

SUPPORTING MATERIAL

Synthesis of Glycosyl-1-Phosphates via Dehydrative Glycosylation

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General Procedures. All reactions were performed in dry modified Schlenk (Kjedahl shape) flasks fitted with a glass stopper or rubber septa under a positive pressure of argon, unless otherwise noted. Air- and moisture-sensitive liquids and solutions were transferred via syringe or stainless steel cannula. Organic solutions were concentrated by rotary evaporation below 35 °C at *ca.* 25 torr. Flash column chromatography was performed employing 230-400 mesh silica gel. Thin-layer chromatography (analytical and preparative) was performed using glass plates pre-coated to a depth of 0.25 mm with 230-400 mesh silica gel impregnated with a fluorescent indicator (254 nm).

Materials. Dichloromethane, triethylamine, and 2-chloropyridine were distilled from calcium hydride at 760 Torr. The carbohydrate hemiacetals and sulfoxides were dried by azeotropic removal of water with toluene in vacuo prior to use. Trifluoromethanesulfonic anhydride was triply distilled from phosphorous pentoxide.

Instrumentation. Infrared (IR) spectra were obtained using a Perkin Elmer Spectrum BX spectrophotometer referenced to a polystyrene standard. Data are presented as frequency of absorption (cm^{-1}). Proton and carbon-13 nuclear magnetic resonance (^1H NMR or ^{13}C NMR) spectra were recorded on a Varian 400, a Varian 500 or a Varian Inova 500 NMR spectrometer; chemical shifts are expressed in parts per million (δ scale) downfield from tetramethylsilane and are referenced to residual protium in the NMR solvent (CHCl_3 : δ 7.26). Data are presented as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, bs = broad singlet, m = multiplet and/or multiple resonances), integration, and coupling constants in Hertz (Hz).

Dibenzylphosphoryl 2,3,4,6-tetra-O-benzoyl- β -D-glucopyranoside (3).

Trifluoromethanesulfonic anhydride (42 μ L, 0.251 mmol, 1.4 equiv) was added to a solution of 2,3,4,6-tetra-O-benzyl-D-glucopyranose (106 mg, 0.179 mmol, 1 equiv), dibenzothiophen-5-oxide (73 mg, 0.366 mmol, 2.0 equiv), and 2,4,6-tri-*t*-butylpyridine (228 mg, 0.923 mmol, 5.2 equiv) in dichloromethane (8 mL) at -78 $^{\circ}$ C. The reaction mixture was stirred at -45 $^{\circ}$ C for 1 h, and then a solution of dibenzylphosphate (153 mg, 0.551 mmol, 3.1 equiv) in dichloromethane (2 mL) was added via cannula. The solution was stirred at -45 $^{\circ}$ C for 1 h, at 0 $^{\circ}$ C for 30 min, and then at 23 $^{\circ}$ C for 1 h before the mixture was neutralized with the addition of triethylamine (249 μ L, 1.79 mmol, 10 equiv). The reaction was concentrated, and the residue was purified by silica gel flash column chromatography (14% ethyl acetate in hexane) to afford **3** (142 mg, 93%). ^1H NMR (500 MHz, C_6D_6) δ 8.08 (m, 2 H), 8.00–7.94 (m, 4 H), 7.87–7.83 (m, 2 H), 7.72–7.04 (m, 21 H), 6.20 (t, 1 H, $J = 9.51$), 6.04 (t, 1 H, $J = 7.68$, H 1), 5.90, 5.74 (dd, 1 H, $J = 9.79$, 8.00), 5.12 (dd, 1 H, $J = 11.79$, 7.14), 5.08 (dd, 1 H, $J = 11.91$, 7.46), 4.92 (dd, 1 H, $J = 11.86$, 6.85), 4.84 (dd, 1 H, $J = 11.83$, 7.41), 4.77–4.73 (m, 2 H), 4.61 (dd, 1 H, $J = 12.44$, 4.85); ^{13}C NMR (500 MHz, C_6D_6) δ 166.4, 166.3, 165.8, 165.7, 136.6, 136.6, 136.2, 136.2, 134.5, 133.8, 133.7, 133.6, 133.4, 130.6, 130.5, 130.5, 130.4, 129.8, 129.8, 129.7, 129.6, 129.0, 129.0, 128.9, 128.8, 128.7, 128.7, 128.7, 128.5, 128.3, 97.5, 97.5, 73.6, 73.6, 73.0, 73.0, 70.1, 70.1, 69.9, 69.8, 69.8, 62.8; FTIR (neat film) 3068, 1730, 1265, 1107, 708 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{48}\text{H}_{44}\text{O}_{13}\text{P}_1$ ($\text{M} + \text{H}$) 857.2363, found 857.2362.

Bis(hexadecyl)phosphoryl 2,3,4,6-tetra-O-benzoyl- β -D-glucopyranoside (4).

^1H NMR (500 MHz, CD_2Cl_2) δ 8.06 (m, 2 H), 7.98 (m, 2 H), 7.92 (m, 2 H), 7.83 (m, 2 H), 7.61–7.31 (m, 13 H), 5.93 (t, 1 H, $J = 9.52$ 9.52 Hz), 5.74 (t, 1 H, $J = 9.75$ Hz), H-1 5.68 (t, 1 H, $J = 7.76$ Hz), 5.62, (dd, 1 H, $J = 9.63$), 4.64 (dd, 1 H, $J = 12.27$, 2.62), 4.71 (dd, 1 H, $J = 12.29$, 4.95), 4.34 (ddd, 1 H, $J = 9.96$, 4.96, 2.80), 3.99 (m, 2 H), 3.73.22 (m, 2 H); ^{13}C NMR (400 MHz, C_6D_6) δ 166.3, 166.2, 165.6, 165.6, 160.6, 133.7, 134.0, 133.6, 133.4, 133.4, 130.7, 130.5, 130.4, 130.4, 123.0, 129.8, 129.6, 129.0, 129.0, 128.9, 128.8, 129.7, 122.6, 121.7, 97.4, 97.4, 73.7, 73.5, 73.1, 73.0, 69.8, 68.8, 68.7, 68.6, 68.5, 63.0, 32.7, 30.9, 30.8, 30.7, 30.6, 30.6, 30.6, 30.6, 30.6, 30.6, 30.5, 30.5, 30.5, 30.5, 30.5, 30.4, 30.4, 30.2, 30.2, 30.2, 29.9, 29.8, 26.2, 25.8, 23.5, 14.8; FTIR (neat film) 2925, 2854, 1735, 1452, 1267, 1094, 1027, 709 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{66}\text{H}_{93}\text{Na}_1\text{O}_{13}\text{P}_1$ ($\text{M} + \text{Na}^+$) 1147.6252, found 1147.6239.

Dibenzylphosphoryl 3,4,6-tri-O-acetyl-2-deoxy-2-phthalimido- β -D-glucopyranoside (5).

^1H NMR (500 MHz, C_6D_6) δ 7.41 (m, 2 H), 7.18–6.78 (m, 11 H), 6.51 (dd, 1 H, $J = 8.54$, 7.69), 6.23 (dd, 1 H, $J = 10.68$, 9.12), 5.37 (dd, 1 H, $J = 10.29$, 9.15) 4.98 (dd, 1 H, $J = 11.63$, 7.4), 4.91 (dd, 1 H, $J = 11.63$, 7.80), 4.79 (dd, 1 H, $J = 10.71$, 8.51), 4.76 (dd, 1 H, $J = 11.81$, 7.13), 4.69 (dd, 1 H, $J = 11.87$, 8.11), 4.22 (dd, 1 H, $J = 12.47$, 4.07), 3.95 (dd, 12.52, 2.14), 3.33 (ddd, 1 H, $J = 10.25$, 4.16, 2.13), 1.68 (s, 3 H), 1.61 (s, 3 H), 1.44 (s, 3 H); ^{13}C NMR (500 MHz, C_6D_6) δ 170.4, 170.2, 169.5, 136.6, 136.5, 136.2, 134.4, 129.0, 128.9, 128.9, 128.7, 128.7, 128.1, 123.9, 94.8, 94.8, 73.2, 71.1, 70.2, 70.1, 69.9, 69.8, 68.8, 61.6, 56.3, 56.2, 20.6, 20.5, 20.2; FTIR (neat film) 2949, 1749, 1720, 1385, 1226, 1015, 722 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{34}\text{H}_{34}\text{N}_1\text{O}_{13}\text{P}_1$ ($\text{M} + \text{H}$) 696.1846, found 696.1853.

Bis(hexadecyl)phosphoryl 2,3,4,6-tetra-O-benzoyl- β -D-galactopyranoside (6).

^1H NMR (500 MHz, C_6D_6) δ 8.24–8.18 (m, 4 H), 8.12–8.07 (m, 2 H), 8.02–7.98 (m, 2 H), 7.15–6.70 (m, 13 H), 6.47 (dd, 1 H, J = 10.36, 8.02), 6.09 (dd, 1 H, J = 3.4, 0.74), 5.98 (t, 1 H, J = 8.03, H-1), 5.97 (dd, 1 H, J = 10.49, 3.44), 4.73 (dd, 1 H, J = 11.44, 7.19), 4.27 (dd, 1 H, J = 11.46, 5.56), 4.24–4.14 (m, 2 H), 3.98–3.96 (m, 2 H), 1.57–0.88 (m, 64 H); ^{13}C NMR (101 MHz, C_6D_6) δ 166.0, 166.0, 165.9, 133.7, 133.6, 133.5, 130.6, 130.6, 130.5, 130.5, 130.4, 130.2, 129.8, 129.7, 129.2, 129.1, 128.8, 128.6, 128.5, 128.3, 128.2, 128.1, 97.7, 97.7, 76.5, 72.9, 72.5, 71.1, 71.0, 70.5, 70.3, 69.6, 69.3, 69.0, 68.7, 68.6, 62.7, 32.7, 30.9, 30.9, 30.7, 30.7, 30.6, 30.6, 30.6, 30.5, 30.5, 30.5, 30.4, 30.4, 30.2, 30.2, 29.9, 29.8, 26.3, 25.8, 23.5, 14.7; FTIR (neat film) 2925, 2854, 1732, 1452, 1267, 1107, 1027, 710 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{66}\text{H}_{93}\text{Na}_1\text{O}_{13}\text{P}_1$ ($\text{M} + \text{Na}^+$) 1147.6252, found 1147.6239.

Dibenzylphosphoryl 2,3,5-tri-O-benzoyl- β -D-ribofuranoside (7).

^1H NMR (500 MHz, C_6D_6) δ 8.12–8.08 (m, 6 H), 7.34 (m, 4 H), 7.20–7.00 (m, 10 H), 6.95–6.88 (m, 6 H), H-1 6.33 (dd, 1 H, J = 6.66, 2.77), 5.85 (t, 1 H, J = 3.71), 5.78 (t, 1 H, 3.33), 5.50 (d, 1 H, J = 2.55), 5.13–5.01 (m, 4 H), 4.01 (dd, 1 H, J = 13.13, 1.92), 3.83 (dd, 1 H, J = 13.3, 3.13); ^{13}C NMR (500 MHz, C_6D_6) δ 166.2, 165.9, 165.6, 136.7, 136.6, 136.5, 133.5, 133.3, 130.7, 130.6, 130.5, 130.4, 130.3, 129.2, 129.2, 129.1, 129.1, 128.9, 128.9, 128.8, 128.8, 128.8, 97.2, 97.1, 70.2, 70.2, 70.1, 70.1, 69.0, 68.9, 67.9, 66.6, 63.2; FTIR (neat film) 30366, 1727, 1453, 1282, 950, 713 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{40}\text{H}_{35}\text{K}_1\text{O}_{11}\text{P}_1$ ($\text{M} + \text{K}^+$) 761.1554, found 761.1557.

Dibenzylphosphoryl 2,3,4-tri-O-pivaloyl- β -D-xylopyranoside (8).

^1H NMR (500 MHz, C_6D_6) δ 7.23–7.00 (m, 13 H), 5.38–5.33 (m, 3 H), 5.05–4.95 (m, 5 H), 3.70 (dd, 1 H, J = 5.54, 11.70) 1.20 (s, 9 H), 1.14 (s, 9 H), 1.08 (s, 9 H); ^{13}C NMR (500 MHz, C_6D_6) δ 177.1, 177.0, 177.0, 136.7, 136.5, 136.4, 129.1, 129.1, 129.0, 128.9, 128.7, 97.8, 97.8, 72.0, 71.7, 71.7, 70.1, 70.0, 69.9, 69.8, 69.2, 63.2, 39.3, 39.1, 39.1, 27.6, 27.6, 27.4; FTIR (neat film) 2972.1, 1742.5, 1480.3, 1278.0, 1142.4, 1000.9, 907.2, 696.6 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{34}\text{H}_{47}\text{Na}_1\text{O}_{11}\text{P}_1$ ($\text{M} + \text{Na}^+$) 685.2754, found 685.2755.

Dibenzylphosphoryl 2,3,4,6-tetra-O-methyl- α -D-mannopyranoside (9).

^1H NMR (500 MHz, C_6D_6) δ 7.35–7.22 (m, 4 H), 7.14–7.00 (m, 6 H), 6.06 (dd, 1 H, J = 6.30, 2.02, H-1), 5.14 (dd, 1 H, J = 11.83, 8.50), 5.07 (dd, 1 H, J = 8.31, 11.83), 5.03 (dd, 1 H, J = 11.87, 8.49), 4.07 (ddd, 1 H, J = 9.98, 5.19, 1.60), 3.79 (t, 1 H, J = 9.64), 3.60 (dd, 1 H, J = 7.29, 3.60), 3.058 (t, 1 H, J = 5.40), 3.48 (dd, 1 H, J = 10.92, 1.65), 3.43 (m, 5 H), 3.15 (s, 3 H), 3.13 (s, 3 H), 3.11 (m, 4 H); ^{13}C NMR (126 MHz, C_6D_6) δ 137.1, 137.1, 136.9, 136.9, 129.1, 129.0, 128.9, 128.8, 128.8, 97.0, 96.9, 81.7, 77.4, 77.4, 76.6, 76.6, 74.8, 72.2, 69.8, 69.8, 69.8, 69.8, 60.9, 59.3, 59.3, 57.6; FTIR (neat film) 3496, 2933, 1456, 1277, 1113, 1013, 946, 742, 698 cm^{-1} .

Dibenzylphosphoryl 3,4,6-tri-O-acetyl-2-deoxy-2-azido- α -D-mannopyranoside (10).

^1H NMR (500 MHz, C_6D_6) δ 7.18-7.28 (m, 3 H), 7.15-7.03 (m, 5 H), 5.70 (dd, 1 H, J = 6.18, 1.67), 5.67 (t, 1 H, J = 10.03), 5.46 (dd, 1 H, J = 9.92, 3.87, H-1), 5.03-4.85 (m, 4 H), 4.19 (dd, 1 H, J = 13.06, 4.57), 4.03-4.00 (m, 2 H), 3.43 (dd, 1 H, J = 3.80, 1.85), 1.66 (s, 3 H), 1.65 (s, 3 H), 1.64 (s, 3 H); ^{13}C NMR (126 MHz, C_6D_6) δ 170.5, 169.7, 169.5, 136.5, 136.5, 136.4, 129.3, 129.3, 129.3, 129.2, 129.1, 128.8, 96.4, 96.3, 71.2, 71.0, 70.4, 70.4, 70.1, 70.1, 65.8, 62.0, 61.9, 61.07, 20.5, 20.5, 20.2; FTIR (neat film) 3484, 2961, 2114, 1752, 1370, 1227, 1034, 960, 743, 699 cm^{-1} .

Dibenzylphosphoryl 2,3,4,6-tetra-O-benzyl- α -D-glucopyranoside (11).

^1H NMR (500 MHz, C_6D_6) δ 6.98-7.40 (m, 32 H), 6.30 (dd, 1 H, J = 7.11, 3.25), 5.10 (dd, 4 H, J = 7.59, 5.25), 4.94 (d, 1 H, J = 11.35), 4.92 (d, 1 H, J = 11.46), 4.77 (d, 1 H, J = 11.39), 4.65 (d, 1 H, J = 11.28), 4.60 (d, 1 H, J = 11.16), 4.40 (d, 1 H, J = 11.16), 4.39 (d, 1 H, J = 12.12), 4.29 (d, 1 H, J = 12.06), 4.18 (ddd, 1 H, J = 10.18, 3.78, 1.66), 4.09 (t, 1 H, J = 9.41), 3.80 (y, 1 H, J = 9.71), 3.64 (dd, 1 H, J = 10.82, 3.95), 3.54 (dd, 1 H, J = 10.94, 1.73), 3.94 (dt, 1 H, J = 9.42, 2.95); ^{13}C NMR (126 MHz, C_6D_6) δ 139.9, 139.5, 139.1, 138.7, 129.0, 129.0, 129.0, 128.9, 128.5, 128.5, 128.5, 128.3, 128.3, 128.3, 128.3, 128.1, 128.1, 128.0, 98.7, 96.4, 96.3, 91.7, 85.4, 84.2, 82.5, 81.9, 81.5, 80.5, 80.4, 78.8, 78.6, 77.8, 75.9, 75.5, 73.9, 73.7, 73.5, 69.8, 69.8, 69.6, 69.6, 69.5, 69.2; FTIR (neat film) 3032, 2868, 1454, 1015, 736, 697 cm^{-1} .

Diethylphosphoryl 2,3,4,6-tetra-O-benzyl-D-glucopyranoside (12).

α -anomer: ^1H NMR (500 MHz, C_6D_6) δ 7.43-6.64 (m, 36 H), 6.25 (dd, 1 H, J = 7.29, 3.21, H-1), 4.97 (d, 1 H, J = 11.37), 4.93 (d, 1 H, J = 11.28), 4.78 (d, 1 H, J = 11.34), 4.67 (d, 1 H, J = 11.29), 4.61 (d, 1 H, J = 11.37), 4.41 (d, 1 H, J = 11.93), 4.41 (d, 1 H, J = 11.19), 4.32 (d, 1 H, J = 12.07), 4.23 (ddd, 1 H, J = 10.11, 4.06, 1.98), 4.12 (t, 1 H, J = 9.14), 4.10-4.01 (m, 5 H), 3.77 (dd, 1 H, J = 10.04, 9.20), 3.71 (dd, 1 H, J = 10.79, 4.04), 3.66 (dd, 1 H, J = 10.69, 1.76), 3.49 (dt, 1 H, J = 9.83, 3.42), 1.04 (m, 6 H); ^{13}C NMR (126 MHz, C_6D_6) δ 139.9, 139.5, 139.2, 138.8, 128.9, 128.9, 128.9, 128.9, 128.8, 128.8, 128.3, 128.3, 128.3, 128.3, 128.1, 128.0, 95.7, 95.7, 81.9, 80.5, 80.5, 78.0, 75.9, 75.5, 73.9, 73.5, 73.3, 69.5, 64.3, 64.2, 64.0, 63.9, 16.5, 16.4, 16.4; FTIR (neat film) 3480, 2911, 1454, 1265, 1029, 737, 698 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{38}\text{H}_{45}\text{Na}_1\text{O}_9\text{P}_1$ ($M + \text{Na}^+$) 699.2699, found 699.2700.

β -anomer: ^1H NMR (500 MHz, C_6D_6) δ 7.03-7.40 (m, 28 H), 5.49 (t, 1 H, J = 7.64, H-1), 4.96 (d, 1 H, J = 11.43), 4.87 (d, 1 H, J = 11.35), 4.81 (d, 1 H, J = 11.48), 4.76 (d, 1 H, J = 11.28), 4.75 (d, 1 H, J = 11.35), 4.55 (d, 1 H, J = 11.42), 4.21-3.96 (m, 5 H), 3.77 (t, 1 H, J = 9.34), 3.64-3.56 (m, 4 H), 3.38 (dt, 1 H, J = 9.94, 2.99), 1.10 (dt, 3 H, J = 7.09, 0.99); ^{13}C NMR (126 MHz, C_6D_6) δ 139.6, 139.5, 139.3, 139.1, 128.9, 128.9, 128.3, 128.3, 128.3, 128.2, 128.1, 128.1, 128.0, 99.7, 99.7, 85.1, 85.1, 82.9, 82.8, 78.1, 76.1, 75.9, 75.3, 75.1, 73.8, 69.3, 64.2, 64.2, 64.1, 57.8, 16.5, 16.5, 16.5, 16.4; FTIR (neat film) 2869, 1454, 1270, 1092, 1029, 698 cm^{-1} ; HRMS (FAB) m/z calcd for $\text{C}_{38}\text{H}_{45}\text{Na}_1\text{O}_9\text{P}_1$ ($M + \text{Na}^+$) 699.2699, found 699.2702.

Dibenzylphosphoryl 2,3,4,6-tetra-O-benzyl- α -D-galactopyranoside (13).

^1H NMR (500 MHz, C_6D_6) δ 7.50-6.98 (m, 45 H), 6.34 (dd, 1 H, J = 6.57, 3.48), 5.15-5.09 (m, 4 H), 5.01 (d, 1 H, J = 11.54), 4.63 (d, 1 H, J = 11.97), 4.59 (d, 1 H, J = 11.39), 4.56 (d, 1 H, J = 11.28), 4.48 (d, 1 H, J = 12.2), 4.44 (d, 1 H, J = 10.98), 4.31-4.16 (m, 4 H), 3.90-3.85 (m, 2 H), 3.71 (dd, 1 H, J = 9.26, 7.16), 3.62 (dd, 1 H, J = 9.13, 5.90); ^{13}C NMR (126 MHz, C_6D_6) δ 139.7, 139.7, 139.1, 139.0, 137.2, 137.2, 129.0, 129.0, 128.9, 128.9, 128.8, 128.7, 128.7, 128.6, 128.5,

128.5, 128.4, 128.2, 128.1, 128.0, 128.0, 97.3, 97.3, 78.9, 77.2, 77.1, 75.9, 75.7, 73.9, 73.9, 73.7, 73.5, 72.4, 69.7, 69.6, 69.5, 69.5, 69.4; FTIR (neat film) 3031, 2871, 1454, 1106, 1014, 956, 736, 697 cm^{-1} .

Dibenzylphosphoryl 2,3,4-tri-O-benzyl-D-xylopyranoside (14).

α -anomer: ^1H NMR (500 MHz, C_6D_6) δ 7.50-6.98 (m, 30 H), 6.22 (dd, 1 H, $J = 7.00, 3.30$, H-1), 5.06 (m, 4 H), 4.87 (d, 1 H, $J = 14.39$), 4.81 (d, 1 H, $J = 14.95$), 4.67 (d, 1 H, $J = 10.69$), 4.48 (d, 1 H, $J = 11.84$), 4.47 (d, 1 H, $J = 11.15$), 4.34 (d, 1 H, $J = 11.71$), 3.98 (t, 1 H, $J = 9.47$), 3.82 (t, 1 H, $J = 11.21$), 3.64 (dd, 1 H, $J = 11.29, 5.75$), 3.46 (ddd, 1 H, $J = 10.94, 9.10, 5.75$), 3.41 (dt, 1 H, $J = 9.45, 2.99$); ^{13}C NMR (126 MHz, C_6D_6) δ 139.9, 139.3, 138.7, 138.7, 137.1, 137.0, 136.9, 129.0, 129.0, 128.9, 128.9, 128.8, 128.8, 128.7, 128.5, 128.4, 128.4, 128.3, 128.2, 128.2, 127.0, 96.5, 96.4, 81.2, 80.1, 80.1, 78.0, 75.9, 73.6, 73.6, 69.8, 69.7, 69.5, 69.5, 62.4; FTIR (neat film) 3031, 2895, 1455, 1278, 1091, 1016, 957, 737, 697 cm^{-1} .

β -anomer: ^1H NMR (500 MHz, C_6D_6) δ 7.50-6.98 (m, 35 H), 5.52 (t, 1 H, $J = 7.03$), 5.20-4.96 (m, 4 H), 4.86 (d, 1 H, $J = 11.47$), 4.80 (s, 2 H), 4.74 (d, 1 H, $J = 11.29$), 4.37 (d, 1 H, $J = 11.93$), 4.26 (d, 1 H, $J = 11.93$), 3.55 (m, 2 H), 3.49 (m, 1 H), 3.12 (dd, 1 H, $J = 11.82, 9.48$); ^{13}C NMR (126 MHz, C_6D_6) δ 139.7, 139.2, 137.0, 136.9, 136.8, 136.8, 133.4, 130.5, 129.0, 129.0, 129.0, 128.9, 128.9, 128.8, 128.8, 128.4, 128.4, 128.1, 128.1, 128.0, 122.6, 121.7, 100.5, 100.5, 83.7, 83.6, 82.1, 82.0, 78.1, 75.6, 75.2, 73.1, 69.7, 69.7, 69.7, 69.6, 64.7; FTIR (neat film) 3032, 2893, 1455, 1277, 1092, 1018, 736, 696 cm^{-1} .