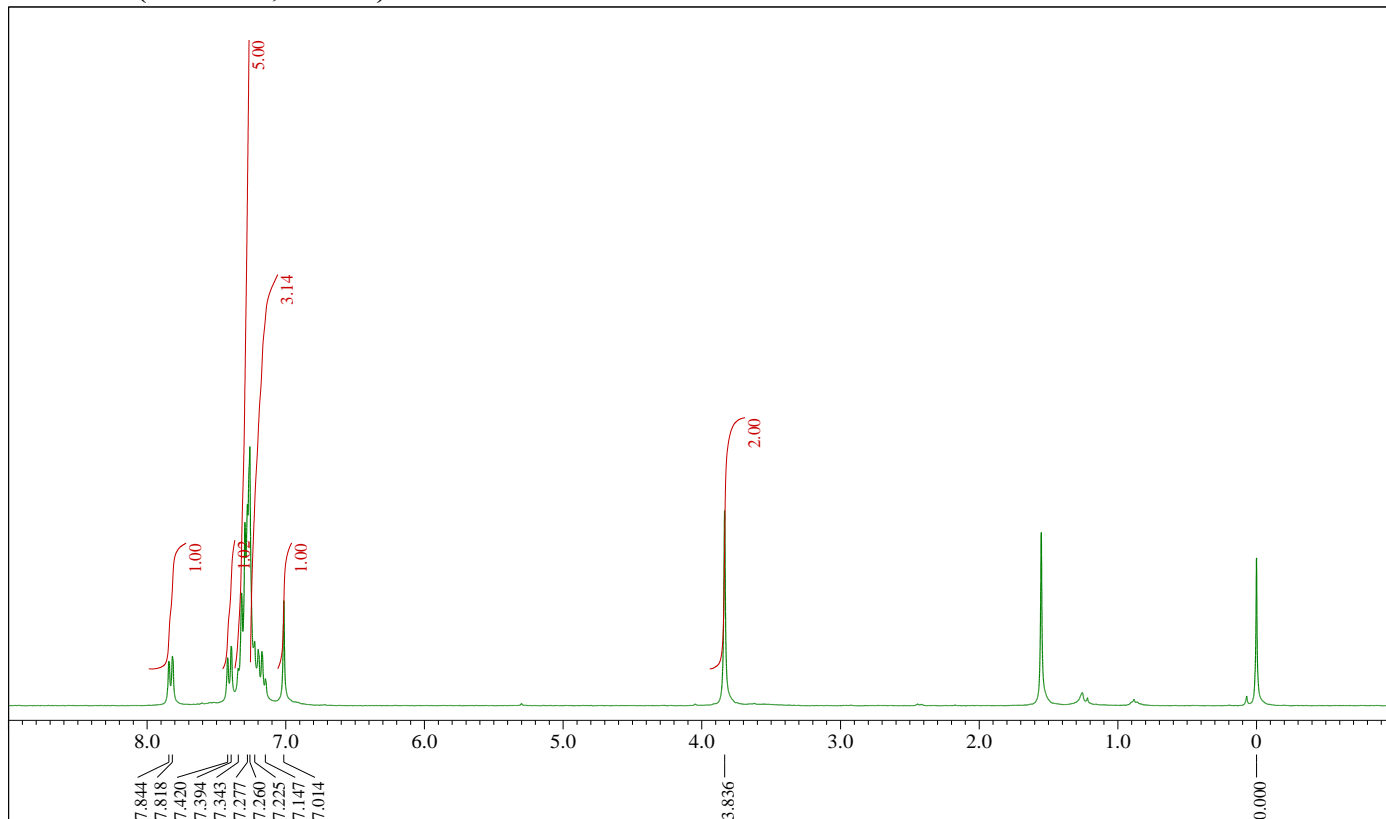
**$^{19}\text{F}$ -NMR (471 MHz,  $\text{CDCl}_3$ )**



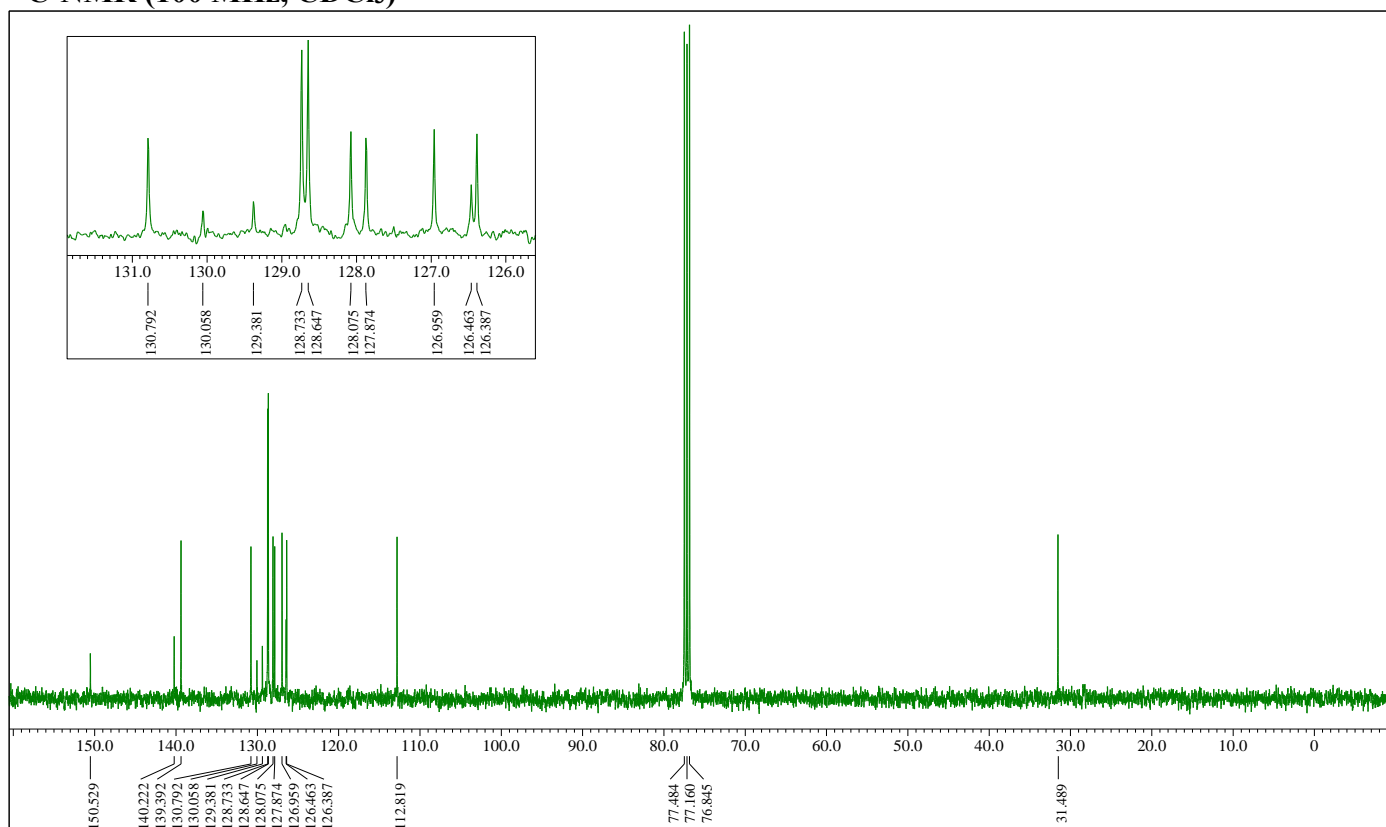
### 4-Benzyl-2-(2-chlorophenyl)furan (4d)



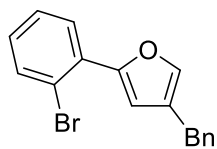
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



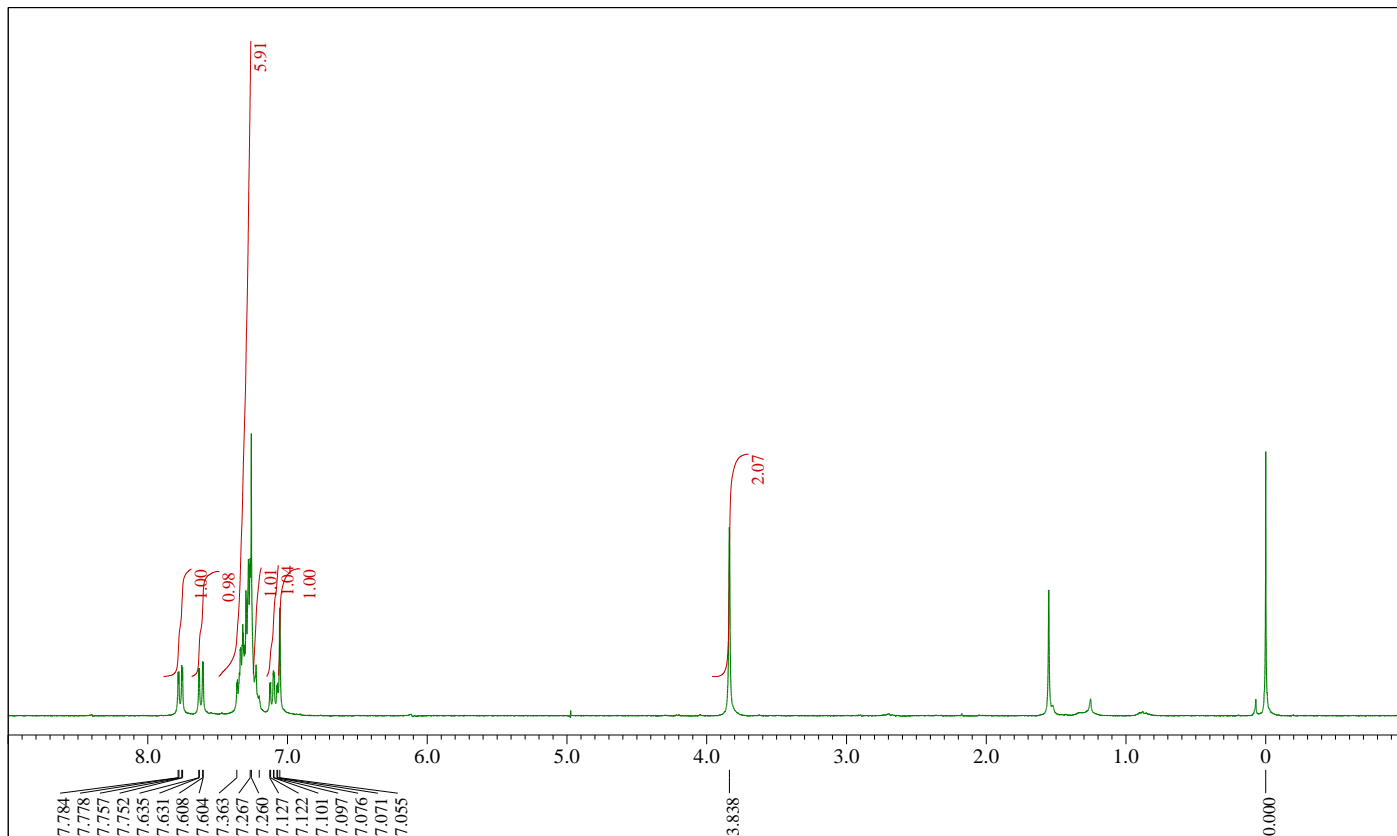
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



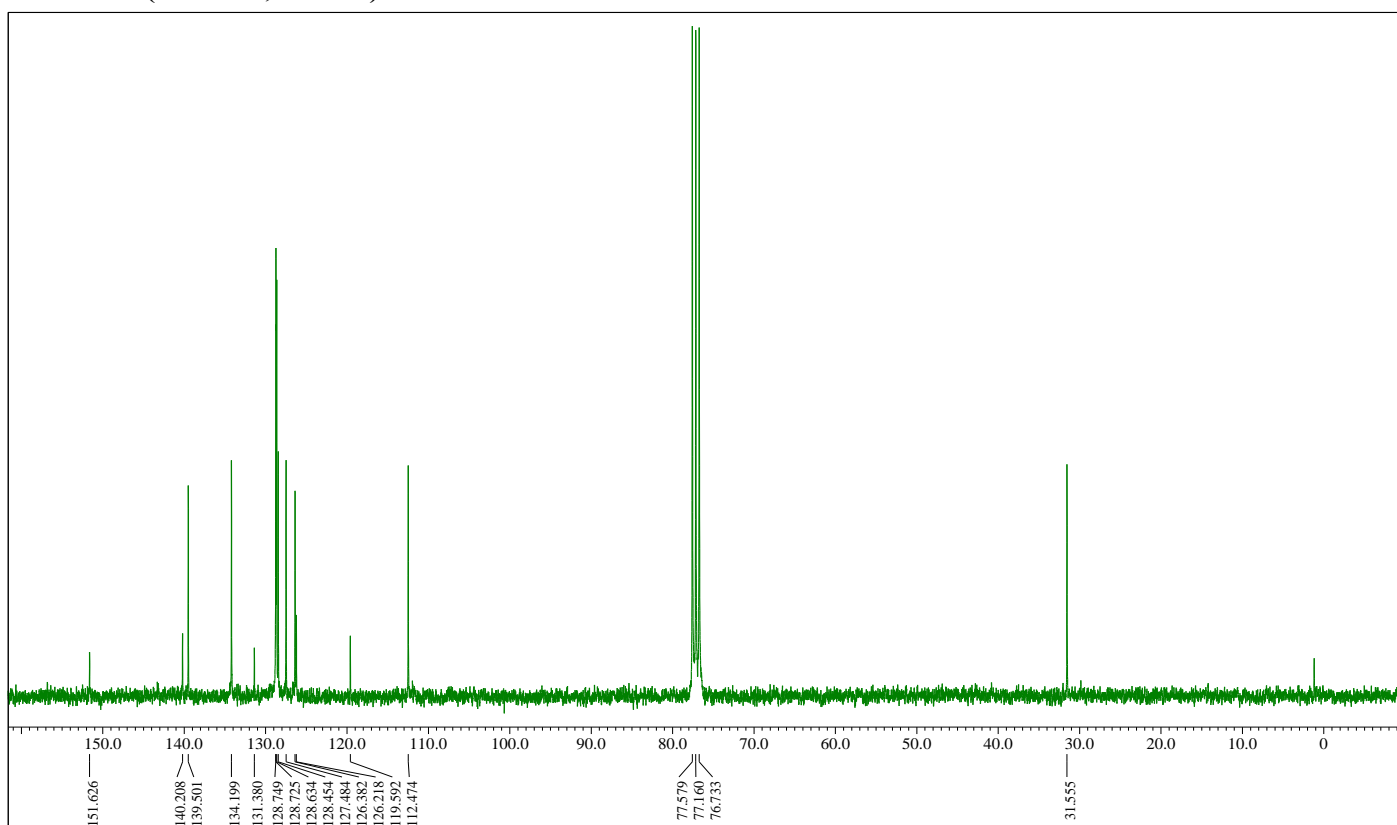
### 4-Benzyl-2-(2-bromophenyl)furan (4e)



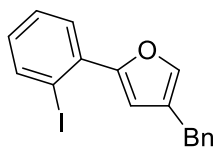
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



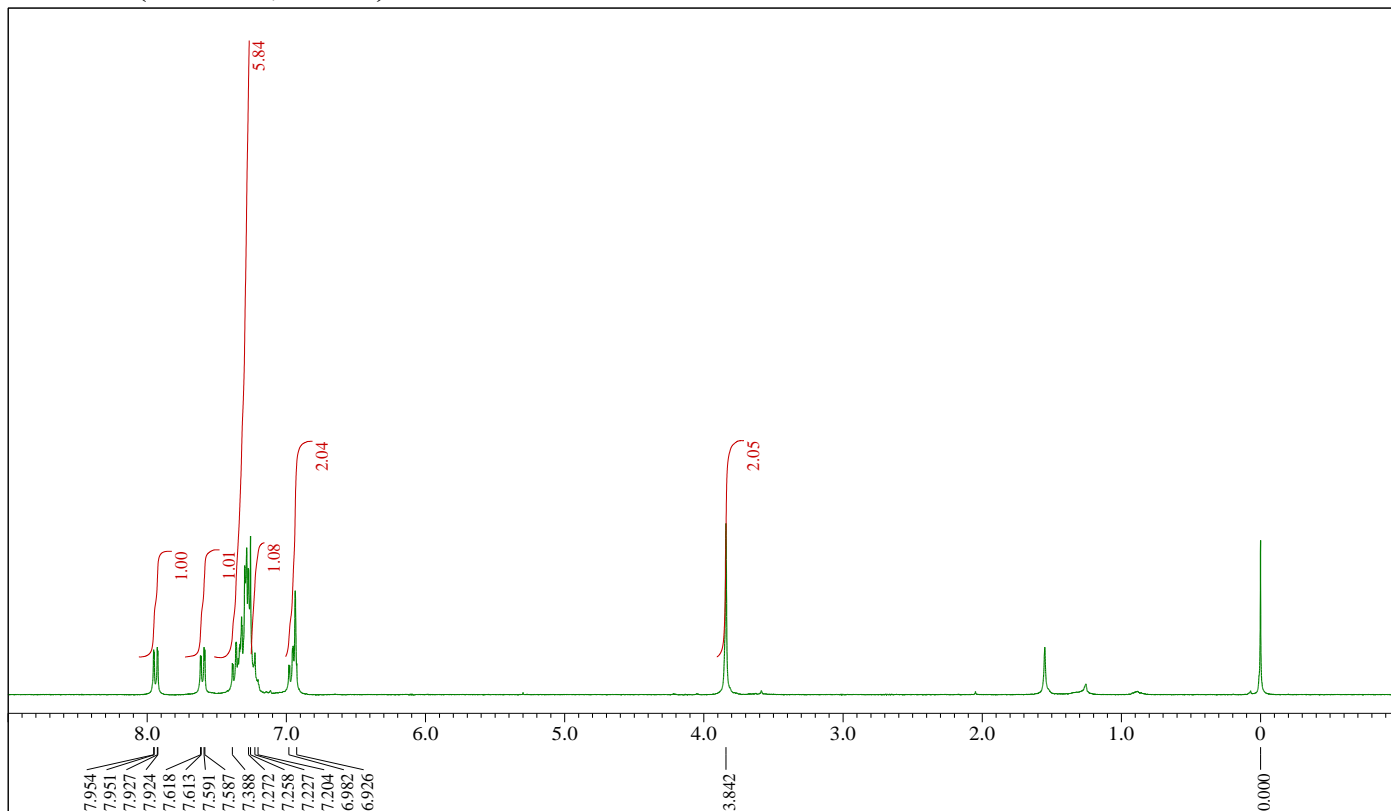
### <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>)



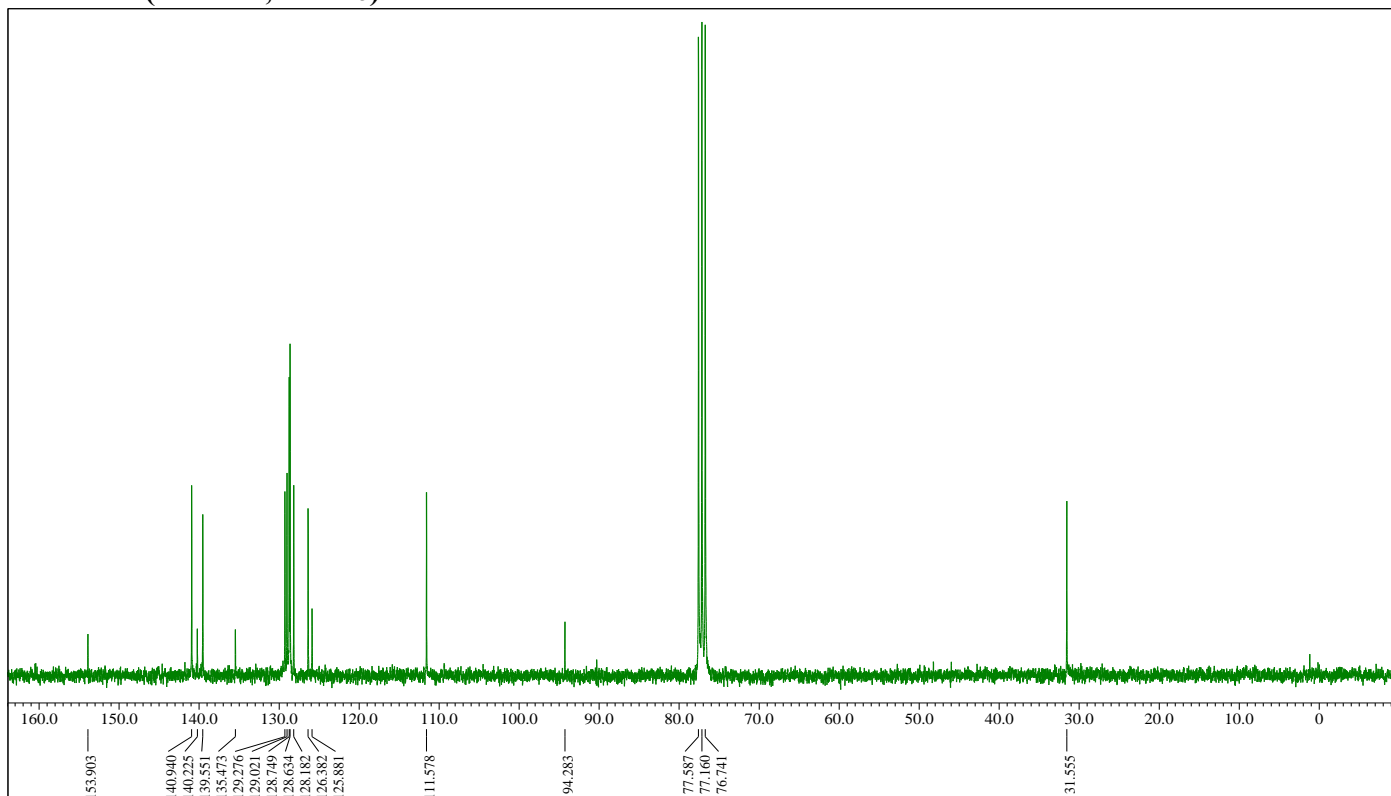
### 4-Benzyl-2-(2-iodophenyl)furan (4f)



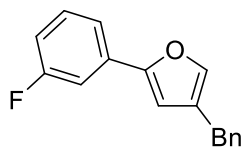
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



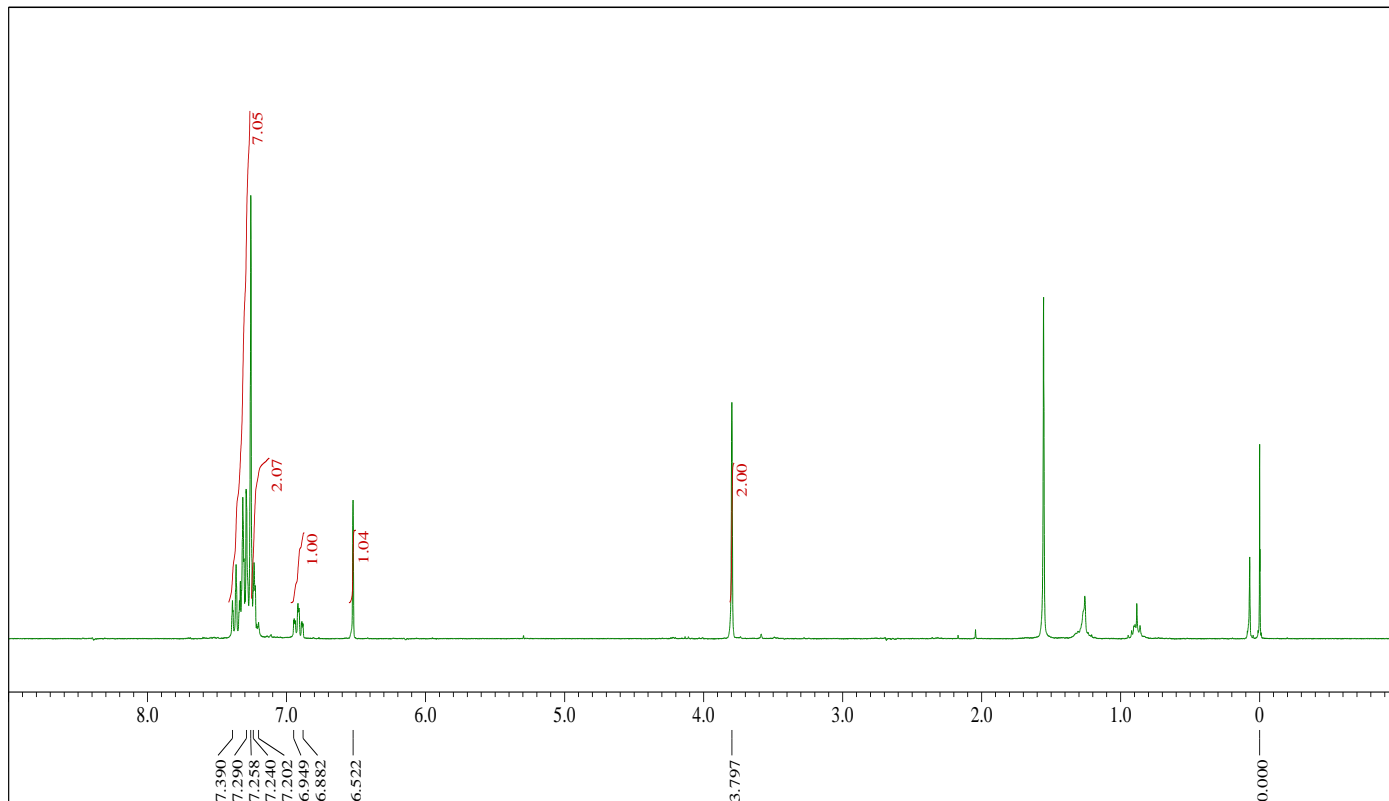
### <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>)



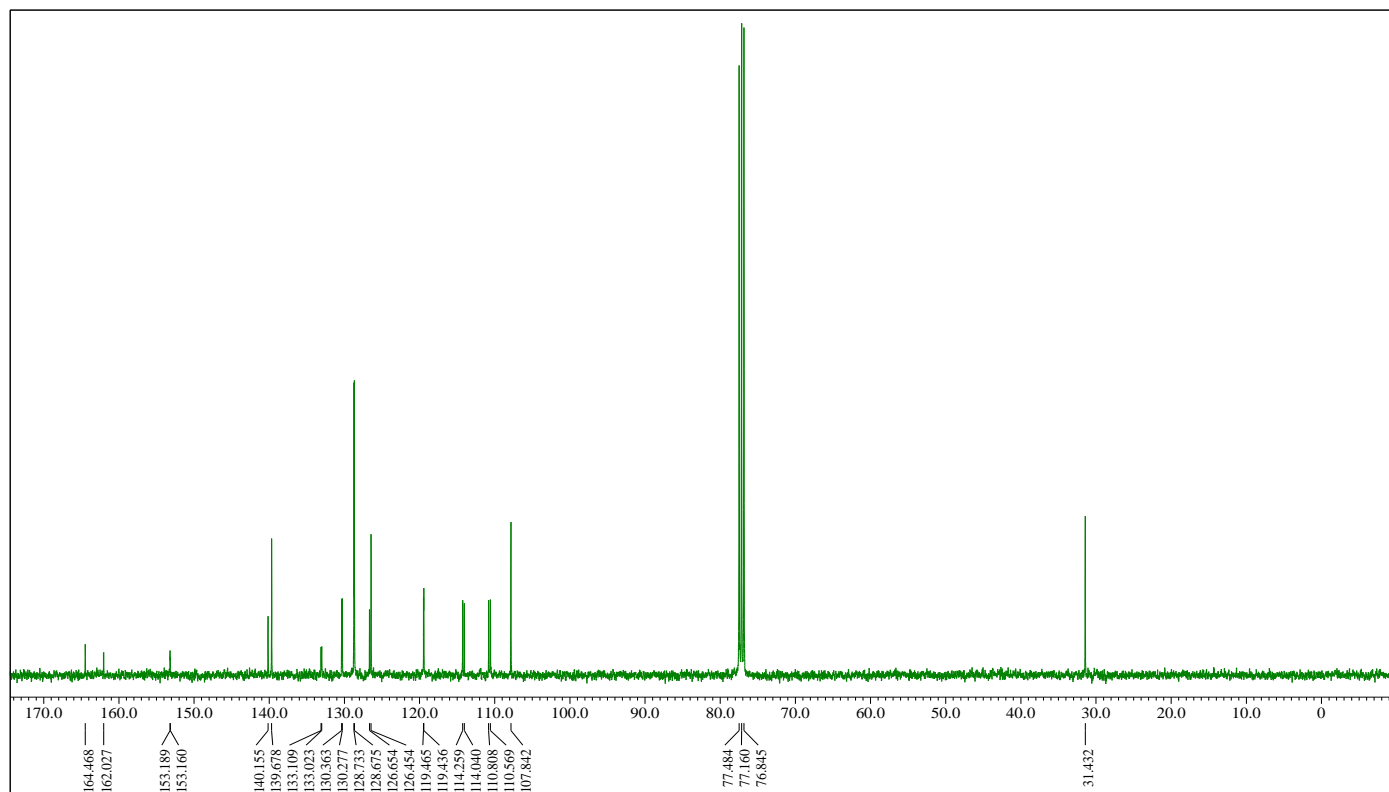
### 4-Benzyl-2-(3-fluorophenyl)furan (4g)



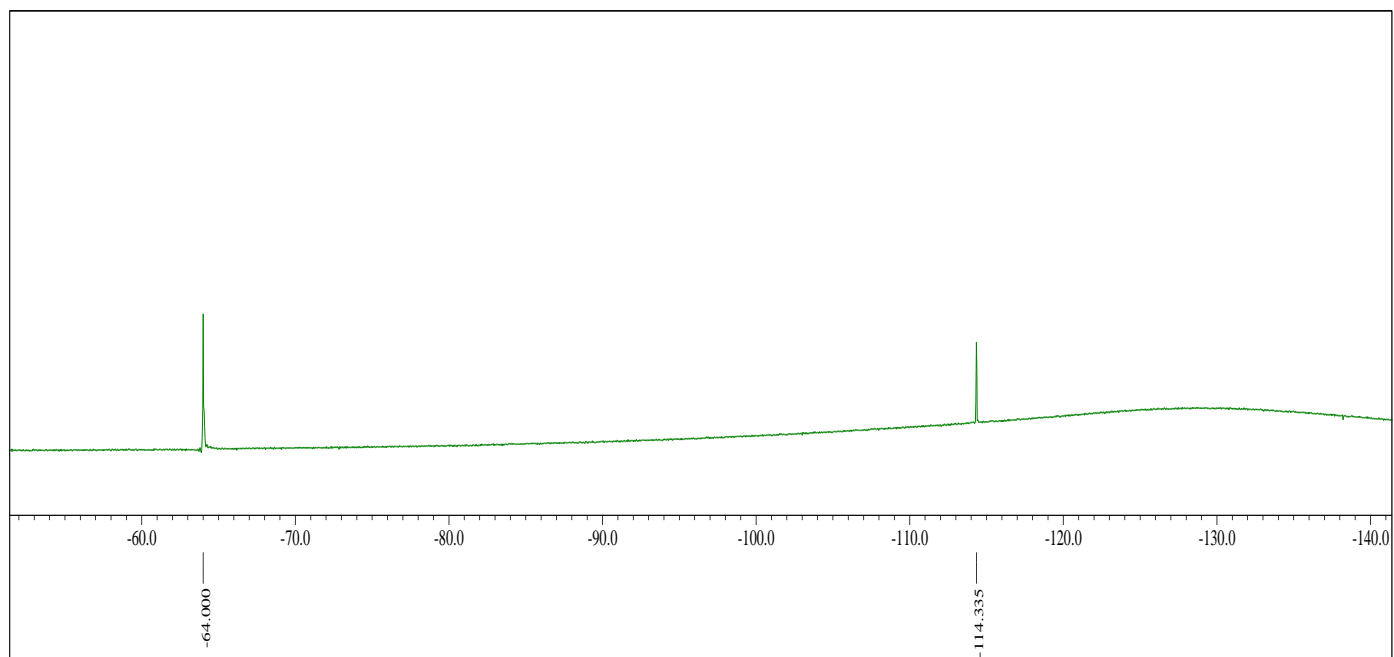
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)

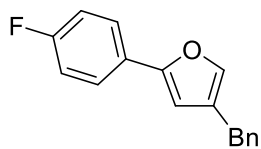


**$^{19}\text{F}$ -NMR (376 MHz,  $\text{CDCl}_3$ )**

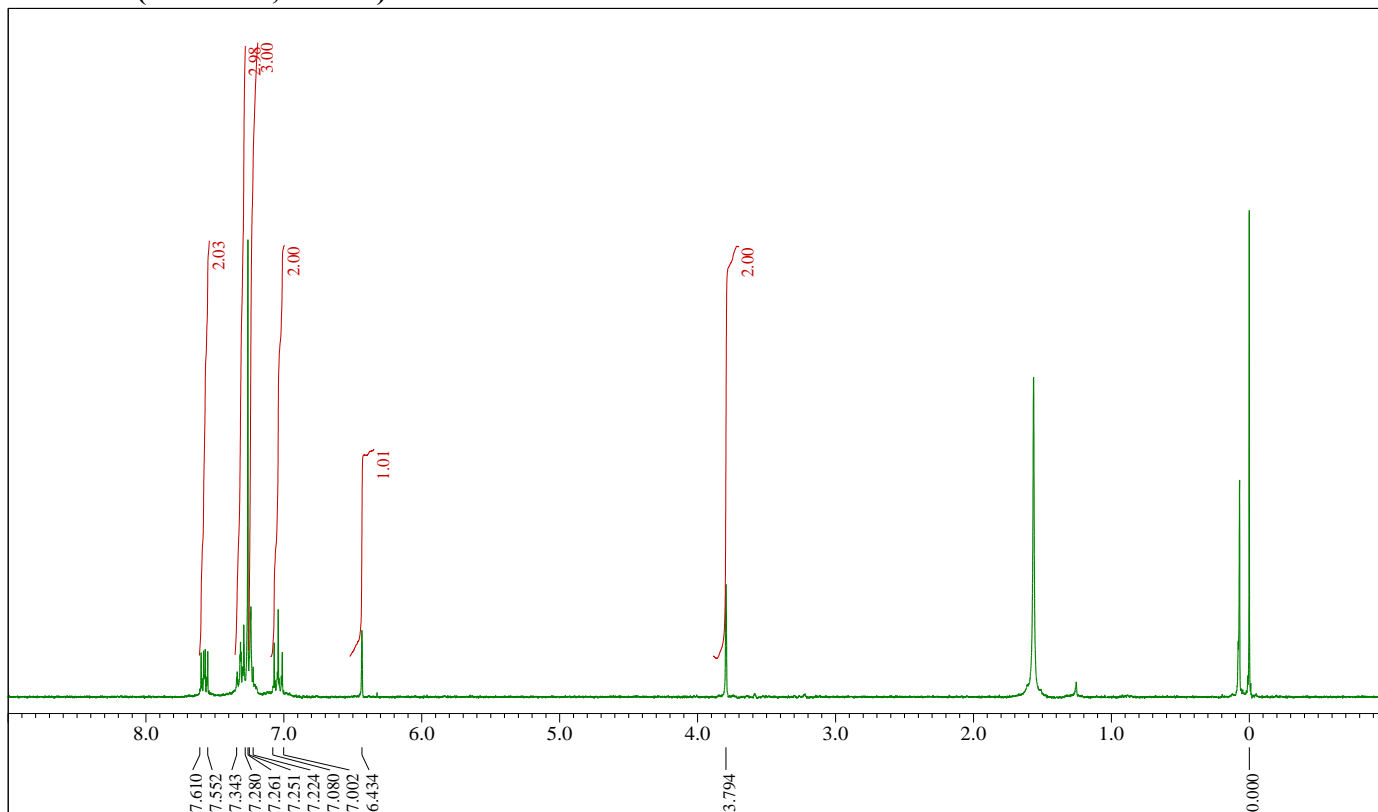




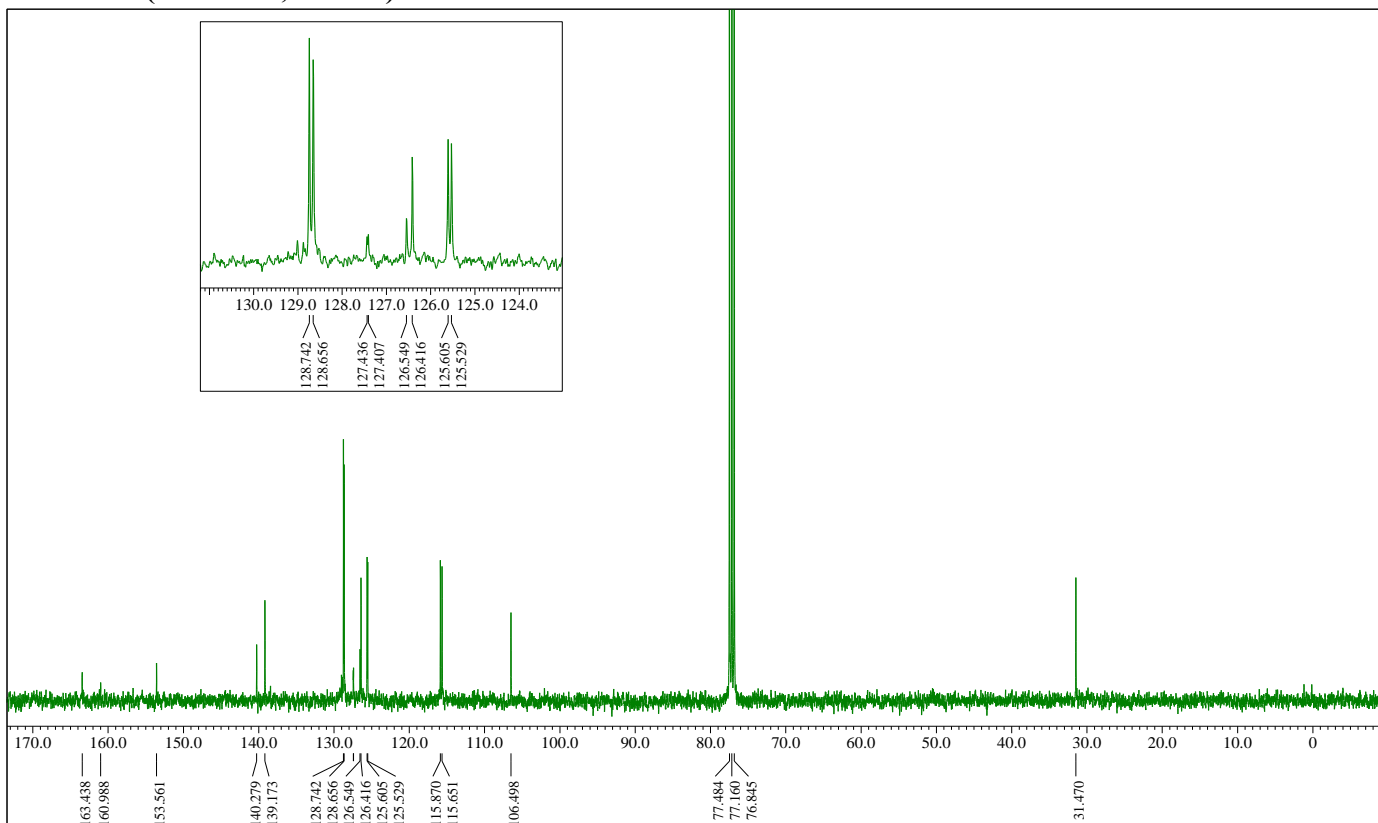
### 4-Benzyl-2-(4-fluorophenyl)furan (4h)



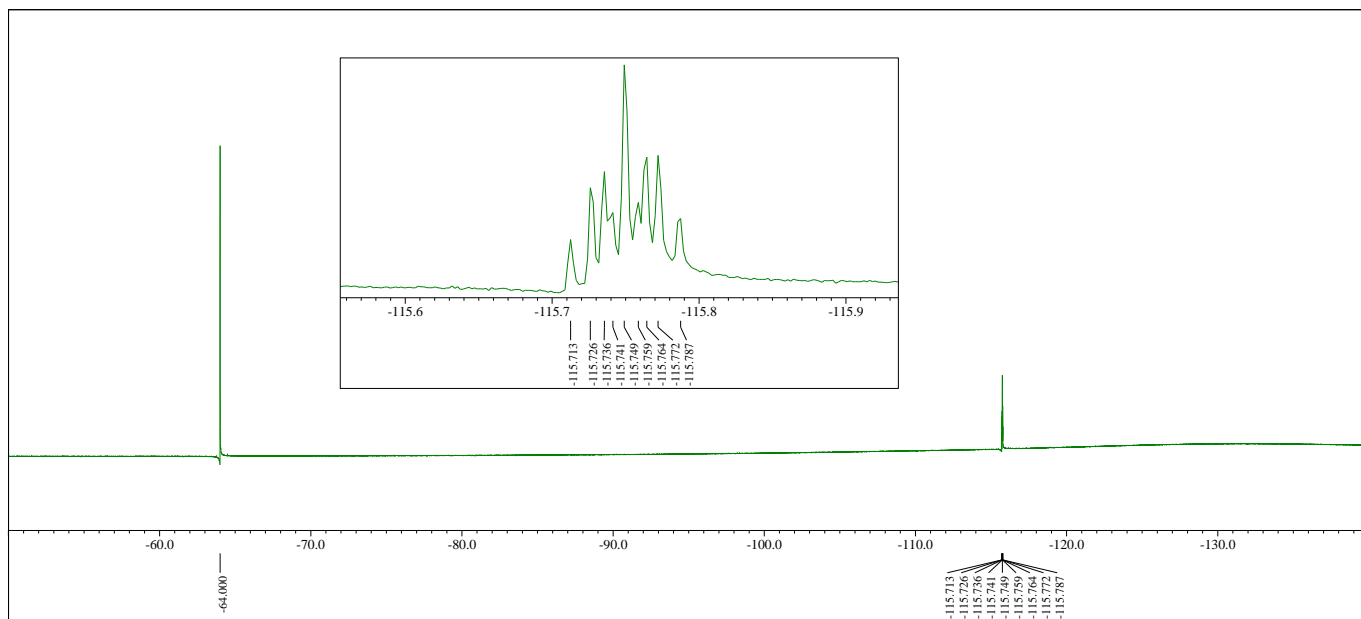
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



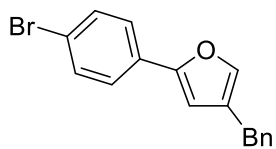
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



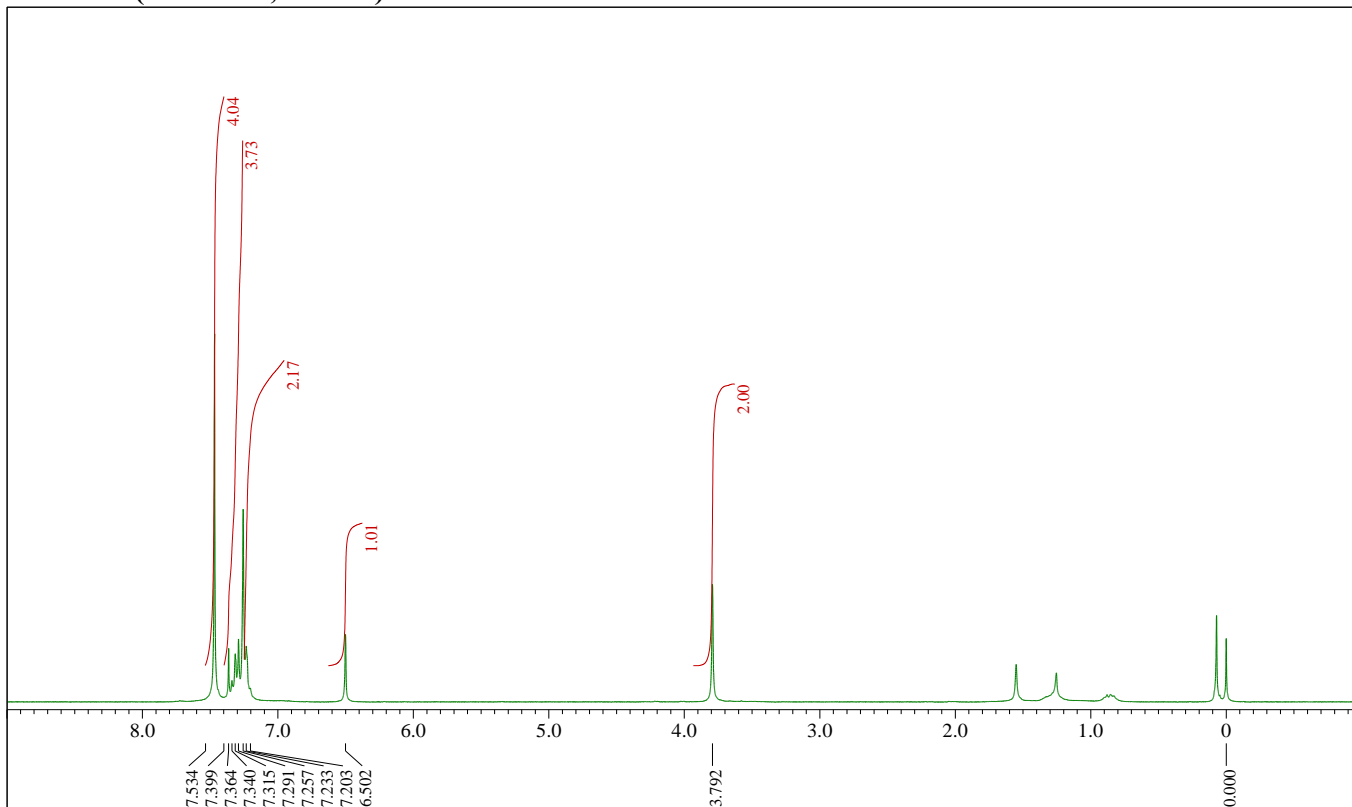
**$^{19}\text{F}$ -NMR (376 MHz,  $\text{CDCl}_3$ )**



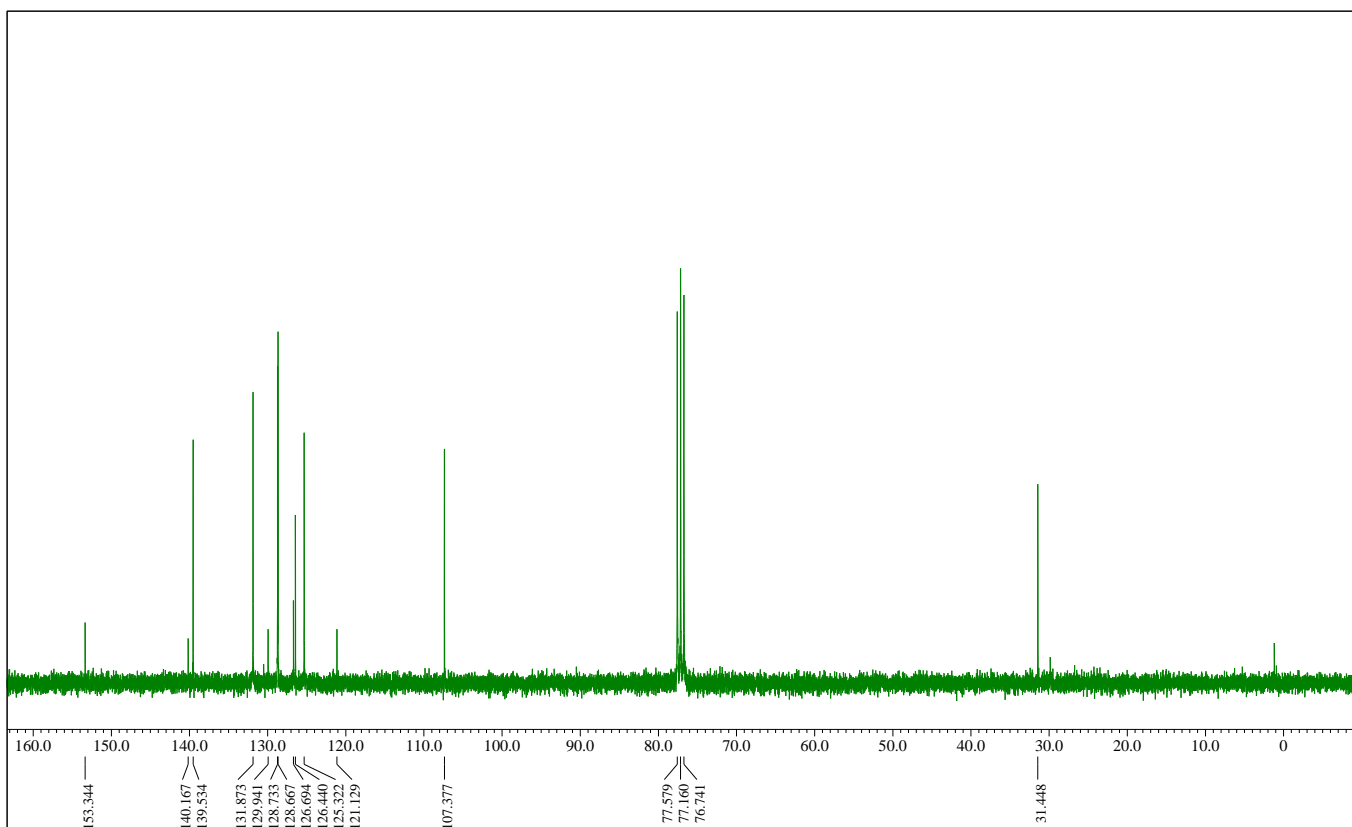
### 4-Benzyl-2-(4-bromophenyl)furan (4i)



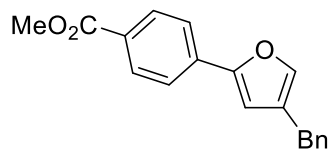
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



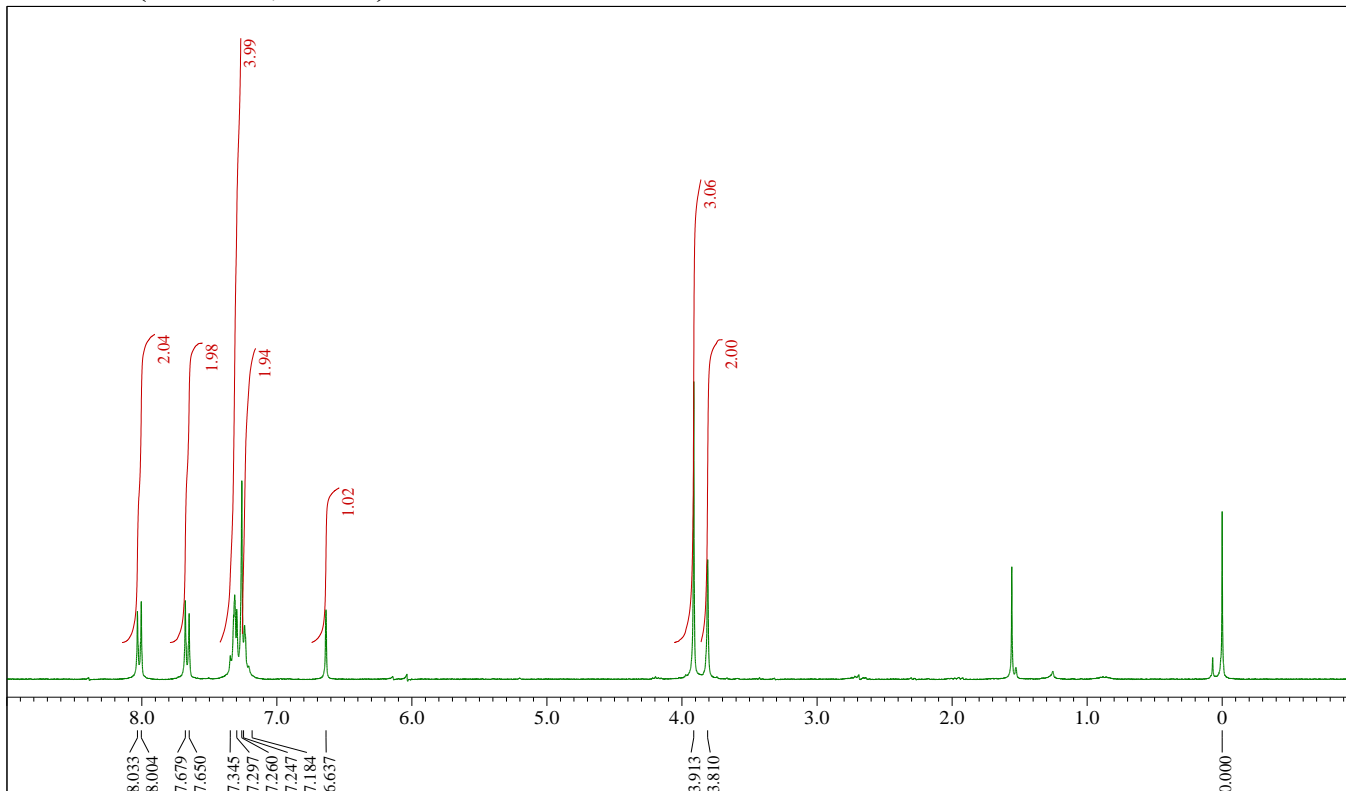
### <sup>13</sup>C-NMR (75 MHz, CDCl<sub>3</sub>)



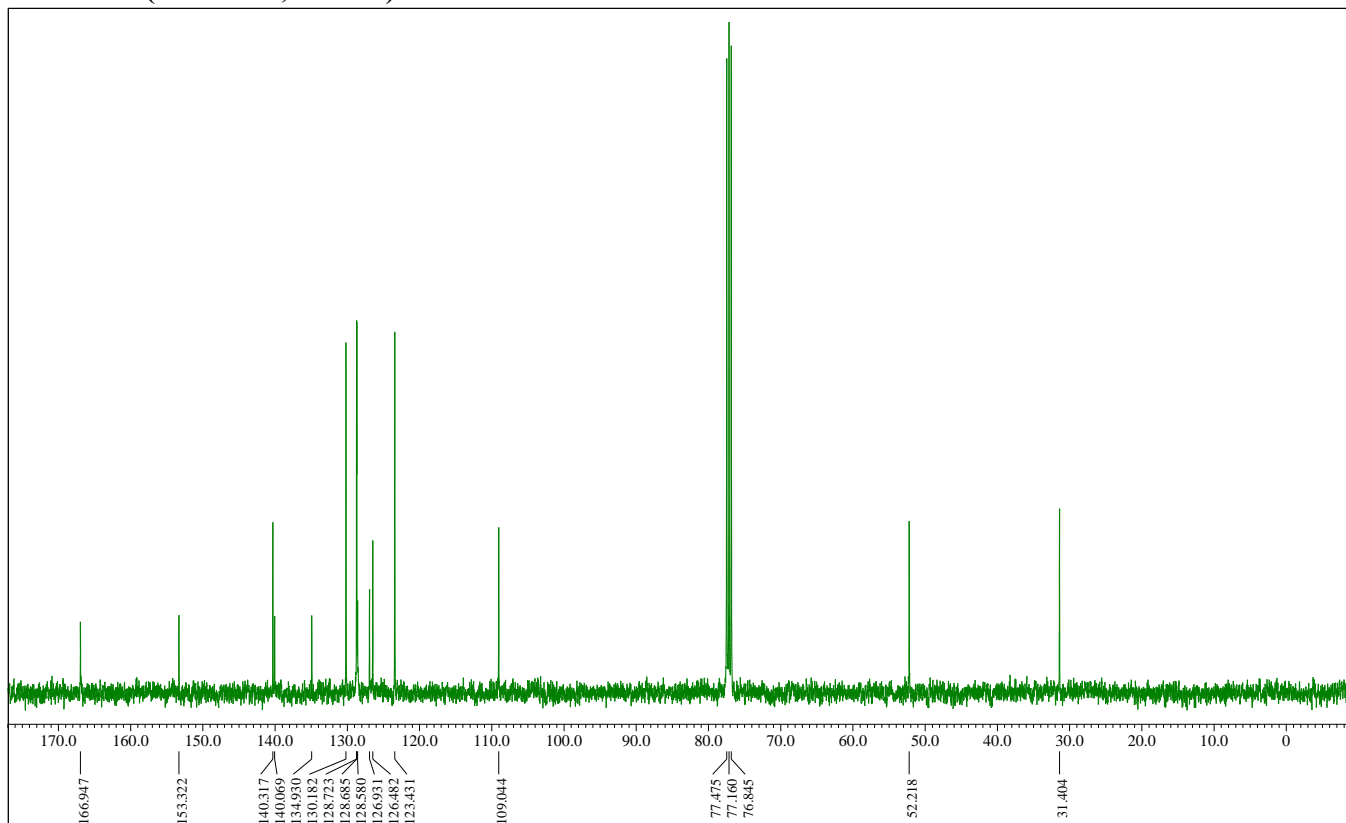
### Methyl 4-(4-benzylfuran-2-yl)benzoate (4j)



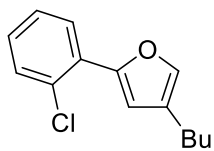
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



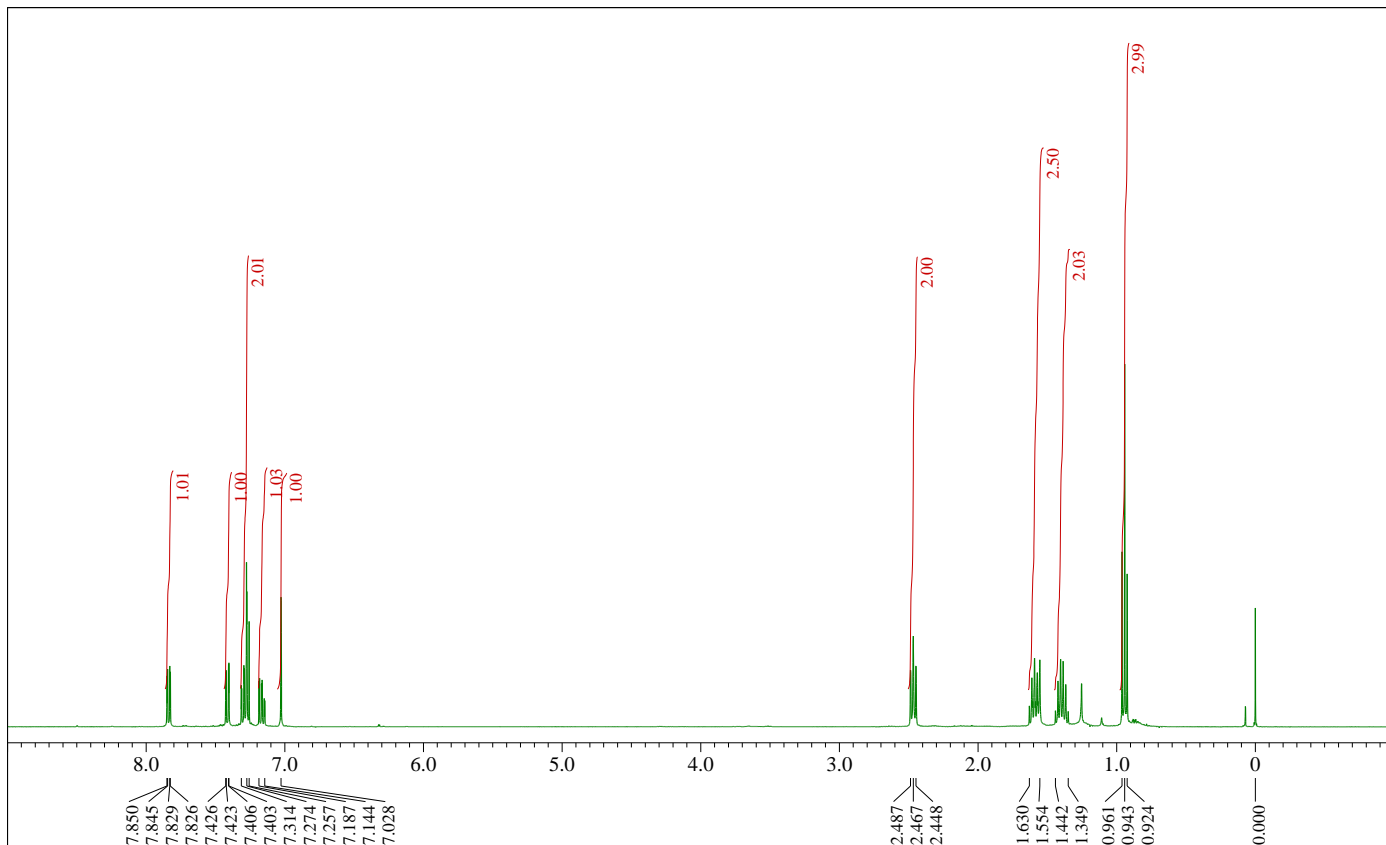
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



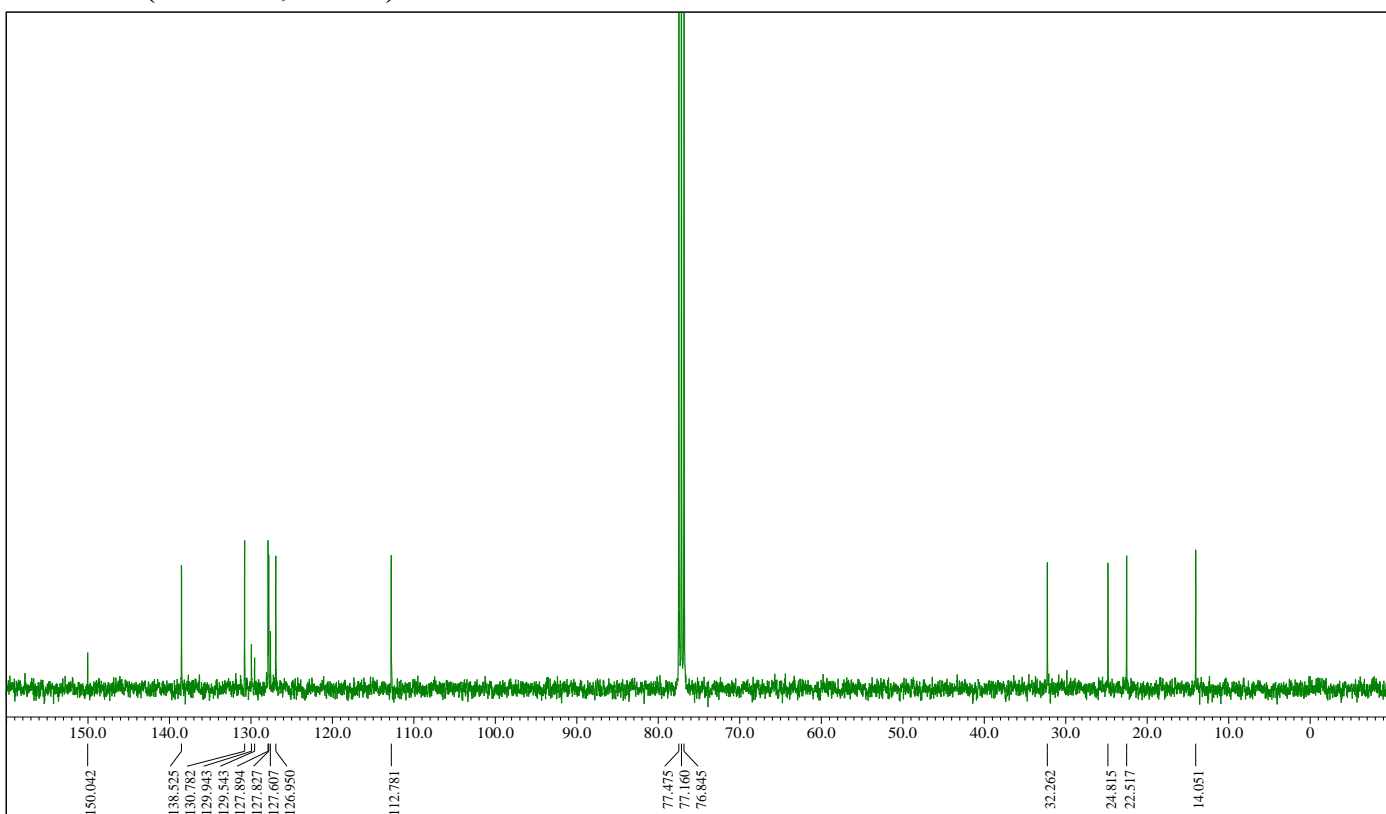
### 4-Butyl-2-(2-chlorophenyl)furan (4k)



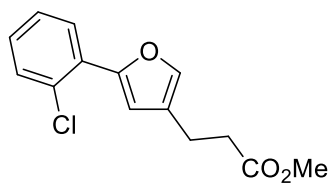
### <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>)



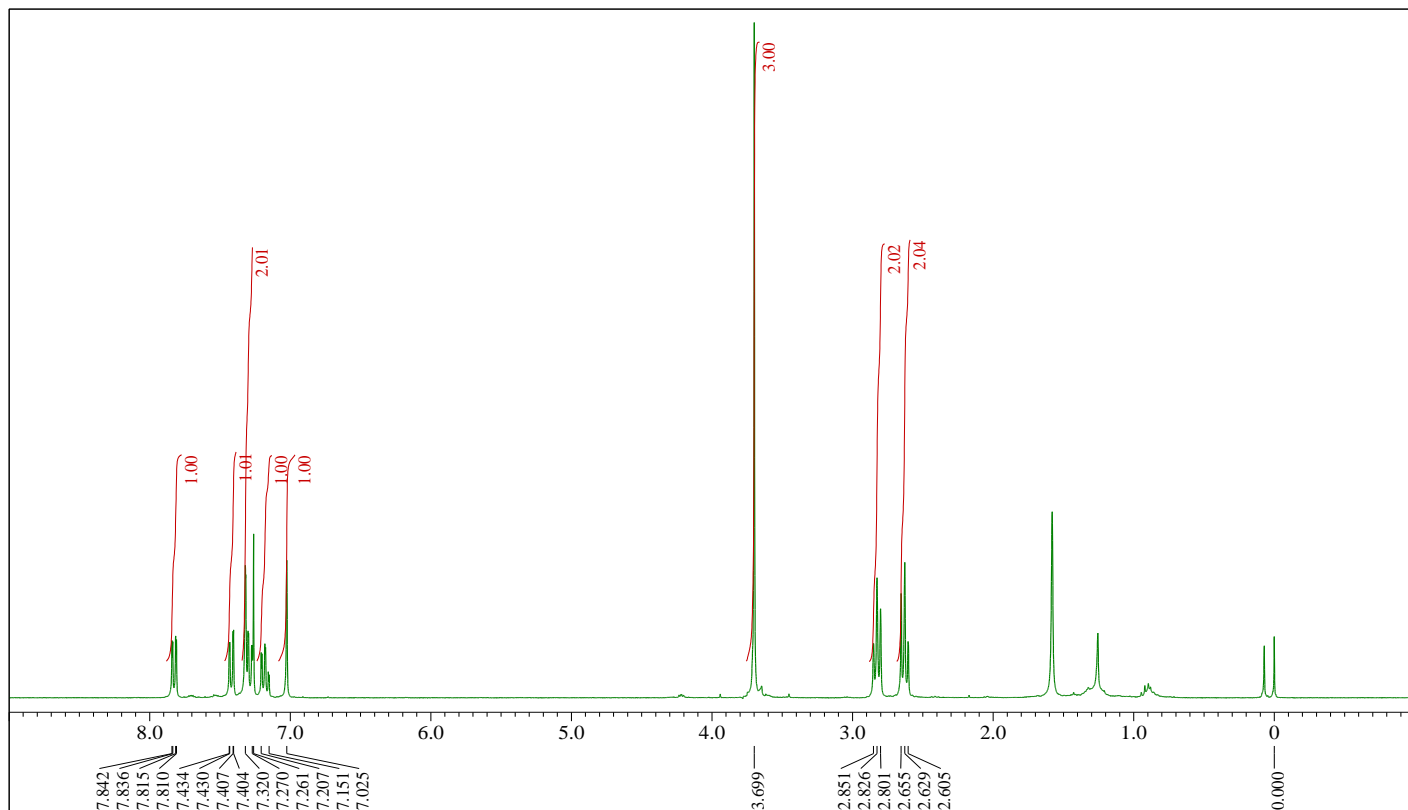
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



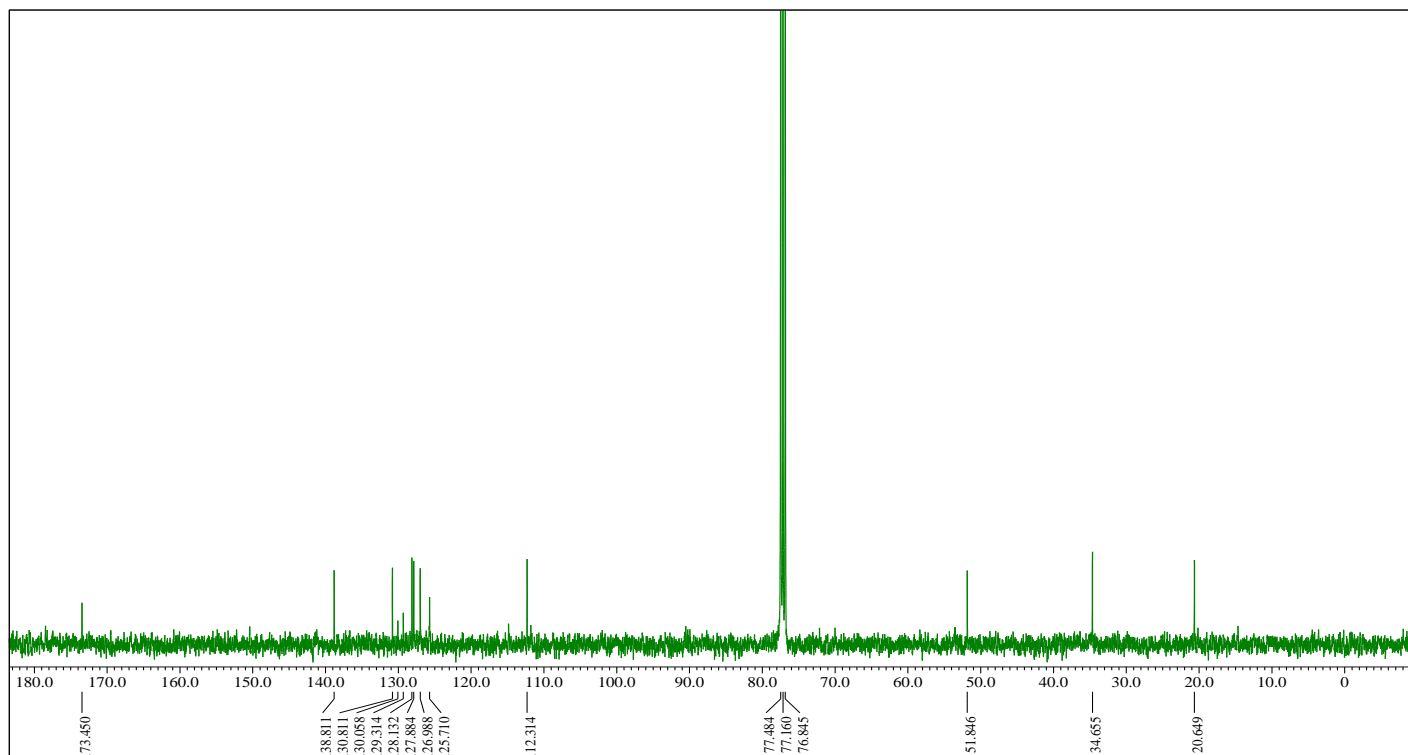
### Methyl 3-(5-(2-chlorophenyl)furan-3-yl)propanoate (4l)



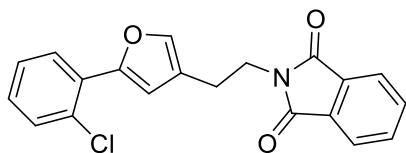
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



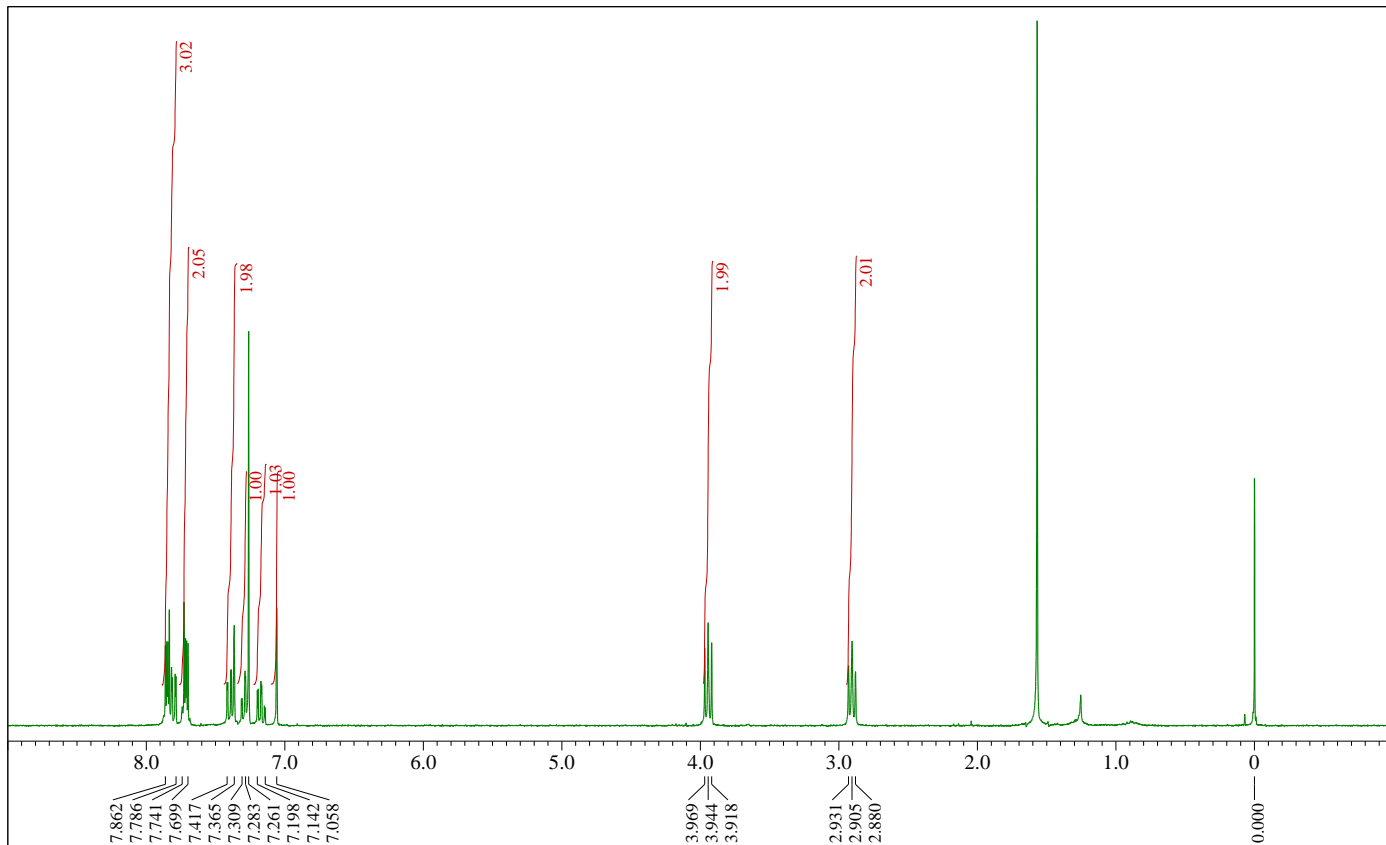
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



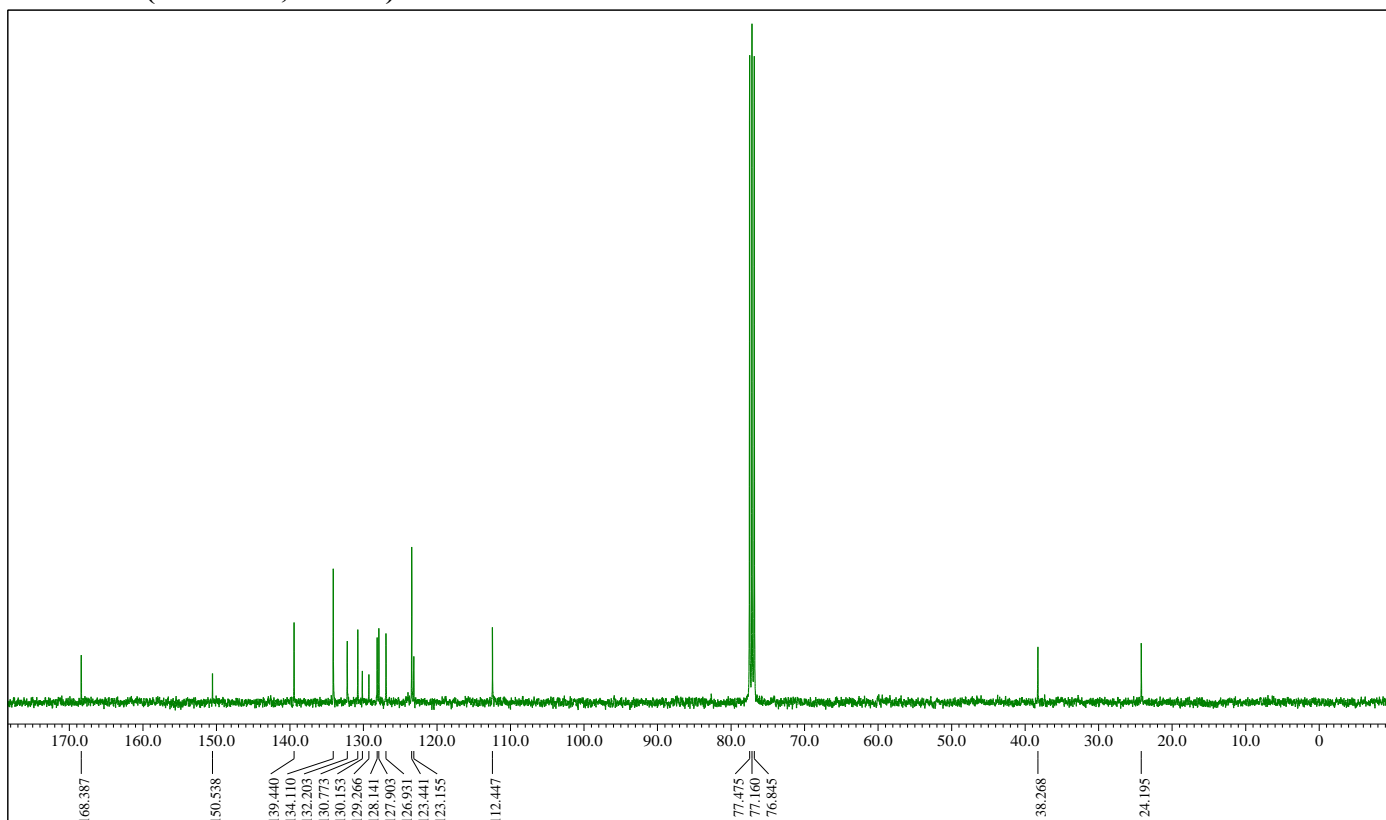
2-(2-(5-(2-Chlorophenyl)furan-3-yl)ethyl)isoindoline-1,3-dione (4m)



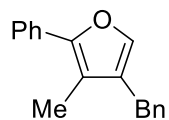
<sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



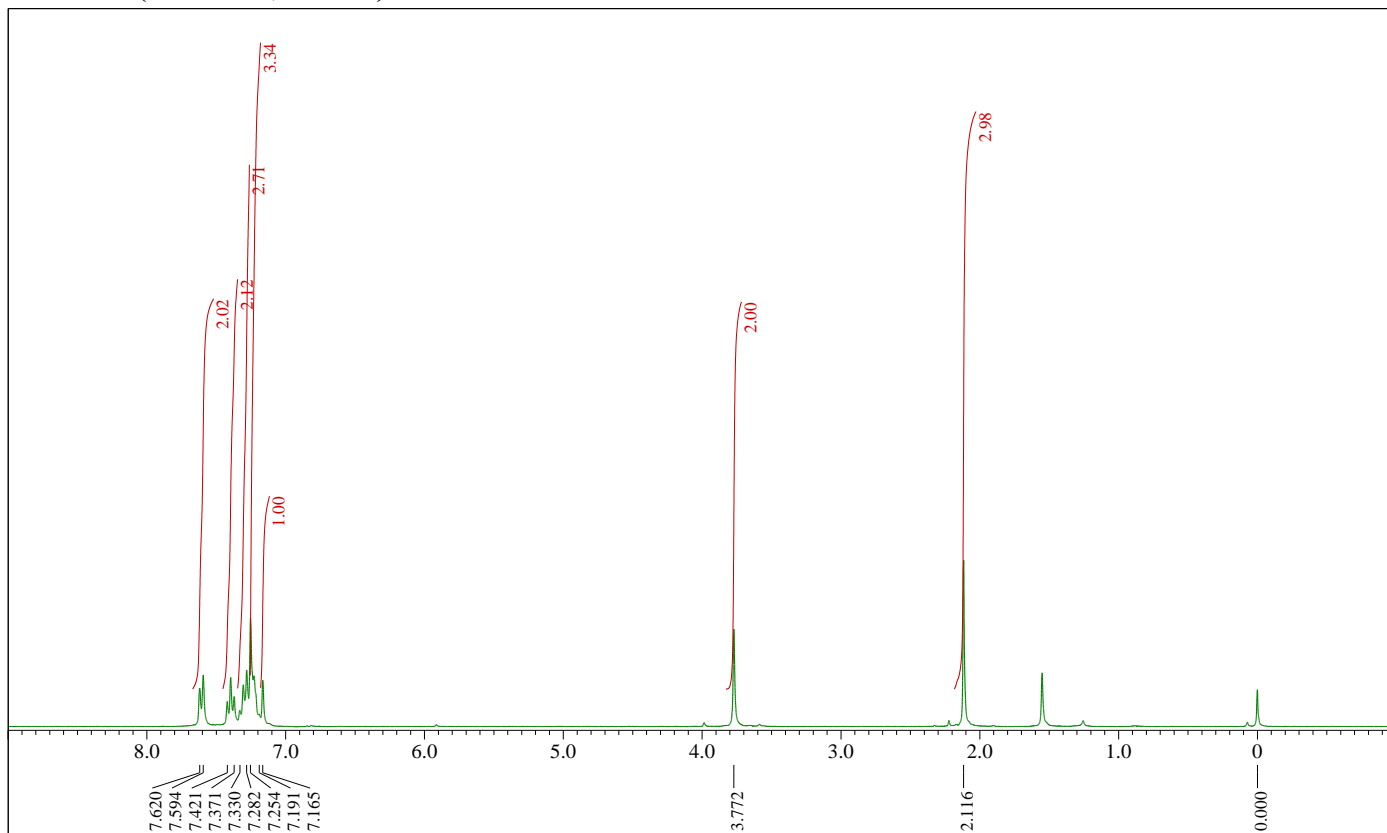
<sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



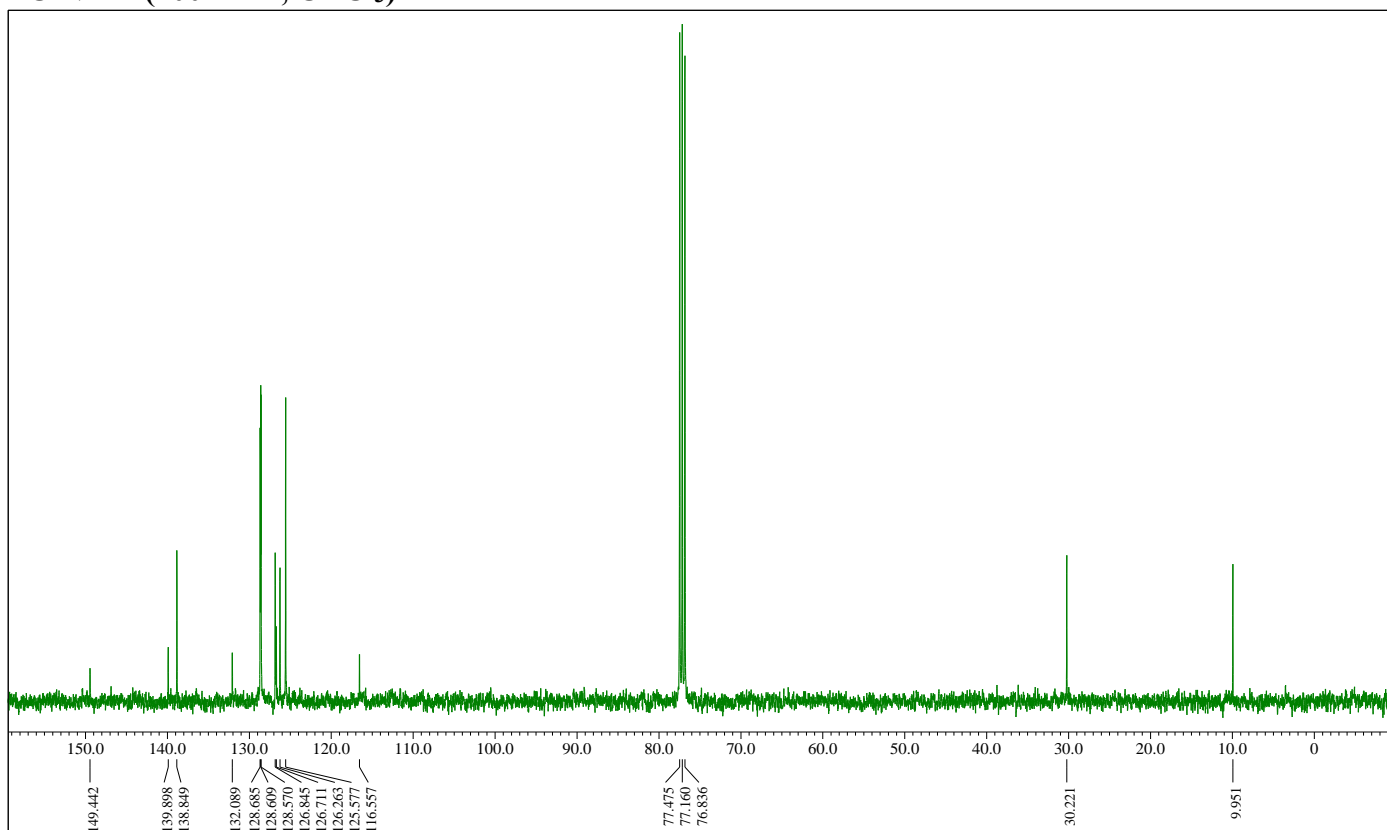
### 4-Benzyl-3-methyl-2-phenylfuran (4n)



### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)

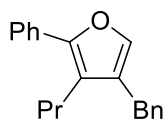


### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)

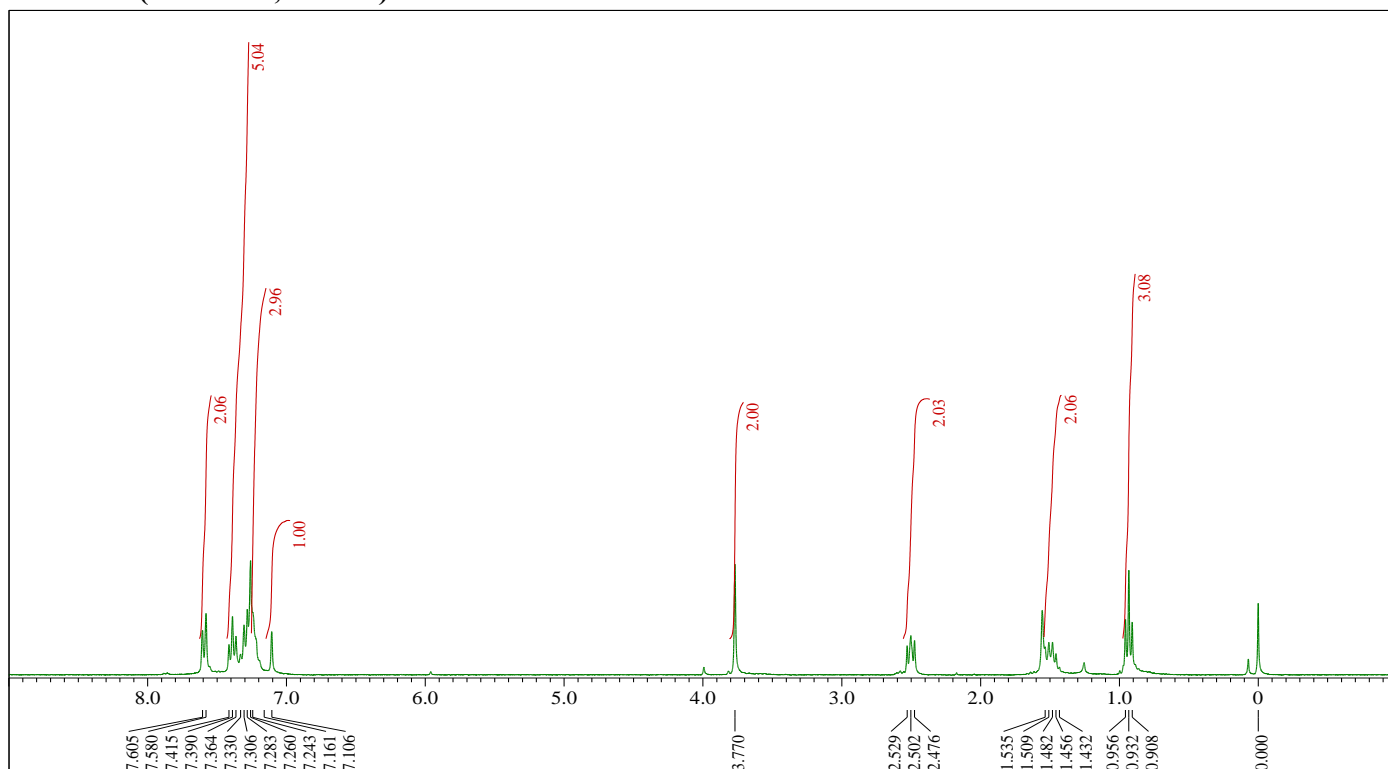




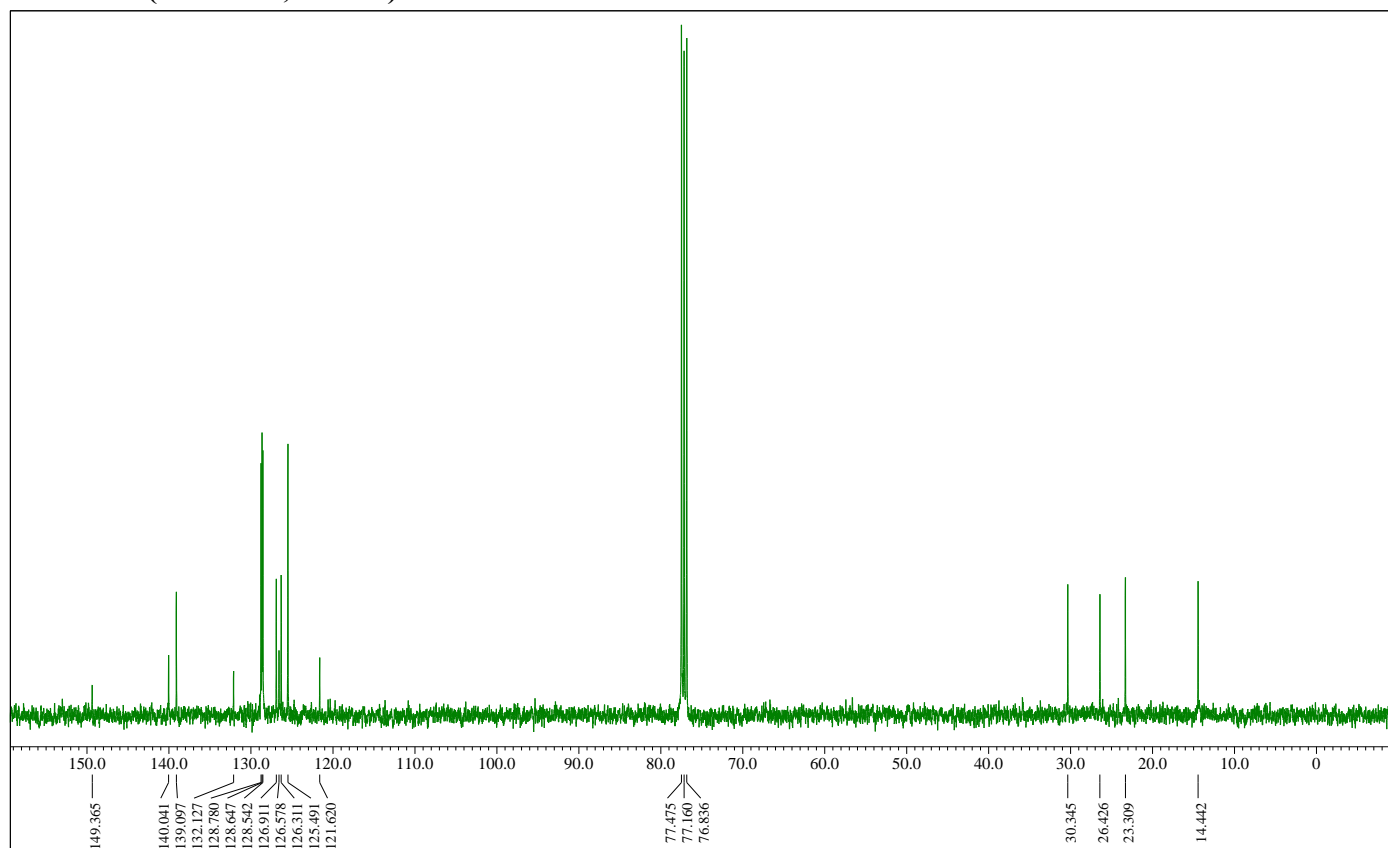
### 4-Benzyl-2-phenyl-3-propylfuran (4o)



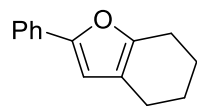
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



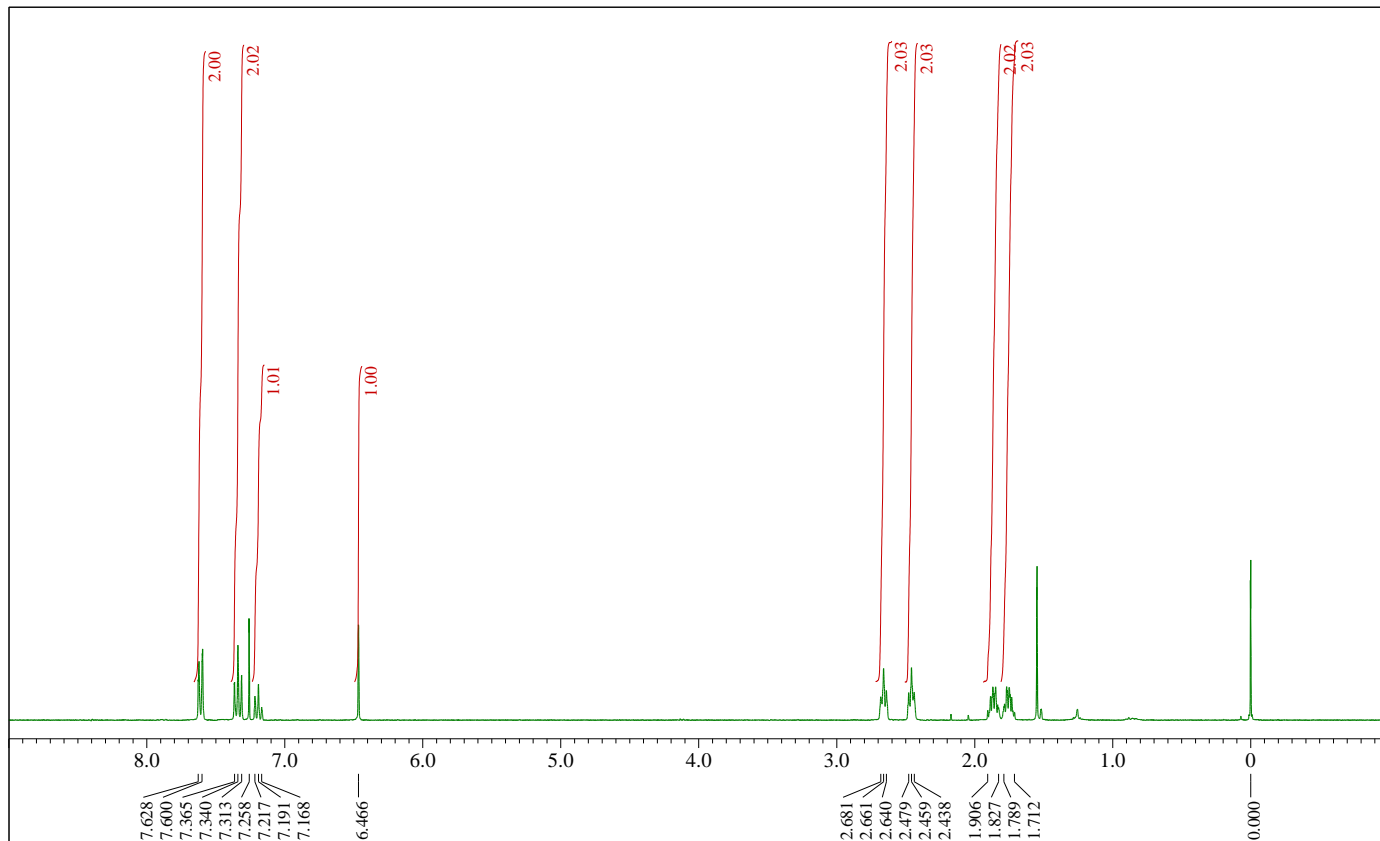
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



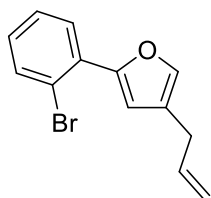
## 2-Phenyl-4,5,6,7-tetrahydrobenzofuran (4p)



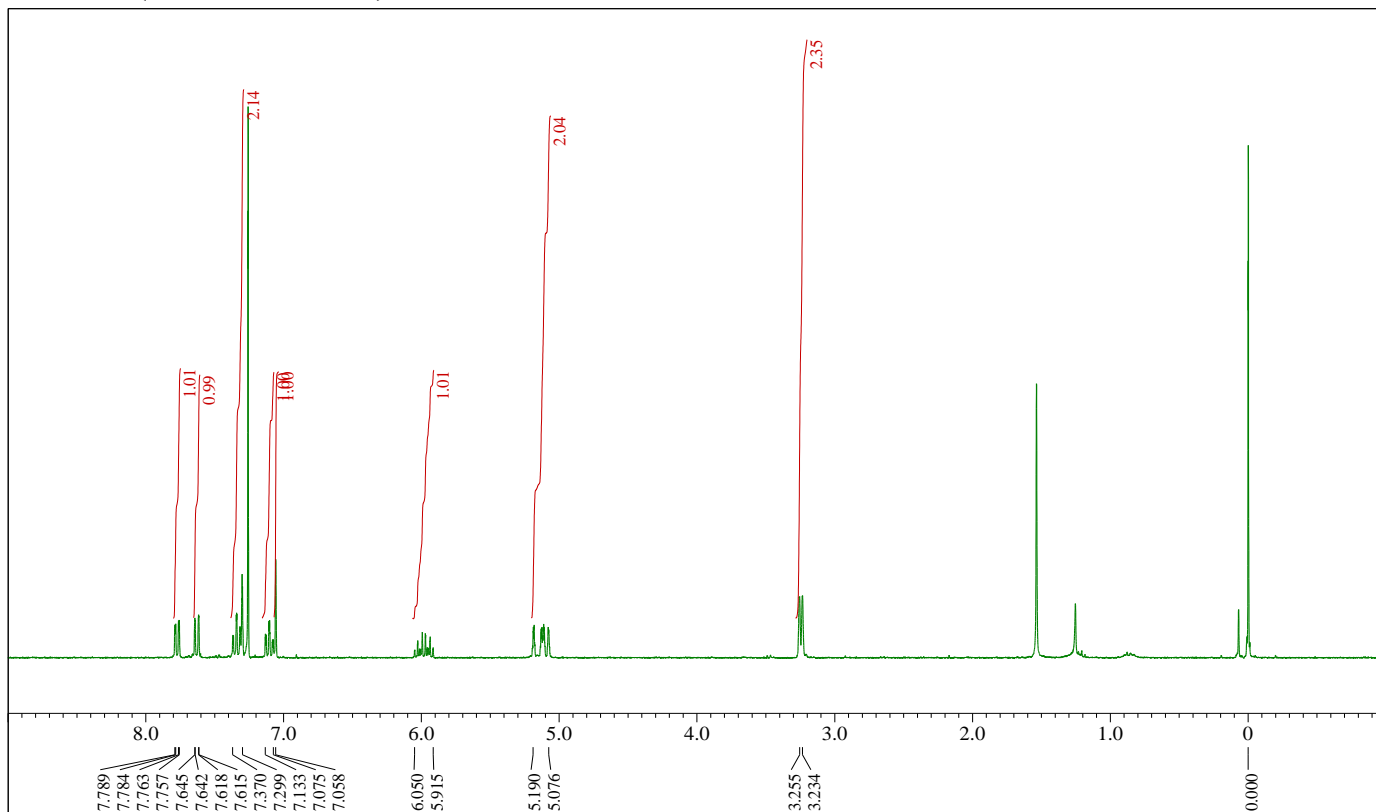
### $^1\text{H-NMR}$ (300 MHz, $\text{CDCl}_3$ )



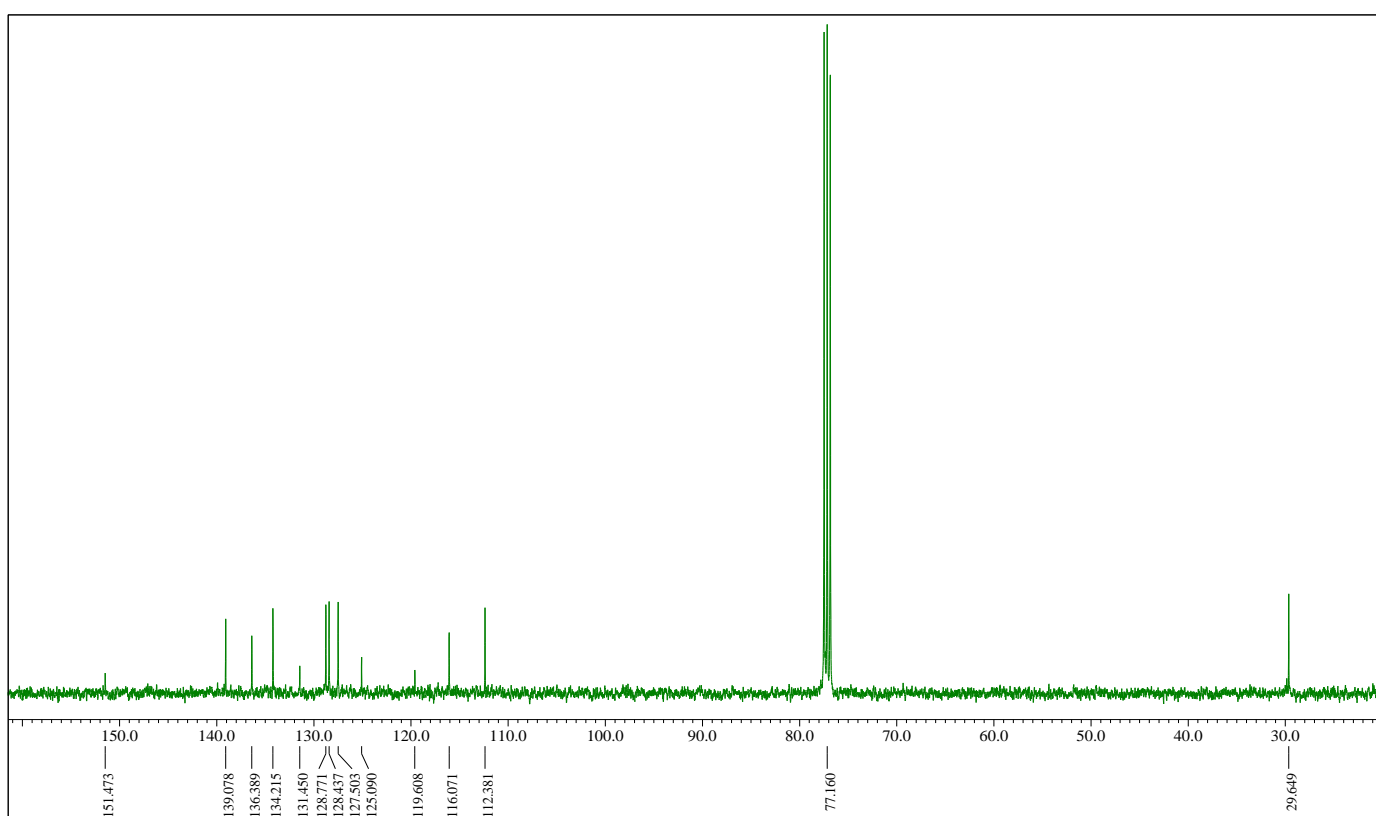
### 4-Allyl-2-(2-bromophenyl)furan (4q)



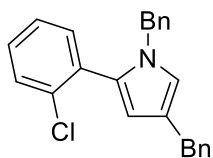
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



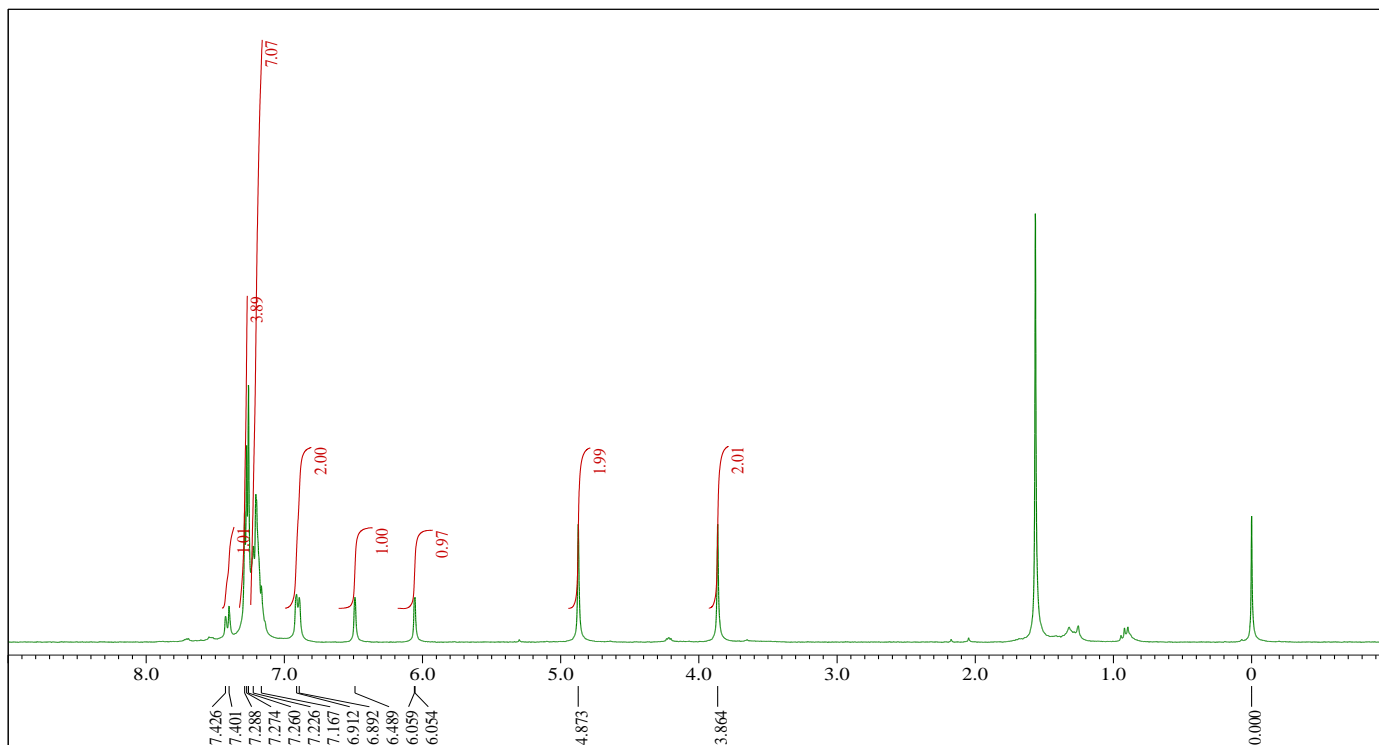
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



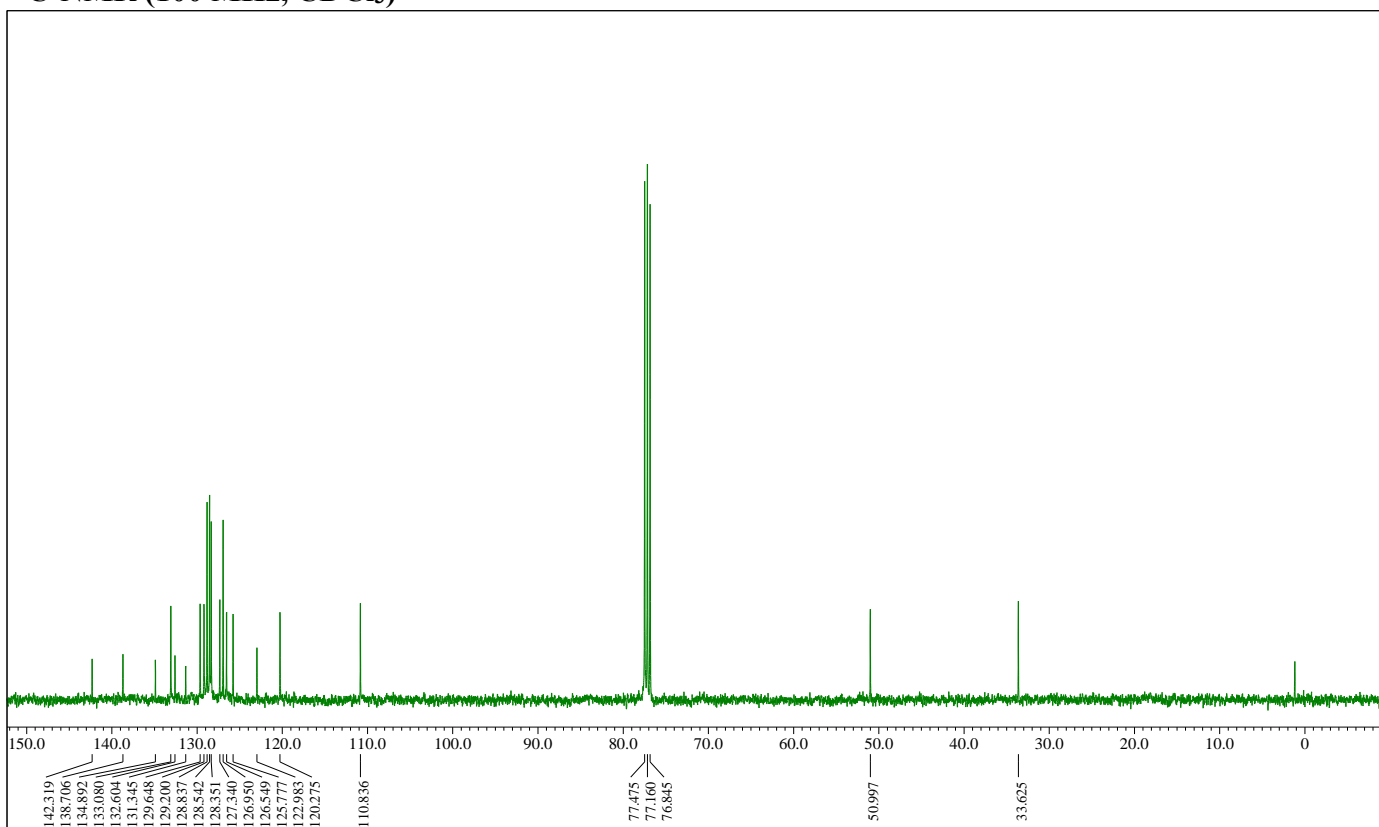
# 1,4-Dibenzyl-2-(2-chlorophenyl)-1H-pyrrole (6a)



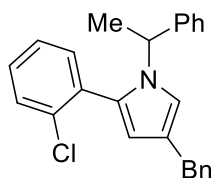
## <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



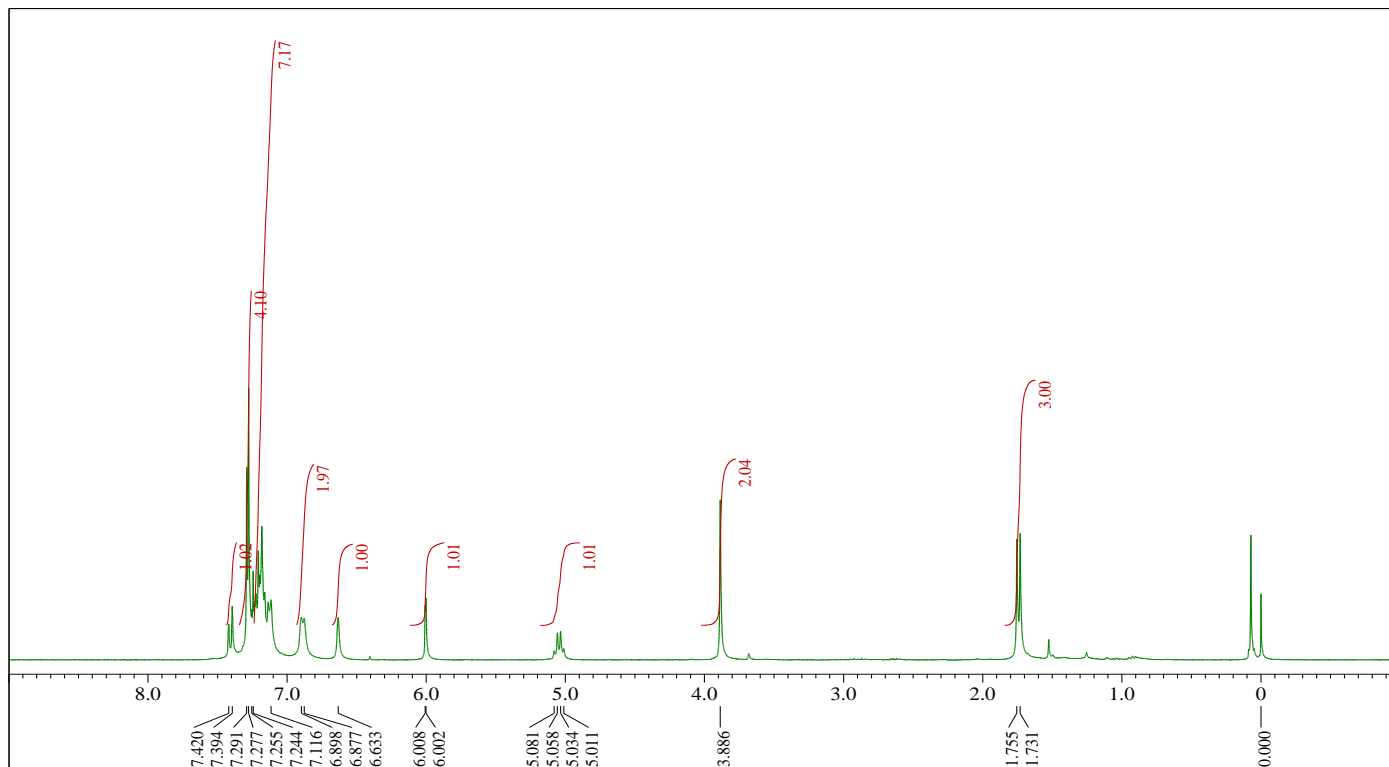
## <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



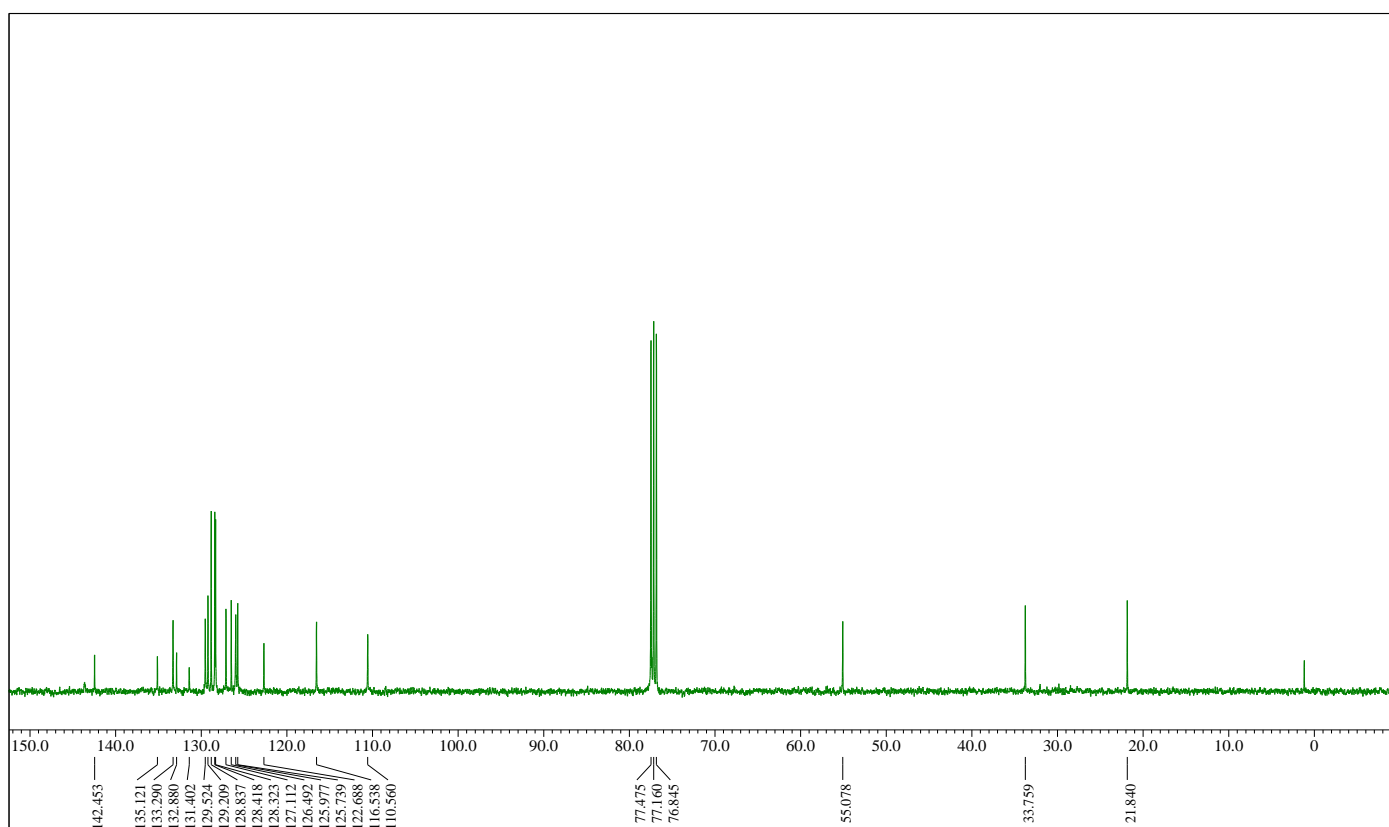
### 4-Benzyl-2-(2-chlorophenyl)-1-(1-phenylethyl)-1H-pyrrole (6b)



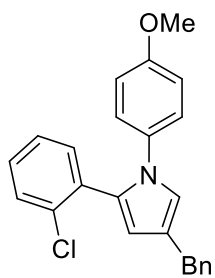
### <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



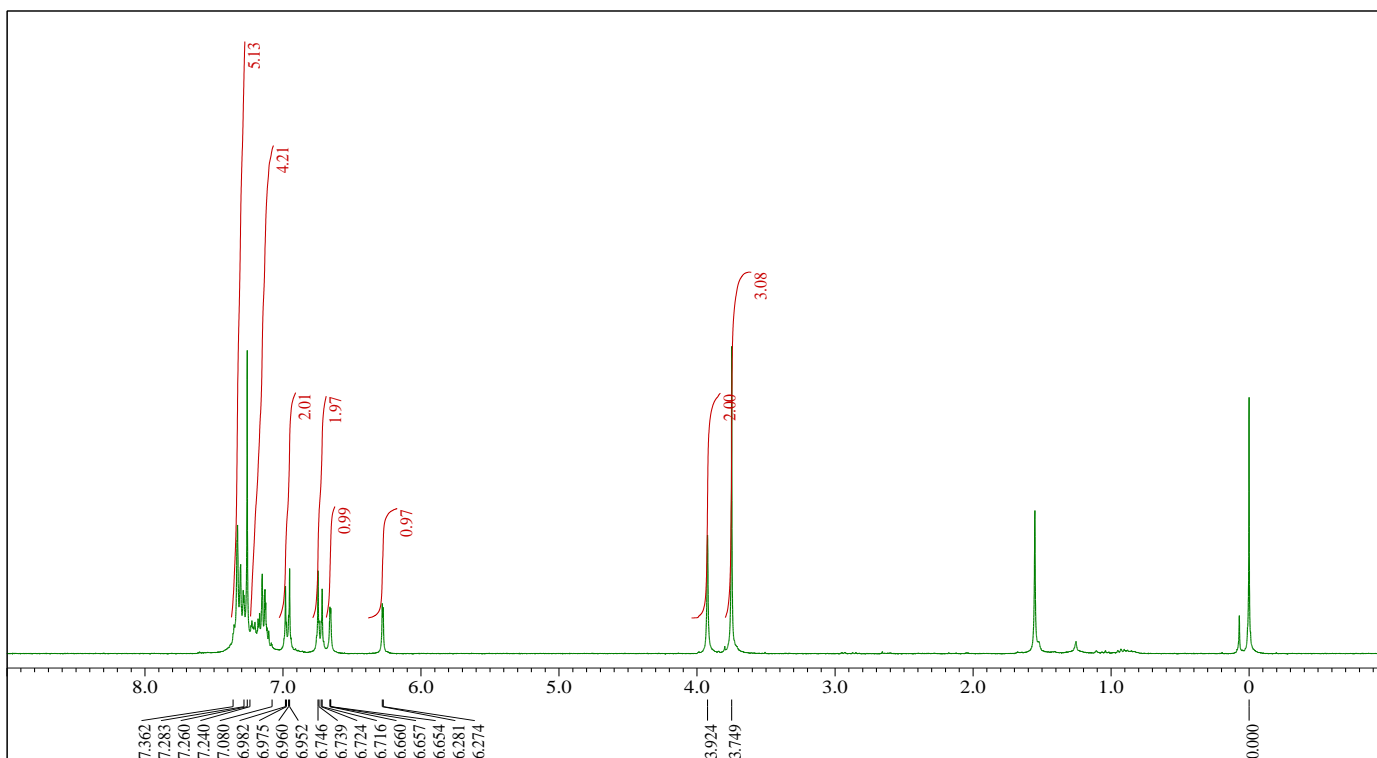
### <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)



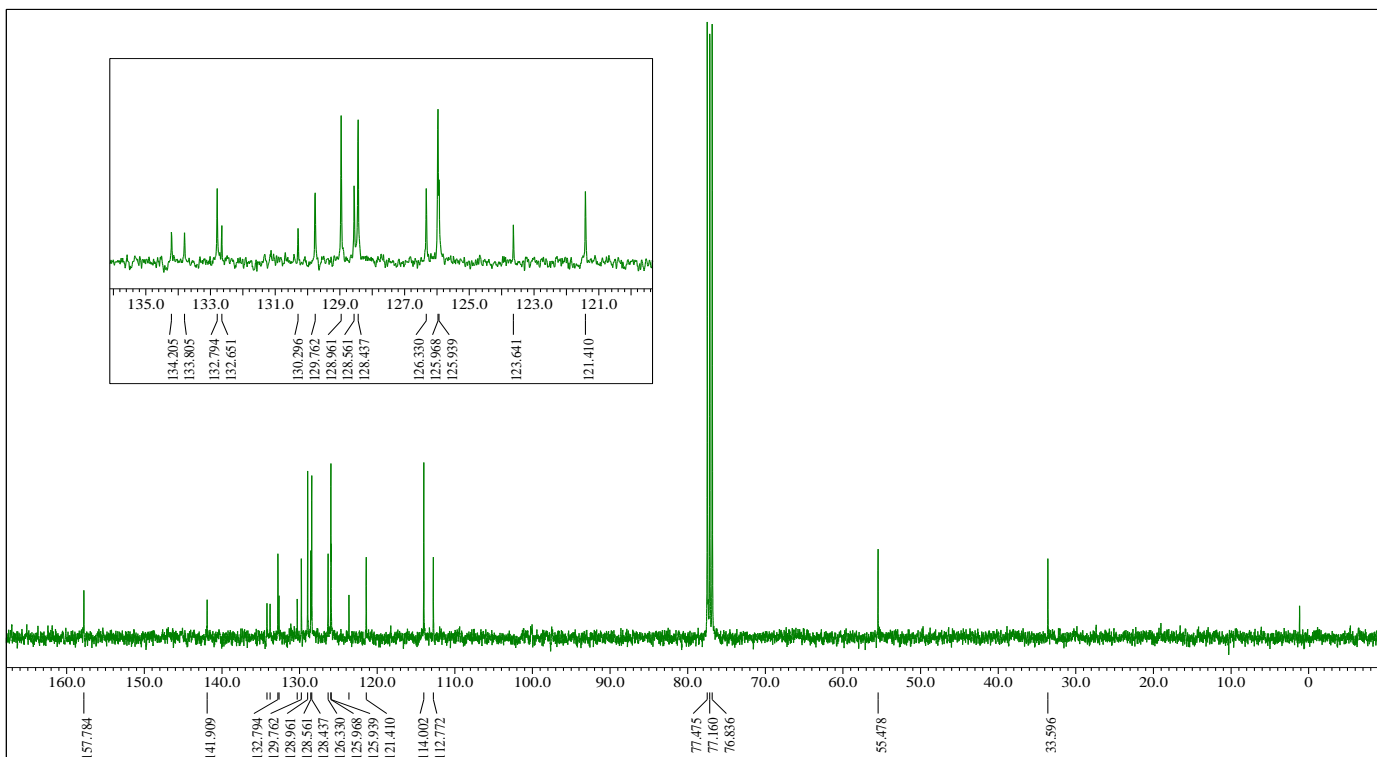
### 4-Benzyl-2-(2-chlorophenyl)-1-(4-methoxyphenyl)-1H-pyrrole (6c)



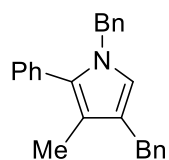
### $^1\text{H-NMR}$ (300 MHz, $\text{CDCl}_3$ )



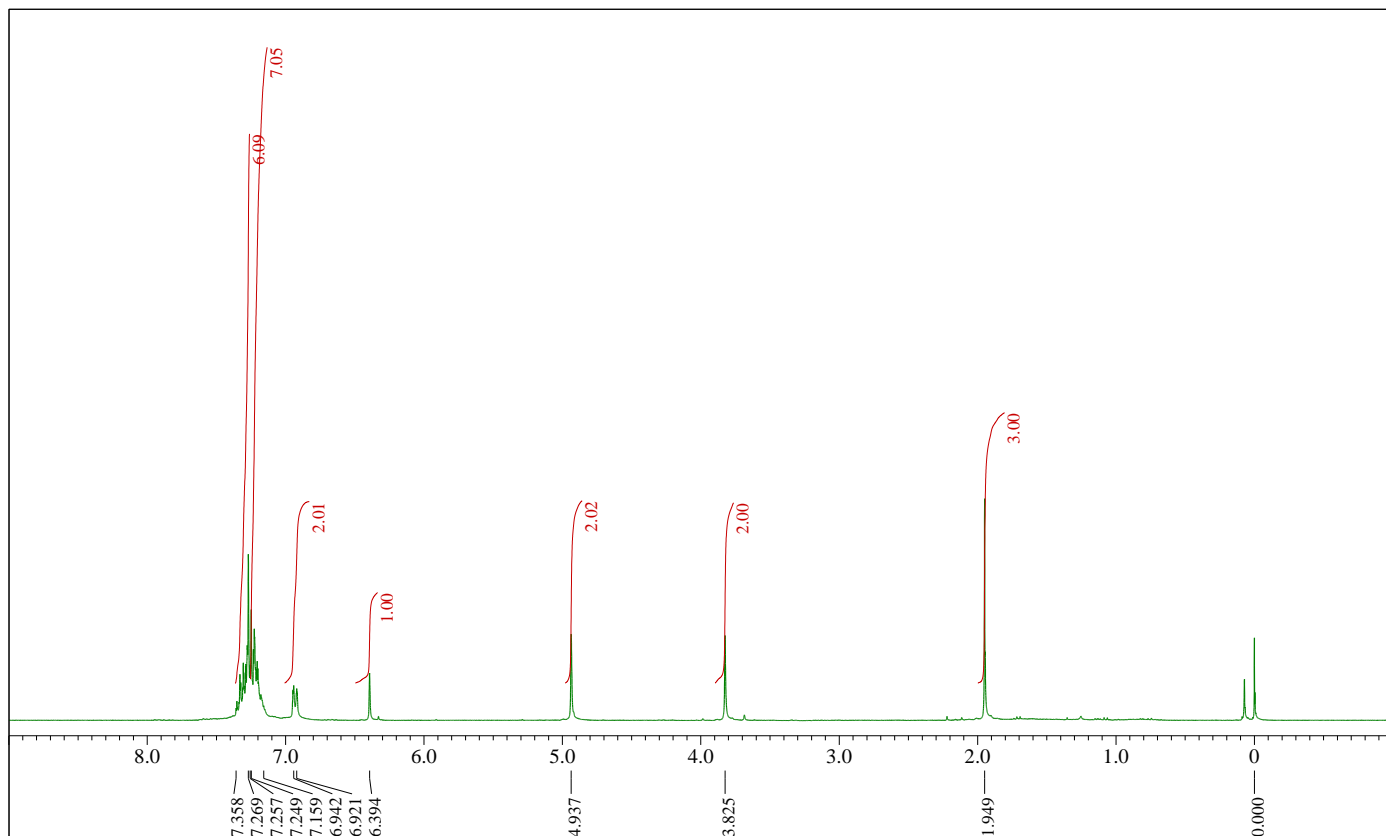
### $^{13}\text{C-NMR}$ (100 MHz, $\text{CDCl}_3$ )



# 1,4-Dibenzyl-3-methyl-2-phenyl-1H-pyrrole (6d)



## <sup>1</sup>H-NMR (300 MHz, CDCl<sub>3</sub>)



## <sup>13</sup>C-NMR (100 MHz, CDCl<sub>3</sub>)

