Supporting Information

Palladium-Catalyzed Benzannulation from Alkynes and Allylic Compounds

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1-Methyl-2,3,4,5-tetrapropylbenzene (3a):

^1H NMR (500 MHz, CDCl_3) δ 0.97-1.06 (m, 12H), 1.48-1.52 (m, 8H), 2.25 (s, 3H), 2.48-2.56 (m, 8H), 6.81 (s, 1H); ^{13}C NMR (125 MHz, CDCl_3) δ 14.6, 15.0, 15.1, 15.1, 19.9, 23.7, 24.8, 24.9, 25.0, 31.6, 32.0, 32.2, 35.3, 129.2, 133.4, 136.5, 137.0, 138.1, 138.9; IR (neat) 2955, 2870, 1466, 1376, 1088, 865, 738 cm^{-1} ; Anal. Calcd for $\text{C}_{19}\text{H}_{32}$: C, 87.62; H, 12.38. Found: C, 87.40; H, 12.69.

Pentamethylbenzene (3b).

The spectroscopic data of **3b** were consistent with a commercially available authentic sample. ^1H NMR (400 MHz, CDCl_3) δ 2.17 (s, 6H), 2.21 (s, 3H), 2.24 (s, 6H), 6.83 (s, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 15.9, 16.3, 20.5, 129.0, 132.3, 133.3, 134.9; IR (KBr) 2968, 2920, 2865, 1473, 1439, 1012, 863 cm^{-1} .

1,2,3,4-Tetraethyl-5-methylbenzene (3c):

^1H NMR (500 MHz, CDCl_3) δ 1.12-1.23 (m, 12H), 2.28 (s, 3H), 2.60-2.68 (m, 8H), 6.86 (s, 1H); ^{13}C NMR (125 MHz, CDCl_3) δ 14.6, 15.6, 15.7, 16.0, 19.8, 21.8, 22.0, 22.5, 25.6, 128.6, 133.6, 137.5, 138.1, 139.4, 139.7; IR (neat) 2964, 2870, 1464, 1375, 1059, 873 cm^{-1} ; Anal. Calcd for $\text{C}_{15}\text{H}_{24}$: C, 88.16; H, 11.84. Found: C, 88.10; H, 11.70.

1,2,3,4-Tetrabutyl-5-methylbenzene (3d):

^1H NMR (500 MHz, CDCl_3) δ 0.93-1.00 (m, 12H), 1.40-1.55 (m, 16H), 2.25 (s, 3H), 2.50-2.56 (m, 8H), 6.81 (d, 1H, $J = 0.5$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 14.0, 14.1, 19.9, 23.2, 23.5, 23.6, 23.7, 28.9, 29.2, 29.5, 32.6, 32.8, 33.8, 34.0, 34.1, 129.2, 133.4, 136.5, 137.0, 138.2, 138.8; IR (neat) 2955, 2871, 1464, 1377, 1103, 867, 730 cm^{-1} ; Anal. Calcd for $\text{C}_{23}\text{H}_{40}$: C, 87.26; H, 12.74. Found: C, 87.23; H, 12.91.

1-Methyl-2,3,4,5-tetraphenylbenzene (3e).

Analytical pure **3e** was obtained by recrystallization from ethanol after preparative MPLC (hexane/ethyl acetate = 10/1). ^1H NMR (500 MHz, CDCl_3) δ 2.21 (s, 3H), 1.40 (s, 9H), 6.76-6.89 (m, 10H), 7.03-7.16 (m, 10H), 7.40 (s, 1H); ^{13}C NMR (125 MHz, CDCl_3) δ 20.1, 124.2, 124.4, 125.0, 125.1, 125.5, 125.8, 126.5, 126.6, 128.9, 129.1, 130.2, 130.6, 134.4, 136.7, 139.0, 139.4, 139.5, 139.6, 139.8, 140.4, 140.9; IR (neat) 3056, 3022, 1600, 1440, 1071, 1027, 762, 735, 699 cm^{-1} ; Anal. Calcd for $\text{C}_{31}\text{H}_{24}$: C, 93.90; H, 6.10. Found: C, 93.70; H, 6.10.

1,2,3,4-Tetrakis(methoxymethyl)-5-methylbenzene (3f):

^1H NMR (400 MHz, CDCl_3) δ 2.39 (s, 3H), 3.37 (s, 6H), 3.40 (s, 3H), 3.43 (s, 3H), 4.53-4.55 (m, 6H), 4.59 (s, 2H), 7.21 (s, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 19.6, 58.1, 58.2, 58.5, 67.6, 67.9, 68.3, 72.4, 131.1, 133.4, 135.4, 137.1, 137.7, 138.5; IR (neat) 2924, 2816, 1459, 1374, 1190, 1098, 946 cm^{-1} ; Anal. Calcd for $\text{C}_{15}\text{H}_{24}\text{O}_4$: C, 67.14; H, 9.01. Found: C, 67.14; H, 8.99.

1,2,3,4-Tetrakis(carbomethoxy)-5-methylbenzene (3g).

The spectroscopic data of **3g** were consistent with an authentic sample reported previously (Munz, C.; Stephan, C.; tom Dieck, H. *J. Organomet. Chem.* **1991**, 407, 413). ^1H NMR (500 MHz, CDCl_3) δ 2.44 (s, 3H), 3.86 (s, 3H), 3.91-3.93 (m, 9H), 7.94 (d, 1H, $J = 0.5$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 19.6, 52.8, 52.9, 53.1, 129.7, 130.0, 133.0, 134.6, 137.1, 138.1, 165.1, 165.8, 167.5, 167.6; IR (KBr) 2959, 1736, 1439, 1257-1161 cm^{-1} .

1,2,3,4-Tetrabenzoyl-5-methylbenzene (3h).

¹H NMR (500 MHz, CDCl₃) δ 2.30 (s, 3H), 7.11-7.18 (m, 4H), 7.31-7.37 (m, 2H), 7.37-7.43 (m, 8H), 7.52-7.56 (m, 2H), 7.62 (s, 1H), 7.69-7.74 (m, 4H); ¹³C NMR (125 MHz) δ 20.04, 127.89, 128.04, 128.36, 128.60, 129.29, 129.53, 129.72, 129.94, 132.40, 133.07, 133.27, 133.39, 133.93, 136.70, 137.28, 137.46, 137.73, 139.64, 141.79; IR (KBr) 3070, 2920, 1666, 1596, 1449, 1254, 713 cm⁻¹; Anal. Calcd for C₂₅H₂₄O₄: C, 82.66; H, 4.76. Found: C, 82.10; H, 5.20; mp. 102-3°C.

1,3,5-Trimethyl-2,4-diphenylbenzene (5a).

 The spectroscopic data of **5a** were consistent with an authentic sample reported previously (Melzer, P.; Kurreck, H.; Kieslich, W. *Chem. Ber.* **1982**, *115*, 3597). ¹H NMR (250 MHz, CDCl₃) δ 1.69 (s, 3H), 2.04 (s, 6H), 6.95 (s, 1H), 7.17-7.42 (m, 10H); ¹³C NMR (62.5 MHz, CDCl₃) δ 18.0, 19.8, 125.5, 126.9, 127.4, 128.3, 128.5, 133.1, 133.9, 138.7, 140.6.

1,3-Diethyl-5-methyl-2,4-diphenylbenzene (5b):

¹H NMR (500 MHz, CDCl₃) δ 7.44-7.21 (m, 10H), 7.06 (s, 1H), 2.30 (q, 2H, *J* = 7.6 Hz), 2.13 (q, 2H, *J* = 7.5 Hz), 2.09 (s, 3H), 1.09 (t, 3H, *J* = 7.6 Hz), 0.63 (t, 3H, *J* = 7.5 Hz); ¹³C NMR (125 MHz, CDCl₃) δ 141.01, 140.98, 140.50, 138.55, 135.23, 129.67, 129.05, 127.87, 127.65, 126.65, 126.21, 26.51, 24.05, 20.81, 15.17, 15.04; IR (neat) 2965, 2871, 1600, 1460, 1440, 765, 707 cm⁻¹; Anal. Calcd for C₂₃H₂₄: C, 91.95; H, 8.05. Found: C, 91.84; H, 8.14.

1,3-Di-tert-Butyl-4-methylbenzene (7a):

¹H NMR (400 MHz, CDCl₃) δ 1.31 (s, 9H), 1.42 (s, 9H), 2.51 (s, 3H), 7.05 (d, 1H, *J* = 7.9 Hz), 7.12 (dd, 1H, *J* = 7.9, 2.1 Hz), 7.42 (d, 1H, *J* = 2.1 Hz); ¹³C NMR (100 MHz, CDCl₃) δ 22.8, 30.5, 31.5, 34.5, 36.1, 122.6, 123.1, 132.4, 133.1, 147.3, 148.2; IR (neat) 2961, 2874, 1609, 1465, 1397, 1362, 1245, 817 cm⁻¹; Anal. Calcd for C₁₅H₂₄: C, 88.16; H, 11.84. Found: C, 88.12; H, 11.52; mp. 179.5°C.

1-Methyl-2,4-phenylbenzene (7b).

The spectroscopic data of **7b** were consistent with an authentic sample reported previously (Dauben, W. G.; Spitzer, W. A.; Kellogg, M. S. *J. Am. Chem. Soc.* **1971**, 93, 3674) ^1H NMR (500 MHz, CDCl_3) δ 2.31 (s, 3H), 7.21-7.44 (m, 9H), 7.48-7.51 (m, 2H), 7.61 (d, 2H, $J = 1.3$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 20.2, 125.9, 127.0, 127.1, 127.2, 128.2, 128.7, 128.8, 129.3, 130.9, 134.6, 138.8, 141.0, 142.0, 142.4; IR (neat) 3060, 3025, 2958, 2921, 1600, 1479, 1441, 760, 698 cm^{-1} .

1,3-Dibenzyl-4-methylbenzene (7c):

^1H NMR (250 MHz, CDCl_3) δ 7.26-7.16 (m, 11H), 7.07 (d, 1H, $J = 7.6$ Hz), 6.97 (s, 1H), 3.95 (s, 2H), 3.92 (s, 2H), 2.18 (s, 3H); ^{13}C NMR (62.5 MHz, CDCl_3) δ 140.5, 138.9, 138.7, 134.4, 130.804, 130.801, 130.5, 128.93, 128.88, 128.7, 128.44, 128.38, 127.0, 126.0, 125.9, 41.6, 39.6, 19.3; IR (neat) 3026, 2917, 1601, 1494, 1452, 697 cm^{-1} ; Anal. Calcd for $\text{C}_{21}\text{H}_{20}$: C, 92.60; H, 7.40. Found: C, 92.44; H, 7.68.

1,3-Diisobutyl-4-methylbenzene (7d):

^1H NMR (250 MHz, CDCl_3) δ 7.03 (d, 1H, $J = 7.5$ Hz), 6.88 (s, 1H), 6.87 (d, 1H, $J = 7.5$ Hz), 2.44 (d, 2H, $J = 7.2$ Hz), 2.41 (d, 2H, $J = 7.1$ Hz), 2.26 (s, 3H), 1.84 (m, 2H), 0.90 (m, 12H); ^{13}C NMR (62.5 MHz, CDCl_3) δ 139.6, 138.8, 133.3, 131.0, 129.9, 126.5, 45.1, 42.7, 30.4, 29.2, 22.7, 22.53, 22.46, 19.1; IR (neat) 2953, 2868, 1614, 1501, 1465, 799 cm^{-1} ; Anal. Calcd for $\text{C}_{15}\text{H}_{24}$: C, 88.16; H, 11.84. Found: C, 87.95; H, 11.85.

1,3-Dibutyl-4-methylbenzene (7e):

 ^1H NMR (250 MHz, CDCl_3) δ 7.03 (d, 1H, $J = 7.6$ Hz), 6.95 (s, 1H), 6.91 (d, 1H, $J = 7.6$ Hz), 2.55 (m, 4H), 2.26 (s, 3H), 1.54 (m, 4H), 1.34 (m, 4H), 0.95 (t, 3H, $J = 6.9$ Hz), 0.92 (t, 3H, $J = 6.8$ Hz); ^{13}C NMR (62.5 MHz, CDCl_3) δ 140.8, 140.3, 132.9, 129.9, 129.0, 125.6, 35.3, 33.8, 33.1, 32.6, 22.8, 22.4, 22.8, 22.4, 18.8, 14.03, 13.98; IR (neat) 2928, 2859, 1614, 1501, 1458, 816 cm^{-1} ; Anal. Calcd for $\text{C}_{15}\text{H}_{24}$: C, 88.16; H, 11.84. Found: C, 88.27; H, 11.62.

1,3-Dihexyl-4-methylbenzene (7f):

 ^1H NMR (250 MHz, CDCl_3) δ 7.03 (d, 1H, $J = 3.8$ Hz), 6.94 (d, 1H, $J = 0.8$ Hz), 6.90 (dd, 1H, $J = 3.8, 0.8$ Hz), 2.54 (q, 4H, $J = 3.8$ Hz), 2.26 (s, 3H), 1.56 (m, 4H), 1.36-1.28 (m, 12H), 0.89 (q, 6H, $J = 3.5$ Hz); ^{13}C NMR (62.5 MHz, CDCl_3) δ 140.9, 140.4, 132.9, 130.0, 129.0, 125.7, 35.7, 33.5, 31.83, 31.82, 31.7, 31.6, 30.4, 29.5, 25.1, 22.7, 22.68, 18.9, 14.1; IR (neat) 2954, 2925, 2855, 1603, 1465, 1376, 816, 724 cm^{-1} ; Anal. Calcd for $\text{C}_{19}\text{H}_{32}$: C, 87.62; H, 12.38. Found: C, 87.70; H, 11.98.

1,3-Di-(3-cyanopropyl)-4-methylbenzene (7g):

 ^1H NMR (250 MHz, CDCl_3) δ 7.10 (d, 1H, $J = 7.6$ Hz), 6.97 (d, 1H, $J = 7.6$ Hz), 6.95 (s, 1H), 2.74 (m, 4H), 2.38 (m, 4H), 2.30 (s, 3H), 1.95 (m, 4H); ^{13}C NMR (62.5 MHz, CDCl_3) δ 138.3, 137.5, 134.1, 130.8, 129.1, 126.6, 119.4, 33.9, 26.9, 16.6, 15.3; IR (neat) 2939, 2869, 2245, 1605, 1503, 1456, 822 cm^{-1} ; Anal. Calcd for $\text{C}_{15}\text{H}_{18}\text{N}_2$: C, 79.61; H, 8.02; N, 12.38. Found: C, 79.37; H, 8.06; N, 12.03.

1-Ethyl-2,3,4,5-tetrapropylbenzene (11a):

^1H NMR (500 MHz, CDCl_3) δ 0.99-1.06 (m, 12H), 1.21 (t, 3H, $J = 7.5$ Hz), 1.48-1.61 (m, 8H), 2.50-2.55 (m, 8H), 2.59 (q, 2H, $J = 7.5$ Hz), 6.85 (s, 1H); ^{13}C NMR (125 MHz, CDCl_3) δ 14.6, 15.0, 15.1, 15.1, 19.9, 23.7, 24.8, 24.9, 25.0, 31.6, 32.0, 32.2, 35.3, 129.2, 133.4, 136.5, 137.0, 138.1, 138.9; IR (neat) 2955, 2870, 1466, 1376, 1088, 865, 738 cm^{-1} ; Anal. Calcd for $\text{C}_{20}\text{H}_{34}$: C, 87.51; H, 12.49. Found: C, 87.64; H, 12.49.

1-Butyl-2,3,4,5-tetrapropylbenzene (11b):

^1H NMR (400 MHz, CDCl_3) δ 0.95 (t, 3H, $J = 7.2$ Hz), 0.98-1.06 (m, 12H), 1.41 (q, 2H, $J = 7.2$ Hz), 1.47-1.64 (m, 10H), 2.45-2.55 (m, 10H), 6.82 (s, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 14.1, 14.6, 15.0, 15.1, 15.3, 23.1, 24.7, 24.8, 24.9, 25.0, 31.6, 32.1, 32.3, 32.8, 33.9, 35.3, 127.9, 136.3, 136.8, 138.0, 138.1, 138.9; IR (neat) 2955, 2870, 1466, 1376, 1088, 865, 738 cm^{-1} ; Anal. Calcd for $\text{C}_{22}\text{H}_{38}$: C, 87.34; H, 12.66. Found: C, 87.50; H, 12.86.

1-Benzyl-2,3,4,5-tetrapropylbenzene (11c):

^1H NMR (500 MHz, CDCl_3) δ 7.36-7.11 (m, 5H), 6.74 (s, 1H), 3.96 (s, 2H), 2.54-2.44 (m, 8H), 2.30 (s, 3H), 1.52-1.48 (m, 8H), 1.06-0.97 (m, 12H); ^{13}C NMR (125 MHz, CDCl_3) δ 141.7, 139.6, 138.1, 137.0, 136.9, 135.7, 129.4, 128.7, 128.2, 125.7, 39.3, 35.2, 31.9, 25.1, 24.8, 24.8, 24.6, 15.3, 15.1, 15.0, 15.0, 14.7; IR (neat) 2955, 2870, 1466, 1376, 1088, 865, 738 cm^{-1} ; Anal. Calcd for $\text{C}_{25}\text{H}_{36}$: C, 89.22; H, 10.78. Found: C, 89.25; H, 10.91.

1-Isopropyl-2,3,4,5-tetrapropylbenzene (11d):

^1H NMR (500 MHz, CDCl_3) δ 6.91 (s, 1H), 3.09 (sept 1H, $J = 6.94$ Hz), 2.56-2.47 (m, 8H), 1.52-1.48 (m, 8H), 1.21 (d, 6H, $J = 6.94$ Hz), 1.06-0.97 (m, 12H); ^{13}C NMR δ 144.0, 138.6, 138.2, 136.0, 135.3, 124.0, 35.5, 32.3, 31.7,

31.2, 28.7, 25.2, 25.0, 24.9, 24.7, 24.5, 15.2, 15.1, 15.0, 14.6. IR (neat) 2956, 2870, 1466, 1377, 1087, 884 cm^{-1} ; Anal. Calcd for $\text{C}_{21}\text{H}_{36}$: C, 87.42; H, 12.58. Found: C, 87.45; H, 12.61.

Tetraethylbenzene (**14**).

The spectroscopic data of **14** were consistent with an authentic sample reported previously (Gottlieb, H. E.; Ben-Ari, C.; Hassner, A.; Marks, V. *Tetrahedron* **1999**, 55, 4003). ^1H NMR (500 MHz, CDCl_3) δ 6.89 (s, 1H), 2.66-2.62 (m, 10H), 1.25-1.14 (m, 15H).

Tetrabutylbenzene (**15**):

^1H NMR (400 MHz, CDCl_3) δ 6.81 (s, 1H), 2.45-2.60 (m, 10H), 1.61-1.36 (m, 20H), 1.03-0.91 (m, 15H); ^{13}C NMR (100 MHz, CDCl_3) δ 138.8, 138.1, 136.2, 127.9, 33.9, 33.6, 32.8, 29.2, 28.8, 23.6, 23.5, 23.1, 14.0, 13.9; IR (neat) 2955, 2928, 2858, 1460, 1377, 1102, 732 cm^{-1} ; Anal. Calcd for $\text{C}_{26}\text{H}_{46}$: C, 87.07; H, 12.93. Found: C, 86.42; H, 13.02.

4,5,7-Trimethylindan (**17a**):

^1H NMR (500 MHz, CDCl_3) δ 6.79 (s, 1H), 2.86 (t, 2H, $J = 7.6$ Hz), 2.82 (t, 2H, $J = 7.6$ Hz), 2.23 (s, 3H), 2.19 (s, 3H), 2.14 (s, 3H), 2.06 (tt, 2H, $J = 7.6$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 142.99, 140.17, 134.23, 130.58, 129.43, 128.83, 32.17, 31.61, 24.62, 19.45, 18.81, 15.70; IR (KBr) 2934, 2865, 1485, 1458, 860 cm^{-1} ; Anal. Calcd for $\text{C}_{12}\text{H}_{16}$: C, 89.94; H, 10.06. Found: C, 89.84; H, 10.04; m.p. 41°C.

4,7-Diethyl-5-methylindan (**17b**):

^1H NMR (500 MHz, CDCl_3) δ 6.81 (s, 1H), 2.89 (t, 2H, $J = 7.4$ Hz), 2.85 (t, 2H, $J = 7.4$ Hz), 2.59 (q, 2H, $J = 7.6$ Hz), 2.54 (q, 2H, $J = 7.6$ Hz), 2.29 (s, 3H), 2.07 (quint 2H, $J = 7.4$ Hz), 1.19 (t, 3H, $J = 7.6$ Hz), 1.11 (t, 3H, $J = 7.6$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 142.68, 139.87, 136.99, 135.72, 133.59, 127.66, 31.66, 31.48, 31.11, 26.27, 24.90, 23.50, 22.72, 18.76, 14.50, 14.19, 13.73; IR (neat) 2962, 2871, 1449, 1062, 870 cm^{-1} ; Anal. Calcd for $\text{C}_{14}\text{H}_{20}$: C, 89.29; H, 10.71%. Found: C, 88.97; H, 10.70.

5-Methyl-4,7-dipropylindan (17c):

^1H NMR (500 MHz, CDCl_3) δ 6.78 (s, 1H), 2.89-2.82 (m, 4H), 2.55-2.46 (m, 4H), 2.27 (s, 3H), 2.05 (quint, 2H, $J = 7.5$ Hz), 1.60-1.49 (m, 4H), 0.99 (t, 3H, $J = 7.3$ Hz), 0.96 (t, 3H, $J = 7.3$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 142.96, 139.98, 135.57, 134.35, 133.64, 128.48, 35.58, 32.75, 31.78, 31.27, 24.94, 23.53, 22.80, 18.98, 14.74, 14.34; IR (neat) 2955, 2867, 1466, 1376 cm^{-1} ; Anal. Calcd for $\text{C}_{16}\text{H}_{24}$: C, 88.82; H, 11.18. Found: C, 89.32; H, 10.97.

5-Methyl-4,7-diphenylindan (17d):

^1H NMR (500 MHz, CDCl_3) δ 7.50-7.49 (m, 2H), 7.42 (t, 4H, $J = 7.3$ Hz), 7.33-7.32 (m, 2H), 7.27-7.25 (m, 2H), 7.15 (s, 1H), 3.00 (t, 3H, $J = 7.3$ Hz), 2.69 (t, 3H, $J = 7.3$ Hz), 2.17 (s, 3H), 1.97 (quint, 2H, $J = 7.3$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 143.90, 141.46, 140.66, 139.30, 137.62, 137.07, 134.10, 129.19, 128.66, 128.30, 126.85, 126.76, 58.57, 33.08, 25.95, 20.14; IR (KBr) 3053, 3022, 2955, 2837, 1468, 1442, 1071, 758, 701 cm^{-1} ; Anal. Calcd for $\text{C}_{22}\text{H}_{20}$: C, 92.91; H, 7.09. Found: C, 92.93; H, 7.29; m.p. 114.8-115.0°C.

4,7-Dimethoxycarbonyl-5-methylindan (17e):

^1H NMR (500 MHz, CDCl_3) δ 7.68 (s, 1H), 3.91 (s, 3H), 3.89 (s, 3H), 3.23 (t, 2H, $J = 7.5$ Hz), 2.98 (t, 2H, $J = 7.5$ Hz), 2.41 (s, 3H), 2.07 (quint, 2H, $J = 7.5$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 169.05, 167.13, 145.28, 144.90, 134.55, 132.54, 130.35, 130.34, 127.64, 51.90, 33.55, 32.53, 24.91, 19.93; IR (KBr) 2962, 2931, 1731, 1432, 1283, 1228, 1129, 782 cm^{-1} ; Anal. Calcd for $\text{C}_{14}\text{H}_{16}\text{O}_4$: C, 67.73; H, 6.50. Found: C, 67.81; H, 6.62; m.p. 109.6-110.0°C.

6-Methyl-1,2,3,4-tetrahydronaphthalene (19a).

The spectroscopic data of **19a** were consistent with a commercially available authentic sample. ^1H NMR (500 MHz, CDCl_3) δ 6.95(d, 1H, $J = 7.9$ Hz), 6.91-6.88 (m, 2H), 2.72 (br, 4H), 2.28 (s, 3H), 1.79-1.76 (m, 4H); ^{13}C NMR (125 MHz, CDCl_3) δ 136.96, 134.84, 134.06, 129.73, 129.60, 126.29, 29.40, 29.04, 23.43, 23.35, 21.00.

5,6,8-Trimethyl-1,2,3,4-tetrahydronaphthalene (19b):

^1H NMR (500 MHz, CDCl_3) δ 6.84 (s, 1H), 2.65 (t, 2H, $J = 6.3$ Hz), 2.60 (t, 2H, $J = 6.3$ Hz), 2.24 (s, 3H), 2.17 (s, 3H), 2.11 (s, 3H), 1.91-1.76 (m, 4H); ^{13}C NMR (125 MHz, CDCl_3) δ 135.45, 133.51, 133.18, 133.05, 132.31, 128.76, 119.64, 82.64, 28.00, 27.29, 23.32, 22.90, 20.33, 19.36, 14.68; IR (KBr) 2924, 2857, 1471, 1010, 865 cm^{-1} ; Anal. Calcd for $\text{C}_{13}\text{H}_{19}$: C, 89.59; H, 10.41. Found: C, 89.17; H, 10.51; m.p. 43-44°C.

5,8-Diethyl-6-methyl-1,2,3,4-tetrahydronaphthalene (19c):

^1H NMR (500 MHz, CDCl_3) δ 6.85 (s, 1H), 2.76 (t, 2H, $J = 6.0$ Hz), 2.68 (t, 2H, $J = 6.0$ Hz), 2.61 (q, 2H, $J = 7.6$ Hz), 2.54 (q, 2H, $J = 7.6$ Hz), 2.29 (s, 3H), 1.79-1.76 (m, 4H), 1.19 (t, 3H, $J = 7.6$ Hz), 1.10 (t, 3H, $J = 7.6$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 139.43, 138.16, 134.85, 132.79, 132.73, 127.43, 26.93, 26.52, 25.47, 23.35, 22.99, 21.88, 19.51, 14.37, 13.40; IR (neat) 2963, 2930, 2870, 1449, 1372, 1060, 872 cm^{-1} ; Anal. Calcd for $\text{C}_{15}\text{H}_{22}$: C, 89.04; H, 10.96. Found: C, 88.98; H, 11.18.

6-Methyl-5,8-diphenyl-1,2,3,4-tetrahydronaphthalene (19d):

^1H NMR (500 MHz, CDCl_3) δ 7.43-7.39 (m, 4H), 7.37-7.32 (m, 4H), 7.20-7.17 (m, 2H), 7.00 (s, 1H), 2.63 (t, 2H, $J = 6.3$ Hz), 2.40 (t, 2H, $J = 6.3$ Hz), 2.00 (s, 3H), 1.68-1.61 (m, 4H); ^{13}C NMR (125 MHz, CDCl_3) δ 142.24, 141.24, 141.12, 141.03, 135.46, 132.95, 132.27, 129.40, 129.23, 128.62, 128.54, 128.03, 126.69, 126.60, 29.15, 28.64, 23.21, 23.01, 20.50; IR (KBr) 3055, 3020, 2925, 2846, 1600, 1439, 1070, 750, 700 cm^{-1} ; Anal. Calcd for $\text{C}_{23}\text{H}_{22}$: C, 92.57; H, 7.43. Found: C, 91.49; H, 7.21; m.p. 71-72°C.

1,4-Diethyl-2-methyl-6,7,8,9-tetrahydro-5H-benzocycloheptene (21):

^1H NMR (400 MHz, CDCl_3) δ 6.81 (s, 1H), 2.86-2.79 (m, 4H), 2.64 (q, 2H, $J = 7.5$ Hz), 2.59 (q, 2H, $J = 7.5$ Hz), 2.28 (s, 3H), 1.81-1.78 (m, 2H), 1.63-1.56 (m, 4H), 1.15 (t, 3H, $J = 7.5$ Hz), 1.09 (t, 3H, $J = 7.5$ Hz); ^{13}C NMR (100 MHz, CDCl_3) δ 142.04, 139.39, 138.47, 137.36, 133.11, 128.66, 32.08, 29.33, 29.00, 27.84, 27.83, 27.35, 22.85, 20.14, 16.06, 14.68; IR (neat) 2962, 2920, 2856, 1450, 1372, 1061, 872 cm^{-1} ; Anal. Calcd for $\text{C}_{16}\text{H}_{24}$: C, 88.82; H, 11.18. Found: C, 88.90; H, 11.52.

4-Ethyl-6-methy-7-phenyllindan (23):

^1H NMR (500 MHz, CDCl_3) δ 7.41-7.37 (m, 2H), 7.33-7.28 (m, 1H), 7.23-7.20 (m, 2H), 6.94 (s, 1H), 2.90 (t, 2H, $J = 7.5$ Hz), 2.66-2.59 (m, 4H), 2.11 (s, 3H), 2.00 (quint, 2H, $J = 7.5$ Hz), 1.23 (t, 3H, $J = 7.5$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 143.04, 140.93, 139.68, 138.65, 135.97, 133.72, 129.27, 128.15, 127.30, 126.49, 32.85, 31.21, 26.41, 25.11, 20.06, 14.42; IR (neat) 2961, 2856, 1603, 1474, 1442, 702 cm^{-1} ; Anal. Calcd for $\text{C}_{18}\text{H}_{20}$: C, 91.47; H, 8.53. Found: C, 91.83; H, 8.86.

4-Ethyl-7-methoxycarbonyl-5-methylindan (25):

^1H NMR (500 MHz, CDCl_3) δ 7.64 (s, 1H), 3.86 (s, 3H), 3.25 (t, 2H, $J = 7.6$ Hz), 2.89 (t, 2H, $J = 7.6$ Hz), 2.65 (q, 2H, $J = 7.6$ Hz), 2.33 (s, 3H), 2.08 (quint, 2H, $J = 7.6$ Hz), 1.11 (t, 3H, $J = 7.6$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 167.89, 144.42, 144.23, 143.58, 133.61, 130.14, 123.63, 51.56, 34.05, 31.06, 24.81, 24.00, 18.68, 13.10; IR (neat) 2964, 1717, 1602, 1435, 1290, 1192, 1066, 781 cm^{-1} ; Anal. Calcd for $\text{C}_{14}\text{H}_{19}\text{O}_2$: C, 77.03; H, 8.31. Found: C, 76.91; H, 8.14.

4,7-Diethyl-5-methyl-phthalan (27):

^1H NMR (500 MHz, CDCl_3) δ 6.90 (s, 1H), 5.12 (dd, 4H, $J = 1.9, 7.9$ Hz), 2.51 (q, 2H, $J = 7.6$ Hz), 2.49 (q, 2H, $J = 7.6$ Hz), 2.31 (s, 3H), 1.91 (t, 3H, $J = 7.6$ Hz), 1.11 (t, 3H, $J = 7.6$ Hz); ^{13}C NMR (125 MHz, CDCl_3) δ 137.81, 135.09, 134.94, 134.61, 133.20, 128.91, 73.24, 73.21, 26.12, 23.63, 18.41, 14.38, 13.71; IR (neat) 2966, 2933, 2872, 1458, 1376, 1303, 1049, 1007, 811 cm^{-1} ; Anal. Calcd for $\text{C}_{13}\text{H}_{18}\text{O}$: C, 82.06; H, 9.53. Found: C, 81.66; H, 8.89.