

# Conversion of 2-Alkylcinnamaldehydes to 2-Alkyindanones Via a Catalytic Intramolecular Friedel-Crafts Reaction

## Supporting Information

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## General Experimental Information

Reagents, anhydrous dichloromethane, anhydrous EtOAc and reagent grade MeOAc (99%) were used as received from commercial sources. 2-Alkylcinnamaldehydes not commercially available were prepared by aldol condensation of the appropriate arylaldehyde and aldehyde (for typical procedures see reference 1). Reaction progress of indene formation was monitored by GC analysis after washing an aliquot of the reaction mixture with water or aqueous 10% Na<sub>2</sub>CO<sub>3</sub>. Column chromatography was performed on 40μm silica gel using hexane and ethyl acetate as eluents. Bulb-to-bulb distillations were performed with a Kugelrohr apparatus, boiling points (bp) corresponding to oven temperatures. NMR spectra were recorded at 400 MHz for  $^1\text{H}$  and 100 MHz for  $^{13}\text{C}$  using CDCl<sub>3</sub> as solvent and tetramethylsilane as internal standard. Coupling constants, *J*, are reported in Hertz. IR spectra were taken as neat liquids on ZnSe plates and reported in wavenumbers (cm<sup>-1</sup>). Mass spectral data were obtained using EI at 70 eV and are reported as *m/z* with intensities relative to the base peak. High-resolution mass spectra were obtained using EI at 70eV.

**1-Methoxy-2-methyl-1H-indene (2a)<sup>2a,b</sup>**

10 mole % FeCl<sub>3</sub> used; bp 60°C (0.08 mmHg), yield 75%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 2.03 (s, 3H), 3.03 (s, 3H), 4.85 (s, 1H), 6.44 (s, 1H), 7.11 (t, J=7.4, 1H), 7.12 (d, J=7.2, 1H), 7.22 (t, J=7.4, 1H), 7.41 (d, J=7.2 Hz, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.1 (q), 51.8 (q), 84.9 (d), 120.1 (d), 123.7 (d), 124.6 (d), 128.4 (d), 128.7 (d), 141.8 (s), 143.9 (s), 145.8 (s); IR: 3048, 2935, 2823, 1625, 1606, 1462, 1441, 1320, 1207, 1105, 1079, 944, 898 cm<sup>-1</sup>; MS: 160(M<sup>+</sup>, 78), 145(100), 129 (26), 128(46), 117(36), 115(56); HRMS calcd for C<sub>11</sub>H<sub>12</sub>O 160.0888, found 160.0884.

**1-Methoxy-2-ethyl-1H-indene (2b)<sup>2a</sup>**

bp 55-75°C (0.018 mmHg), yield 93%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.22 (t, J=7.4, 3H), 2.29-2.48 (m, 2H), 3.02 (s, 3H), 4.93 (s, 1H), 6.43 (s, 1H), 7.11 (t, J=7.2, 1H), 7.14 (d, J=7.2, 1H), 7.22 (t, J=7.4, 1H), 7.41 (d, J=7.4, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 12.4 (q), 21.6 (t), 51.9 (q), 83.9 (d), 120.3 (d), 123.8 (d), 124.7 (d), 126.7 (d), 128.4 (d), 141.9 (s), 143.8 (s), 152.2 (s); MS: 174(M<sup>+</sup>, 57), 159 (100), 145 (80), 141 (16), 131(20), 128 (46), 115 (44) 102 (11), 91 (18); HRMS calculated for C<sub>12</sub>H<sub>14</sub>O 174.1045, found 174.1048.

**1-Methoxy-2-propyl-1H-indene (2c)**

bp 80-90°C (0.018 mmHg), yield 92%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 0.99 (t, J=7.2, 3H), 1.54-1.76 (m, 2H), 2.34 (t, J=7.7, 2H), 3.02 (s, 3H), 4.93 (s, 1H), 6.44 (s, 1 H), 7.11 (t, J=7.4, 1H), 7.14 (d, J=7.2, 1H), 7.22 (t, J=7.4, 1H), 7.42 (d, J=7.2, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.1 (q), 21.5 (t), 30.5 (t), 51.9 (q), 83.8 (d), 120.3 (d), 123.8 (d), 124.7 (d), 127.6 (d), 128.4 (d), 141.9 (s), 143.8 (s), 150.5 (s); MS: 188(M<sup>+</sup>, 19), 159 (100), 145 (19), 141 (6), 129 (22), 128 (27), 115 (22), 102 (6), 91 (8); HRMS calcd for C<sub>13</sub>H<sub>16</sub>O 188.1201, found 188.1198.

**1-Methoxy-2-butyl-1H-indene (2d)**

bp 85-90°C (0.019 mmHg), yield 95%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 0.95 (t, J=7.2, 3H), 1.36-1.46 (m, 2H), 1.51-1.70 (m, 2H), 2.29-2.43 (m, 2H), 3.02 (s, 3H), 4.93 (s, 1H), 6.43 (s, 1H), 7.11 (t, J=7.2, 1H), 7.14 (d, J=7.2, 1H), 7.22 (t, J=7.2, 1H), 7.41 (d, J=7.2, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.0 (q), 22.7 (t), 28.1 (t), 30.4 (t), 51.8 (q), 83.8 (d), 120.3 (d), 123.8 (d), 124.6 (d), 127.4 (d), 128.4 (d), 141.8 (s), 143.8 (s), 150.7 (s); IR: 2958, 2931, 1618, 1464, 1321, 1202, 1106, 1079, 948, 898 cm<sup>-1</sup>; MS: 202 (M<sup>+</sup>, 17), 159 (100), 145 (18), 141 (5), 129 (19), 128 (21), 115 (15), 102 (4), 91 (5); HRMS calcd for C<sub>14</sub>H<sub>18</sub>O 202.1358, found 202.1356.

**1-Methoxy-2-pentyl-1H-indene (2e)<sup>3</sup>**

bp 95-100°C (0.024 mmHg), yield 90%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 0.91 (t, J=7.2, 3H), 1.30-1.42 (m, 4H), 1.52-1.72 (m, 2H), 2.28-2.42 (m, 2H), 3.01 (s, 3H), 4.92 (s, 1H), 6.43 (s, 1H), 7.11 (t, J=7.2, 1H), 7.13 (d, J=7.2, 1H), 7.21 (t, J=7.2, 1H), 7.41 (d, J=7.2, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.1 (q), 22.6 (t), 28.0 (t), 28.4 (t), 31.8 (t), 51.9 (q), 83.8 (d), 120.3 (d), 123.8 (d), 124.6 (d), 127.5 (d), 128.4 (d), 141.8 (s), 143.8 (s), 150.7 (s); IR: 2958, 2930, 1618, 1464, 1321, 1202, 1106, 1079, 947, 898 cm<sup>-1</sup>; MS: 216(M<sup>+</sup>, 16), 159 (100), 145 (15), 129 (16), 128 (18), 115 (12); HRMS calcd for C<sub>15</sub>H<sub>20</sub>O 216.1514, found 216.1511.

**1-Ethoxy-2-methyl-1H-indene (5a)**

15 mol % FeCl<sub>3</sub>, EtOAc, 70°C, 7 h; bp 60-80°C (0.045 mmHg), yield 69%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.16 (t, *J*=7.2, 3H), 2.03 (s, 3H), 3.16-3.28 (m, 2H), 4.87 (s, 1H), 6.40 (s, 1H), 7.10 (t, *J*=7.4, 1H), 7.11 (d, *J*=7.2, 1H), 7.20 (t, *J*=7.4, 1H), 7.42 (d, *J*=7.2, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.1 (q), 15.7 (q), 60.0 (t), 84.5 (d), 120.1 (d), 123.6 (d), 124.6 (d), 128.1 (d), 128.2 (d), 142.6 (s), 143.6 (s), 146.4 (s); IR: 2978, 2883, 1637, 1344, 1312, 1175, 1136, 1037 cm<sup>-1</sup>; MS: 174 (M<sup>+</sup>, 99), 146 (62), 145 (98), 131 (100), 128 (67), 117 (56), 115 (65); HRMS calcd for C<sub>12</sub>H<sub>14</sub>O 174.1045, found 174.1042.

**1-Ethoxy-2-butyl-1H-indene (5b)**

5 mol % FeCl<sub>3</sub>, DCM, reflux, 4 h; bp 110-120°C (0.018 mmHg), yield 96%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 0.95 (t, *J*=7.4, 3H), 1.15 (t, *J*=6.9, 3H), 1.36-1.46 (m, 2H), 1.50-1.70 (m, 2H), 2.30-2.45 (m, 2H), 3.15-3.27 (m, 2H), 4.95 (s, 1H), 6.41 (s, 1H), 7.10 (t, *J*=7.2, 1H), 7.13 (d, *J*=7.2, 1H), 7.21 (t, *J*=7.2, 1H), 7.42 (d, *J*=7.2, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.0 (q), 15.7 (q), 22.7 (t), 28.1 (t), 30.5 (t), 60.0 (t), 83.4 (d), 120.2 (d), 123.7 (d), 124.6 (d), 126.9 (d), 128.2 (d), 142.5 (s), 143.6 (s), 151.3 (s); IR: 2960, 2929, 2873, 1618, 1462, 1200, 1171, 1106, 1078, 1017, 910 cm<sup>-1</sup>; MS: 216 (M<sup>+</sup>, 33), 173 (85), 145 (100), 131 (29), 129 (30), 128 (32), 117 (14), 115 (26); HRMS calcd for C<sub>15</sub>H<sub>20</sub>O 216.1514, found 216.1504.

**1-Methoxy-2,6-dimethyl-1H-indene (6a)<sup>2a</sup>**

bp 60-70°C (0.020 mmHg), yield 67%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 2.00 (s, 3H), 2.35 (s, 3H), 3.03 (s, 3H), 4.82 (s, 1H), 6.40 (s, 3H), 6.99-7.04 (m, 2H), 7.24 (s, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.1 (q), 21.4 (q), 51.8 (q), 84.8 (d), 119.8 (d), 124.8 (d), 128.5 (d), 128.8 (d), 134.3 (s), 141.2 (s), 142.1 (s), 144.7 (s); MS: 174 (M<sup>+</sup>, 85), 159 (100), 144 (12), 143 (13), 141 (13), 131 (24), 128 (23), 115 (24), 91 (11).

**1-Methoxy-2,4-dimethyl-1H-indene (6b)<sup>2a</sup>**

bp 60-67°C (0.018 mmHg), yield 83%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 2.03 (s, 3H), 2.32 (s, 3H), 3.02 (s, 3H), 4.84 (s, 1H), 6.54 (s, 1H), 7.02 (d, *J*=4.6, 2H), 7.24 (t, *J*=4.6, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.2 (q), 18.0 (q), 51.7 (q), 85.1 (q), 121.1 (d), 124.7 (d), 126.8 (d), 129.2 (s), 129.6 (d), 141.7 (s), 142.3 (s), 145.2 (s); MS: 174 (M<sup>+</sup>, 69), 159 (100), 144( 12), 143 (14), 141 (14), 131 (23), 128 (27), 116 (17), 115 (29), 91 (15); HRMS calcd for C<sub>12</sub>H<sub>14</sub>O 174.1045, found 174.1042.

**1,4-Dimethoxy-2-methyl-1H-indene (6d)**

bp 76-87°C (0.018 mmHg), yield 56%, recrystallized from pentane, mp=64-65°C

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 2.01 (s, 3H), 3.01 (s, 3H), 3.83 (s, 3H), 4.85 (s, 1H), 6.60 (s, 1H), 6.78 (d, *J*=7.7, 1H), 7.05-7.12 (m, 2H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.0 (q), 51.7 (q), 55.4 (q), 85.3 (d), 111.1 (d), 116.8 (d), 124.7 (d), 126.0 (d), 131.8 (s), 143.8 (s), 143.9 (s), 152.2 (s); MS: 190 (M<sup>+</sup>, 71), 175 (100), 160 (17), 159 (16), 147 (14), 145 (9), 129 (17), 115 (35); HRMS calcd for C<sub>12</sub>H<sub>14</sub>O<sub>2</sub> 190.0994, found 190.0984.

**6-Isopropyl-1-methoxy-2-methyl-1H-indene (6e)**

bp 85-92°C (0.018 mTorr), yield 72%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.25 (d, *J*=6.9, 6H), 2.01 (s, 3H), 2.90 (septet, *J*=6.9, 1H), 3.03 (s, 3H), 4.84 (s, 1H), 6.40 (s, 1H), 7.04 (d, *J*=7.7, 1H), 7.08 (dd, *J*=1.5 and 7.7, 1H), 7.31 (s, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.1(q), 24.2 (q), 24.3 (q), 34.1 (d), 51.8 (q), 84.9 (d), 119.8 (d), 122.1 (d), 126.3 (d), 128.5 (d), 141.6 (s), 142.1 (s), 144.9 (s), 145.6 (s); MS: 202 (M<sup>+</sup>, 58), 187 (60), 172 (12), 160 (14), 159 (100), 157 (12), 156 (14), 144 (10), 141 (15), 128 (24), 117 (12), 115 (23); HRMS calcd for C<sub>14</sub>H<sub>18</sub>O 202.1358, found 202.1358.

#### **6-*tert*-Butyl-1-methoxy-2-methyl-1H-indene (6f)**

flash chromatographed (hexane/EtOAc 98:2), bp 90-100°C (0.020 mmHg), yield 65%  
<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.33 (s, 9H), 2.02 (s, 3H), 3.02 (s, 3H), 4.85 (s, 1H), 6.41 (s, 1H), 7.05 (d, *J*=7.7, 1H), 7.25 (dd, *J*=1.5 and 7.7, 1H), 7.48 (s, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.1 (q), 31.6 (q), 34.6 (s), 51.7 (q), 85.0 (d), 119.5 (d), 121.1 (d), 125.0 (d), 128.4 (d), 141.2 (s), 141.7 (s), 145.1 (s), 147.9 (s); MS: 216 (M<sup>+</sup>, 76), 201 (100), 186 (21), 170 (18), 159 (99), 128 (21), 115 (19); HRMS calcd for C<sub>15</sub>H<sub>20</sub>O 216.1514, found 216.1502.

#### **1-Methoxy-2-ethyl-6-methyl-1H-indene (7a)**

bp 80-90°C (0.02 mmHg), yield 92%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.21 (t, *J*=7.4, 3H), 2.35 (s, 3H), 2.27-2.46 (m, 2H), 3.02 (s, 3H), 4.91 (s, 1H), 6.40 (s, 1H), 7.02 (s, 2H), 7.24, s 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 12.5 (q), 21.4 (q), 21.5 (t), 51.8 (q), 83.8 (d), 119.9 (d), 124.9 (d), 126.6 (d), 128.8 (d), 134.3 (s), 141.1 (s), 142.1 (s), 151.0 (s); MS: 188 (M<sup>+</sup>, 72), 173 (100), 159 (69), 145 (20), 141 (21), 128, (17), 115 (18); HRMS calcd for C<sub>13</sub>H<sub>16</sub>O 188.1201, found 188.1197.

#### **1-Methoxy-2-ethyl-4-methyl-1H-indene (7b)**

bp 65-72°C (0.018 mmHg), yield 96%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.24 (t, *J*=7.4, 3H), 2.34 (s, 3H), 2.50-2.30 (m, 2 H), 3.01 (s, 3H), 4.93 (s, 1H), 6.54 (s, 1H), 7.03 (overlapping d, *J*=3.6 and 5.1, 2H), 7.25 (dd, *J*=3.6 and 5.1, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 12.5 (q), 18.0 (q), 21.7 (t), 51.8 (q), 84.1 (d), 121.3 (d), 124.7 (d), 124.8 (d), 129.4 (s), 129.6 (d), 141.7 (s), 142.3 (s), 151.5 (s); MS: 188 (M<sup>+</sup>, 56), 173 (93), 159 (100), 145 (19), 142 (23), 141 (31), 129 (21), 128 (30), 115 (41); HRMS calcd for C<sub>13</sub>H<sub>16</sub>O 188.1201, found 188.1192.

#### **2-Ethyl-1,6-dimethoxy-1H-indene (7c)**

bp 95-100°C (0.018 mmHg), yield 82%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.21 (t, *J*=7.4, 3H), 2.26-2.45 (m, 2H), 3.01 (s, 3H), 3.80 (s, 3H), 4.91 (s, 1H), 6.38 (s, 1H), 6.76 (dd, *J*=8.2, *J*<sub>4</sub>=2.6, 1H), 7.04 (d, *J*=8.2, 1H), 7.05 (broad s, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 12.5 (q), 21.5 (t), 51.7 (q), 55.5 (q), 83.8 (d), 111.1 (d), 113.0 (d), 120.5 (d), 126.3 (d), 136.7 (s), 143.8 (s), 149.9 (s), 158.0 (s); MS: 204 (M<sup>+</sup>, 73), 189 (100), 175 (56), 161 (30), 160 (29), 158 (16), 128 (17), 115 (29); HRMS calcd for C<sub>13</sub>H<sub>16</sub>O<sub>2</sub> 204.1150, found 204.1156.

#### **2-Ethyl-1,4-dimethoxy-1H-indene (7d)**

bp 80-100°C (0.018 mmHg), yield 80%

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.22 (t, *J*=7.4, 3H), 2.27-2.48 (m, 2H), 3.00 (s, 3H), 3.85 (s, 3H), 4.94 (s, 1H), 6.61 (s, 1H), 6.79 (d, *J*=7.7, 1H), 7.06-7.12 (m, 2H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 12.4 (q), 21.6 (t), 51.8 (q), 55.4 (q), 84.3 (d), 110.9 (d), 116.8 (d), 122.7 (d), 126.1 (d), 131.7 (s), 143.8 (s), 150.3 (s), 152.2 (s); MS: 204 (M<sup>+</sup>, 62), 189 (75), 175 (100), 161 (17), 160 (17), 145 (13), 128 (20), 115 (29); HRMS calcd for C<sub>13</sub>H<sub>16</sub>O<sub>2</sub> 204.1150, found 204.1147.

### 2-Butyl-3-methoxy-1H-indene (**18a**)

**2d** (25.3 g, 0.125 m) and triethyl amine (25.3 g, 0.25 m) were mixed in 150 mL of ethyl acetate for three days. The mixture was concentrated to remove solvent and subjected to bulb-to-bulb distillation (50-60°C oven temperature, 3 mbar) to remove triethyl amine. Further distillation (102-105°C, 0.020 mmHg) yielded 24.8 g of **18a** (0.123 m, 98% yield) as a pale yellow oil.

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 0.93 (t, *J*=7.2, 3H), 1.37 (sextet, *J*=7.2, 2H), 1.49-1.56 (m, 2H), 2.48 (t, *J*=7.7, 2H), 3.20 (s, 2H), 3.89 (s, 3H), 7.13 (t, *J*=7.7, 1H), 7.25 (t, *J*=7.7, 1H), 7.33 (t, *J*=7.7, 2H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.0 (q), 22.7 (t), 26.4 (t), 31.8 (t), 36.7 (t), 59.7 (q), 117.6 (d), 123.8 (d), 124.2 (d), 126.1 (d), 127.6 (s), 141.1 (s), 141.2 (s), 152.6 (s); IR: 2958, 2932, 1632, 1465, 1356, 1301, 1133, 990 cm<sup>-1</sup>; MS: 202 (M<sup>+</sup>, 20), 160 (14), 159 (100), 145 (11), 131 (6), 129 (7), 128 (9), 115 (18), 91 (8); HRMS calcd for C<sub>14</sub>H<sub>18</sub>O 202.1358, found 202.1361.

### 2-Butylindanone (**19a**)

bp 120°C (0.02 mmHg), yield 95% from **2d**. Spectral data matched that reported in the literature.<sup>4</sup>

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 0.92 (t, *J*=7.2, 3H), 1.30-1.50 (m, 5H), 1.90-2.00 (m, 1H), 2.61-2.67 (m, 1H), 2.81 (dd, *J*=17.1, 3.8, 1H), 3.31 (dd, *J*=17.1, 7.9, 1H), 7.34 (t, *J*=7.6, 1H), 7.44 (d, *J*=7.6, 1H), 7.57 (t, *J*=7.6, 1H), 7.74 (d, *J*=7.6, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.0 (q), 22.7 (t), 29.6 (t), 31.2 (t), 32.9 (t), 47.4 (d), 123.8 (d), 126.6 (d), 127.3 (d), 134.6 (d), 136.9 (s), 153.8 (s), 209.1 (s); IR: 2958, 2931, 2858, 1713, 1610, 1465, 1287 cm<sup>-1</sup>; MS: 188 (2), 145 (13), 133 (10), 132 (100), 131 (16), 115 (11); HRMS calcd for C<sub>13</sub>H<sub>16</sub>O 188.1201, found 188.1209.

### 2-Pentylindanone (**19b**)<sup>5</sup>

bp 102-115°C (0.025 mmHg), yield 91% from **2e**

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 0.89 (t, *J*=6.9, 3H), 1.28-1.36 (m, 3H), 1.38-1.50 (m, 4H), 1.89-2.00 (m, 1H), 2.61-2.68 (m, 1H), 2.80 (dd, *J*=17.2, 4.1, 1H), 3.31 (dd, *J*=17.2, 7.7, 1H), 7.35 (t, *J*=7.6, 1H), 7.44 (d, 7.6, 1H), 7.56 (t, *J*=7.6, 1H), 7.73 (d, *J*=7.6, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 14.0 (q), 22.5 (t), 27.1 (t), 31.4 (t), 31.8 (t), 32.9 (t), 47.5 (d), 123.8 (d), 126.5 (d), 127.3 (d), 134.6 (d), 136.9 (s), 153.8 (s), 209.0 (s); IR: 2958, 2930, 2856, 1712, 1610, 1464 cm<sup>-1</sup>; MS: 202 (M<sup>+</sup>, 2), 145 (16), 133 (11), 132 (100), 131 (13), 115 (10). HRMS calcd for C<sub>14</sub>H<sub>18</sub>O 202.1358, found 202.1355; Anal. calcd for C<sub>14</sub>H<sub>18</sub>O: C 83.12, H 8.97; found C 82.80, 8.77.

### 2,4-Dimethylindan-1-one (**19c**)

bp 100-107°C (0.025 mmHg), yield 94% from **6b**, mp=34-35°C (lit.<sup>6</sup> 36-37°C)

<sup>1</sup>H NMR (CDCl<sub>3</sub>, 400 MHz): δ 1.31 (d, *J*=7.2, 3H), 2.34 (s, 3H), 2.58 (dd, *J*=4.1, 16.9, 1H), 2.65-2.74 (m, 1H), 3.28 (dd, *J*=7.7, 16.9, 1H), 7.24 (t, *J*=7.4, 1H), 7.38 (d, *J*=7.4, 1H), 7.58 (d, *J*=7.4, 1H); <sup>13</sup>C NMR (CDCl<sub>3</sub>, 100 MHz): δ 16.4 (q), 17.7 (q), 33.8 (t), 41.9 (d), 121.3 (d), 127.6 (d), 135.1 (d), 135.7 (s), 136.1 (s), 152.5 (s), 209.7

(s); MS: 160 ( $M^+$ , 56), 145 (100), 117 (19), 115 (24), 91 (11); Anal. calcd for  $C_{11}H_{12}O$ : C 82.46, H 7.55; found C 82.27, H 7.68.

#### **4-Methoxy-2-methylindan-1-one (19d)**

bp 105°C (0.025 mmHg), yield 88% from **6d**, mp=73-75°C (lit.<sup>7</sup> 72-73°C). Spectral data matched that reported in the literature.<sup>7</sup>

<sup>1</sup>H NMR ( $CDCl_3$ , 400 MHz):  $\delta$  1.30 (d,  $J=7.7$ , 3H), 2.59 (dd,  $J=3.6$ ; 17.4, 1H), 2.64-2.72 (m, 1H), 3.31 (dd,  $J=7.7$ , 17.4, 1H), 3.89 (s, 3H), 7.00-7.04 (m, 1H), 7.31-7.35 (m, 2H); <sup>13</sup>C NMR ( $CDCl_3$ , 100 MHz):  $\delta$  16.4 (q), 31.6 (t), 41.8 (d), 55.4 (q), 114.9 (d), 115.6 (d), 128.9 (d), 137.9 (s), 142.3 (s), 157.0 (s), 209.5 (s); Anal. calcd for  $C_{11}H_{12}O_2$ : C 74.98, H 6.86; found C 74.91, H 6.86.

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