Supplementary Information

Catalytic reductive cleavage of methyl α-D-glucoside acetals to ethers using hydrogen as a clean reductant

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1. General information

Methyl α-D-glucoside **1** (> 98% purity) was purchased from Sigma-Aldrich or Alfa-Aesar and Pd/C (5 or 10 %, Pd on activated carbon, reduced and dry, Escat 1431) from Strem Chemicals. Valeraldehyde, hexanal, octanal, decanal and dodecanal were supplied by Sigma-Aldrich or Alfa-Aesar. Amberlyst 15 dry was bought from Rohm and Haas. All other reagents and solvents were used as received without further purification. NMR spectra were acquired on a Bruker 300 (^{1}H, 300 MHz; ^{13}C, 75 MHz) spectrometer at 293 K. Shifts are referenced relative to the $CDCl_3$ residual peak (δ_H: 7.26 ppm; δ_C: 77.16 ppm). The chemical shifts (δ) are expressed in ppm and the coupling constants (*J*) are given in Hz. The following abbreviations used are: s = singlet, d = doublet, t = triplet, dd = doublet of doublets, td = triplet of doublets, m = multiplet, br = broad. Electrospray ionization (ESI) mass spectra (MS) and High-Resolution Mass Spectra (HRMS) were recorded in the positive mode using spectrometer (MicroTOFQ-II, Bruker Daltonics, Bremen). Thin-layer chromatography (TLC) was carried out on aluminum sheets coated with silica gel Merck 60 F254 (0.25 mm) revealed with a solution of sulfuric acid at 2.5 v/v% in ethanol. Flash column chromatography was performed with silica gel Merck Si 60 (40–63 μm). Infrared (IR) spectra were recorded in a SMART iTR-Nicolet iS10 spectrometer using Attenuated Total Reflectance (ATR) and the wavenumbers (ν max) are expressed in cm^{-1}. Melting points were measured using a Kofler apparatus and noted in °C.

2. Derivatization method[1]

Prior to analysis, the sample was silylated as follows: the crude mixture was diluted in THF (25mL), then 1 mL of this solution was diluted in 1.3 mL of the silylating reagent (pyridine:hexamethyldisilazane (HMDS):chlorotrimethylsilane (TMSCl) in v/v/v 1:0.2:0.1 proportions) The mixture was then heated at 70°C and stirred vigorously for 10 min. Then, the sample was diluted in 10 mL of a THF solution containing methyl oleate (internal standard) at 0.3 g/L. Finally, the sample was filtrated using a syringe filter (PTFE; 0.2 μm) before injection in GC.

3. GC method

Gas chromatography analyses (GC) for the optimization of the hydrogenolysis of methyl α-D-glucoside acetals were performed using a Shimadzu GC (GC-2025) equipped with a DB-5MS capillary column (30 m, 0.25 mm i.d, 0.25 μm film thickness) and a FID as detector. The carrier gas was helium, at a flow rate of 1.24 mL/min. The column temperature was initially at 100°C, gradually increased to 240°C at 8°C/min and kept at 240°C for 3 min., then gradually increased to 280°C at 8°C/min. and finally kept at 280°C for 10min. The injector temperature was set at 240°C and the transfer line temperature was at 280°C.

[1] C.C. Sweeley, R. Bentley, M. Makita, W.W. Wells, *J. Am. Chem. Soc*., **1963**, *85*, 2497-2507.

4. General procedures

General procedure for the preparation of methyl α-D-glucoside acetals (A)

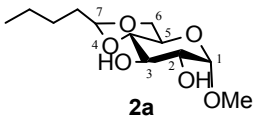
In a 100-mL round bottom flask, under an argon atmosphere, methyl α-D-glucoside **1** (3.22 g, 16.6 mmol, 2 equiv) was dissolved in dry THF (10 mL) with sodium sulfate (1.8 g, 12 mmol, 1.5 equiv) under an argon atmosphere. The aldehyde (8.3 mmol, 1 equiv) was added dropwise over a 1-min period, followed by Amberlyst 15 (20wt%/aldehyde). The mixture was magnetically stirred at reflux (66°C) for 3 hours. After cooling to room temperature, the reaction mixture was filtered, washed with EtOAc (2×25 mL) and the filtrate was concentrated under reduced pressure. The residue was purified by flash chromatography (EtOAc:cylohexane) to give methyl 4,6-*O*-alkylidene α-D-glucoside **2a-e** as a single diastereoisomer.

General procedure for the reductive cleavage of methyl α-D-glucoside acetals (B)

Methyl 4,6-*O*-alkylidene α-D-glucoside **2a-e** (3 mmol) was diluted in dry CPME (30 mL) and 5%-Pd/C (0.45 g, 5 mol% in Pd) was added in a 100-mL stainless steel autoclave. The reactor was tightly closed, purged three times with hydrogen and hydrogen pressure was introduced (30 bar). The system was heated at 120°C and mechanically stirred for 15 hours. After cooling to room temperature, hydrogen pressure was released and the reaction mixture was then dissolved in absolute ethanol (100 mL) and filtered (Millipore Durapore filter 0.01 µm). The filtrate was evaporated under reduced pressure and the residue was purified by flash chromatography (EtOAc/cyclohexane 50:50 to 100:0 then EtOH/EtOAc 10:90) to give methyl glucoside ethers **3a-e** and **4a-e** as a colourless oil. GC analysis after silylation revealed a mixture of 4-and 6-ether regioisomers.

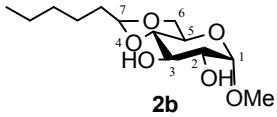
5. Characterization data

5.1. Characterization data of methyl α-D-glucoside acetals **2a-e**



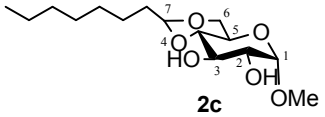
2a

Methyl 4,6-*O*-pentylidene α-D-glucopyranoside [1374411-10-5] (2a): The title compound was prepared from methyl α-D-glucoside **1** (7.49 g, 38.5 mmol) and valeraldehyde (1.64 g, 19 mmol) following the procedure **A** to give **2a** (2.14 g, 43%) as a white solid. Mp = 78°C; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.88 (3H, t, *J* = 7, CH_3 alkyl), 1.21–1.44 (4H, m, 2(CH_2) alkyl), 1.52–1.72 (2H, m, CH_2 alkyl), 2.80 (1H, d, *J* = 9, OH^3), 3.23 (1H, t, *J* = 9, H^3), 3.31 (1H, d, *J*=2, OH^2), 3.40 (3H, s, OCH_3), 3.48 (1H, t, *J*=10, H^2), 3.52–3.67 (2H, m, H^5+H^6), 3.83 (1H, td, *J*=9 and 2, H^4), 4.09 (1H, dd, *J*=10 and 4, H^6), 4.52 (1H, t, *J*=5, H^7), 4.73 (1H, d, *J*=4, H^1); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.05 (CH_3alkyl), 22.62 (CH_2 alkyl), 26.30 (CH_2 alkyl), 34.03 (CH_2 alkyl), 55.54 (OCH_3), 62.62 (CH^5), 68.57 (CH_2^6), 71.70 (CH^4), 72.98 (CH^2), 80.47 (CH^3), 99.87 (CH^1), 102.81 (CH^7). IR ν_{max}: 3399 (OH), 2956 (-CH_3), 2862 (-CH_2-), 1428, 1390, 1062, 1041, 989; HRMS (ESI^+) calcd for $C_{12}H_{22}NaO_6$: 285.1309 $[M+Na]^+$,found: 285.1315 (-2.2 ppm); GC: R_t = 15.85 min; Rf = 0.27 (80:20 EtOAc/cyclohexane).



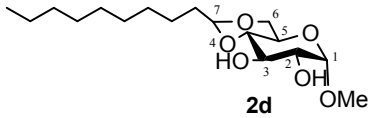
2b

Methyl 4,6-*O*-hexylidene α-D-glucopyranoside [123828-42-2] (2b): The title compound was prepared from methyl α-D-glucoside **1** (3.22 g, 16.6 mmol) and hexanal (0.83 g, 8.3 mmol) following the procedure **A** to give **2b** (0.98 g, 43%) as a white solid. Mp = 84°C; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.86 (3H, t, *J* = 7, CH_3 alkyl), 1.05–1.30 (4H, m, 2(CH_2) alkyl), 1.31–1.46 (2H, m, CH_2 alkyl), 1.52–1.74 (2H, m, CH_2 alkyl), 3.02 (1H, br s, OH^3), 3.23 (1H, t, *J* = 9, H^3), 3.40 (3H, s, OCH^3), 3.47 (1H, t, *J*=10, H^2), 3.52–3.66 (2H, m, H^5+H^6), 3.83 (1H, t, *J*=9, H^4), 4.09 (1H, dd, *J*=10 and 5, H^6), 4.52 (1H, t, *J*=5, H^7), 4.72 (1H, d, *J*=4, H^1); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.10 (CH_3 alkyl), 22.62 (CH_2 alkyl), 23.86 (CH_2 alkyl), 31.74 (CH_2 alkyl), 34.28 (CH_2 alkyl), 55.51 (OCH_3), 62.62 (CH^5), 68.56 (CH_2^6), 71.61 (CH^4), 72.95 (CH^2), 80.49 (CH^3), 99.90 (CH^1), 102.81 (CH^7); IR ν_{max}: 3433 (OH), 2925 (-CH_3), 2860 (-CH_2-), 1465, 1379, 1061, 983; HRMS (ESI^+) calcd for $C_{13}H_{24}NaO_6$: 299.1465 $[M+Na]^+$; found: 299.1464 (+0.4 ppm); GC: R_t = 17.37 min; Rf = 0.27 (80:20 EtOAc/cyclohexane).



2c

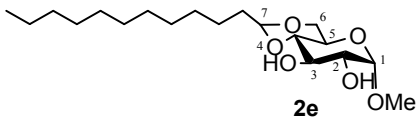
Methyl 4,6-*O*-octylidene α-D-glucopyranoside [123828-44-4] (2c): The title compound was prepared from methyl α-D-glucoside **1** (3.22 g, 16.6 mmol) and octanal (1.06 g, 8.3 mmol) following the procedure **A** to give **2c** (0.94 g, 37%) as a white solid. Mp = 80°C; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.85 (3H, t, *J* = 7, CH_3 alkyl), 1.07–1.31 (8H, m, 4(CH_2) alkyl), 1.32–1.47 (2H, m, CH_2 alkyl), 1.50–1.73 (2H, m, CH_2 alkyl), 3.02 (2H, br s, OH^2+OH^3), 3.23 (1H, t, *J* = 9, H^3), 3.40 (3H, s, OCH_3), 3.48 (1H, t, *J*=10, H^2), 3.52–3.67 (2H, m, H^5), 3.83 (1H, t, *J*=9, H^4), 4.09 (1H, dd, *J*=10 and 5, H^6), 4.52 (1H, t, *J*=5, H^7), 4.72 (1H, d, *J*=4, H^1); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.18 (CH_3 alkyl), 22.73 (CH_2 alkyl), 24.18 (CH_2 alkyl), 29.26 (CH_2 alkyl), 29.51 (CH_2 alkyl), 31.85 (CH_2 alkyl), 34.33 (CH_2 alkyl), 55.53 (OCH_3), 62.62 (CH^5), 68.56 (CH_2^6), 71.68 (CH^4), 72.97 (CH^2), 80.48 (CH^3), 99.88 (CH^1), 102.82 (CH^7); IR ν_{max}: 3368 (OH), 2924 (-CH_3), 2857 (-CH_2-), 1465, 1378, 1128, 1090, 1064, 1037, 993; HRMS (ESI^+) calcd for $C_{15}H_{28}NaO_6$: 327.1778 $[M+Na]^+$; found: 327.1780 (-0.6 ppm); GC: R_t = 19.86 min; Rf = 0.21 (50:50 EtOAc/cyclohexane).



2d

Methyl 4,6-*O*-decylidene α-D-glucopyranoside [123828-46-6] (2d): The title compound was prepared from methyl α-D-glucoside **1** (20 g, 102 mmol) and decanal (7.97 g, 51 mmol) following the procedure **A** to give **2d** (7.48 g, 44%) as a white solid. Mp = 72°C; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.87 (3H, t, *J* = 7, CH_3 alkyl), 1.16–1.32 (12H, m, 6(CH_2) alkyl), 1.33–1.45 (2H, m, CH_2 alkyl), 1.55–1.72 (2H, m, CH_2 alkyl), 2.61 (2H, br s, OH^3+OH^2), 3.24 (1H, t, *J* = 9, H^3), 3.42 (3H, s, OCH_3), 3.49 (1H, t, *J*=10, H^2), 3.53–3.68 (2H, m, H^5), 3.84 (1H, t, *J*=9, H^4), 4.11 (1H, dd, *J*=10 and 5, H^6), 4.53 (1H, t, *J*=5, H^7), 4.74 (1H, d, *J*=4, H^1); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.03 (CH_3alkyl), 22.59 (CH_2 alkyl), 24.08 (CH_2 alkyl), 29.25 (CH_2 alkyl), 29.46 (CH_2 alkyl), 29.49 (2CH_2 alkyl), 31.82 (CH_2 alkyl), 34.19 (CH_2 alkyl), 55.20 (OCH_3), 62.54 (CH^5), 68.43 (CH_2^6), 70.90 (CH^4), 72.65 (CH^2), 80.53 (CH^3), 100.02 (CH^1), 102.64 (CH^7); IR ν_{max}: 3393 (OH), 2922 (-CH_3), 2853 (-CH_2-), 1466, 1378, 1112, 1088,

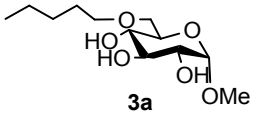
1063, 1037, 990; HRMS (ESI$^+$) calcd for $C_{17}H_{32}NaO_6$: 355.2091 [M+Na]$^+$; found: 355.2102 (-3.2 ppm); GC: R_t = 23.15 min; Rf = 0.32 (80:20 EtOAc/cyclohexane).



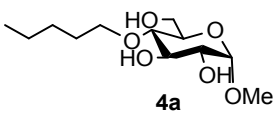
2e

Methyl 4,6-*O*-dodecylidene α-D-glucopyranoside [2465-69-2] (2e): The title compound was prepared from methyl α-D-glucoside **1** (3.22 g, 16.6 mmol) and dodecanal (1.52 g, 8.3 mmol) following the procedure **A** to give **2e** (0.77 g, 26%) as a white solid. Mp = 69°C; ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.86 (3H, t, *J* = 7, CH_3 alkyl), 1.17–1.32 (16H, m, 8(CH_2) alkyl), 1.33–1.47 (2H, m, CH_2 alkyl), 1.53–1.74 (2H, m, CH_2 alkyl), 2.85 (2H, br s, OH^3+OH^2), 3.24 (1H, t, *J* = 9, H^3), 3.41 (3H, s, OCH_3), 3.49 (1H, t, *J*=10, H^2), 3.53–3.68 (2H, m, H^5), 3.84 (1H, t, *J*=9, H^4), 4.10 (1H, dd, *J*=10 and 5, H^6), 4.52 (1H, t, *J*=5, H^7), 4.74 (1H, d, *J*=4, H^1); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.24 (CH_3 alkyl), 22.80 (CH_2 alkyl), 24.20 (CH_2 alkyl), 29.46 (CH_2 alkyl), 29.58 (CH_2 alkyl), 29.62 (CH_2 alkyl), 29.67 (CH_2 alkyl), 29.74 (CH_2 alkyl), 29.76 (CH_2 alkyl), 32.03 (CH_2 alkyl), 34.36 (CH_2 alkyl), 55.57 (OCH_3), 62.63 (CH^5), 68.57 (CH_2^6), 71.81 (CH^4), 73.02 (CH^2), 80.46 (CH^3), 99.85 (CH^1), 102.84 (CH^7); IR ν_{max}: 3388 (OH), 2921 (-CH_3), 2852 (-CH_2-), 1466, 1378, 1089, 1063, 1037, 991; HRMS (ESI$^+$) calcd for $C_{19}H_{36}NaO_6$: 383.2404 [M+Na]$^+$; found: 383.2398 (+1.6 ppm); GC: R_t = 25.45 min; Rf = 0.30 (60:40 EtOAc/cyclohexane).

5.2. Characterization data of methyl α-D-glucoside ethers **3a-e** and **4a-e**

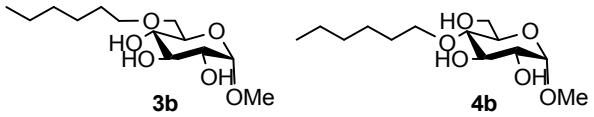


3a

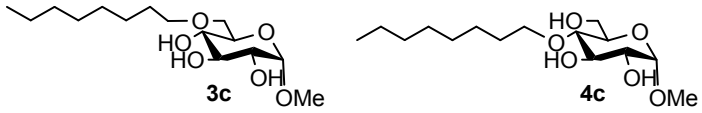


4a

Methyl 6-*O*-pentyl α-D-glucopyranoside (3a) and methyl 4-*O*-pentyl α-D-glucopyranoside (4a): The title compounds were prepared from methyl α-D-glucoside acetal **2a** (4.00 g, 15 mmol) following the procedure **B** to give a 70:30 mixture of **3a** and **4a** (1.51 g, 38%) as a white paste. The mixture of ethers was purified by column chromatography (EtOAc/cyclohexane 50:50 to 100:0 then EtOH/EtOAc 10:90) for the characterization of each regioisomer. **3a**: colourless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.84 (3H, t, *J* = 7, CH_3 alkyl), 1.14–1.36 (4H, m, 2(CH_2) alkyl), 1.41–1.68 (2H, m, CH_2 alkyl), 3.34 (3H, s, OCH_3), 3.40–3.82 (7H, m), 4.53–4.81 (4H, m, CH-anomeric + 3OH); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.06 (CH_3 alkyl), 22.53 (CH_2 alkyl), 28.20 (CH_2 alkyl), 29.29 (CH_2 alkyl), 55.12 (OCH_3), 70.20 (CH_2), 70.57 (CH), 70.74 (CH), 71.91 (CH), 72.05 (CH_2), 74.26 (CH), 99.56 (CH-anomeric); IR ν_{max}: 3382 (OH), 2929 (-CH_3), 2861 (-CH_2-), 1455, 1363, 1192, 1144, 1108, 1040, 900; HRMS (ESI$^+$) calcd for $C_{12}H_{24}NaO_6$: 287.1465 [M+Na]$^+$; found: 287.1467 (-0.8 ppm); GC: R_t = 17.64 min; Rf = 0.35 (10:1 EtOAc/EtOH). **4a**: colourless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.86 (3H, t, *J* = 7, CH_3 alkyl), 1.16–1.38 (4H, m, 2(CH_2) alkyl), 1.42–1.66 (2H, m, CH_2 alkyl), 3.16 (3H, br s, OH), 3.21 (1H, t, *J* = 10), 3.37 (3H, s, OCH_3), 3.42–3.87 (7H, m), 4.71 (1H, d, *J* = 3, CH anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.11 (CH_3 alkyl), 22.61 (CH_2 alkyl), 28.26 (CH_2 alkyl), 30.05 (CH_2 alkyl), 55.32 (OCH_3), 61.92 (CH_2), 71.00 (CH), 72.61 (CH), 73.14 (CH_2), 74.52 (CH), 77.86 (CH), 99.35 (CH-anomeric); IR ν_{max}: 3388 (OH), 2928 (-CH_3), 2852 (-CH_2-), 1452, 1371, 1092, 1083, 1037, 931; HRMS (ESI$^+$) calcd for $C_{12}H_{24}NaO_6$: 287.1465 [M+Na]$^+$; found: 287.1465 (+0.2 ppm); GC: R_t = 16.49 min; Rf = 0.40 (10:1 EtOAc/EtOH).

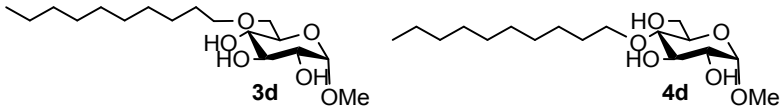


Methyl 6-*O*-hexyl α-D-glucopyranoside (3b) and methyl 4-*O*-hexyl α-D-glucopyranoside (4b): The title compounds were prepared from methyl α-D-glucoside acetal **2b** (5.50 g, 20 mmol) following the procedure **B** to give a 72:28 mixture of **3b** and **4b** (2.18 g, 37%) as a colourless oil. The mixture of ethers was purified by column chromatography (EtOAc/cyclohexane 50:50 to 100:0 then EtOH/EtOAc 10:90) for the characterization of each regioisomer. **3b**: colourless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.84 (3H, t, J = 7, CH_3 alkyl), 1.13–1.38 (6H, m, 3(CH_2) alkyl), 1.44–1.64 (2H, m, CH_2 alkyl), 3.38 (3H, s, OCH_3), 3.39–3.78 (8H, m), 4.53 (3H, br s, OH), 4.71 (1H, d, J = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.10 (CH_3 alkyl), 22.66 (CH_2 alkyl), 25.75 (CH_2 alkyl), 29.60 (CH_2 alkyl), 31.75 (CH_2 alkyl), 55.18 (OCH_3), 70.24 (CH_2), 70.55 (CH), 70.79 (CH), 71.94 (CH), 72.13 (CH_2), 74.28 (CH), 99.56 (CH-anomeric); IR ν_{max}: 3376 (OH), 2928 (-CH_3), 2859 (-CH_2-), 1455, 1364, 1192, 1144, 1006, 1043, 900; HRMS (ESI$^+$) calcd for $C_{13}H_{26}NaO_6$: 301.1622 [M+Na]$^+$; found: 301.1612 (+3.3 ppm); GC: R_t = 18.82 min; Rf=0.32 (10:1 EtOAc/EtOH). **4b**: colourless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.87 (3H, t, J = 7, CH_3 alkyl), 1.17–1.40 (6H, m, 3(CH_2) alkyl), 1.46–1.66 (2H, m, CH_2 alkyl), 2.43–2.78 (3H, br s, OH), 3.23 (1H, t, J = 10), 3.39 (3H, s, OCH_3), 3.48 (1H, dd, J = 10 and 4), 3.53–3.64 (2H, m), 3.64–3.91 (4H, m), 4.73 (1H, d, J = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.16 (CH_3 alkyl), 22.72 (CH_2 alkyl), 25.83 (CH_2 alkyl), 30.38 (CH_2 alkyl), 31.80 (CH_2 alkyl), 55.41 (OCH_3), 62.05 (CH_2), 71.00 (CH), 72.72 (CH), 73.24 (CH_2), 74.80 (CH), 77.91 (CH), 99.27 (CH-anomeric); IR ν_{max}: 3395 (OH), 2927 (-CH_3), 2852 (-CH_2-), 1456, 1365, 1192, 1114, 1027, 896; $C_{13}H_{26}NaO_6$: 301.1622 [M+Na]$^+$; found: 301.1610 (+4.0 ppm); GC: R_t = 17.56 min; Rf=0.38 (10:1 EtOAc/EtOH).

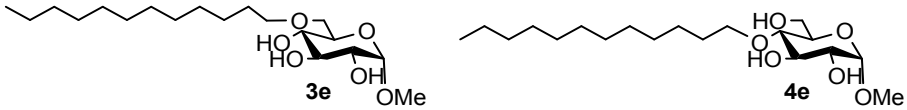


Methyl 6-*O*-octyl α-D-glucopyranoside (3c) and methyl 4-*O*-octyl α-D-glucopyranoside (4c): The title compounds were prepared from methyl α-D-glucoside acetal **2c** (5.00 g, 16.4 mmol) following the procedure **B** to give a 75:25 mixture of **3c** and **4c** (2.30 g, 40%) as a colourless oil. The mixture of ethers was purified by column chromatography (EtOAc/cyclohexane 50:50 to 100:0 then EtOH/EtOAc 10:90) for the characterization of each regioisomer. **3c**: colourless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.86 (3H, t, J = 7, CH_3 alkyl), 1.15–1.38 (10H, m, 5(CH_2) alkyl), 1.48–1.68 (2H, m, CH_2 alkyl), 3.40 (3H, s, OCH_3), 3.42–3.92 (8H, m), 4.22 (3H, br s, OH), 4.73 (1H, d, J = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.22 (CH_3 alkyl), 22.78 (CH_2 alkyl), 26.15 (CH_2 alkyl), 29.39 (CH_2 alkyl), 29.59 (CH_2 alkyl), 29.72 (CH_2 alkyl), 31.96 (CH_2 alkyl), 55.30 (OCH_3), 70.44 (CH_2), 71.12 (CH), 72.08 (CH), 72.24 (CH), 74.44 (CH_2), 77.36 (CH), 99.60 (CH-anomeric); IR ν_{max}: 3371 (OH), 2923 (-CH_3), 2854 (-CH_2-), 1456, 1365, 1192, 1144, 1108, 1044, 900; HRMS (ESI$^+$) calcd for $C_{15}H_{30}NaO_6$: 329.1935 [M+Na]$^+$; found: 329.1943 (-2.5 ppm); GC: R_t = 21.92 min; Rf = 0.26 (10:1 EtOAc/EtOH). **4c**: white solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.86 (3H, t, J = 7, CH_3 alkyl), 1.09–1.39 (10H, m, 5(CH_2) alkyl), 1.43–1.66 (2H, m, CH_2 alkyl), 2.58 (3H, br s, OH), 3.23 (1H, t, J = 10)*;* 3.39 (3H, s, OCH_3), 3.48 (1H, dd, J = 10 and 4), 3.53–3.64 (2H, m), 3.66–3.89 (4H, m), 4.73 (1H, d, J = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.20 (CH_3 alkyl), 22.76 (CH_2 alkyl), 26.18 (CH_2 alkyl), 29.37 (CH_2 alkyl), 29.58 (CH_2 alkyl), 30.44 (CH_2 alkyl), 31.93 (CH_2 alkyl), 55.41 (OCH_3), 62.08 (CH_2), 71.01 (CH), 72.75 (CH), 73.25 (CH_2), 74.84 (CH), 77.94 (CH), 99.28 (CH-anomeric); IR

ν_{max}: 3388 (OH), 2922 (-CH_3), 2853 (-CH_2-), 1456, 1365, 1192, 1144, 1110, 1045, 899; $C_{15}H_{30}NaO_6$: 329.1935 $[M+Na]^+$; found: 329.1935 (-0.2 ppm); GC: R_t = 20.35 min; Rf = 0.38 (10:1 EtOAc/EtOH).



Methyl 6-*O*-decyl α-D-glucopyranoside (3d) and methyl 4-*O*-decyl α-D-glucopyranoside (4d): **(**CG478+CG521)The title compounds were prepared from methyl α-D-glucoside acetal **2a** (6 g, 18 mmol) following the procedure **B** to give a 77:23 mixture of **3d** and **4d** (1.52 g, 25%) as a white paste. The mixture of ethers was purified by column chromatography (EtOAc/cyclohexane 50:50 to 100:0 then EtOH/EtOAc 10:90) for the characterization of each regioisomer. **3d**: colourless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.86 (3H, t, *J* = 7, CH_3 alkyl), 1.11–1.38 (14H, m, 7(CH_2) alkyl), 1.47–1.66 (2H, m, CH_2 alkyl), 3.40 (3H, s, OCH_3), 3.42–3.89 (8H, m), 4.32 (3H, br s, OH), 4.73 (1H, d, *J* = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.22 (CH_3 alkyl), 22.79 (CH_2 alkyl), 26.15 (CH_2 alkyl), 29.45 (CH_2 alkyl), 29.65 (CH_2 alkyl), 29.72 (2CH_2 alkyl), 29.74 (CH_2 alkyl), 32.02 (CH_2 alkyl), 55.27 (OCH_3), 70.41 (CH_2), 70.48 (CH), 71.02 (CH), 72.04 (CH), 72.23 (CH_2), 74.40 (CH), 99.60 (CH-anomeric); IR ν_{max}: 3400 (OH), 2919 (-CH_3), 2852 (-CH_2-), 1467, 1369, 1123, 1043, 1014, 901; HRMS (ESI^+) calcd for $C_{17}H_{34}NaO_6$: 357.2248 $[M+Na]^+$; found: 357.2247 (+0.1 ppm); GC: R_t = 24.5 min; Rf = 0.30 (10:1 DCM/MeOH). **4d**: white solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.88 (3H, t, *J* = 7, CH_3 alkyl), 1.10–1.39 (14H, m, 7(CH_2) alkyl), 1.47–1.68 (2H, m, CH_2 alkyl), 2.13 (4H, br s, OH + H), 3.25 (1H, t, *J* = 10)*;* 3.41 (3H, s, OCH_3), 3.48 (1H, dd, *J* = 10 and 4), 3.54–3.68 (2H, m), 3.69–3.94 (3H, m), 4.75 (1H, d, *J* = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.25 (CH_3 alkyl), 22.82 (CH_2 alkyl), 26.21 (CH_2 alkyl), 29.45 (CH_2 alkyl), 29.63 (CH_2 alkyl), 29.70 (CH_2 alkyl), 29.73 (CH_2 alkyl), 30.47 (CH_2 alkyl), 32.02 (CH_2 alkyl), 55.47 (OCH_3), 62.18 (CH_2), 70.99 (CH), 72.82 (CH), 73.28 (CH_2), 75.08 (CH), 77.95 (CH), 99.19 (CH-anomeric); IR ν_{max}: 3370 (OH), 2923 (-CH_3), 2853 (-CH_2-), 1466, 1370, 1317, 1192, 1112, 1070, 1050, 899; $C_{17}H_{34}NaO_6$: 357.2248 $[M+Na]^+$; found: 357.2252 (-1.2 ppm); GC: R_t = 23.2 min; Rf = 0.38 (10:1 EtOAc/EtOH).

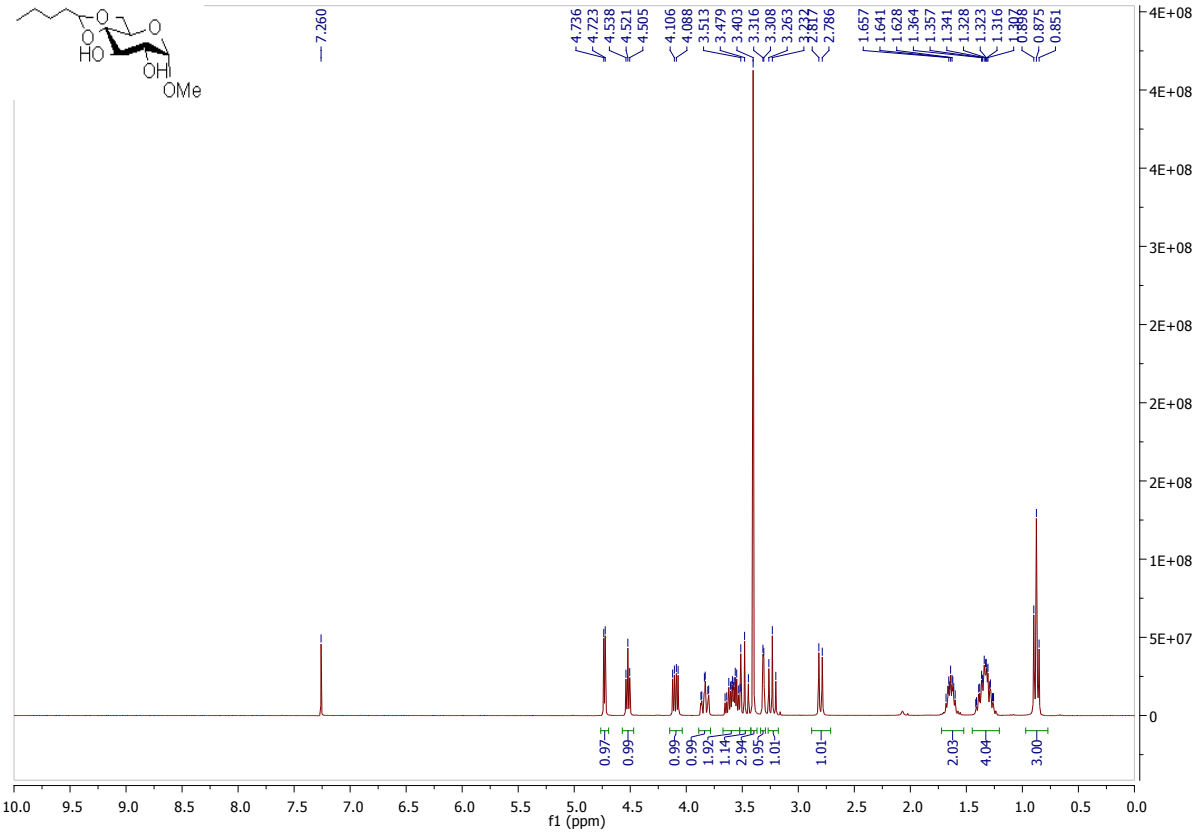


Methyl 6-*O*-dodecyl α-glucopyranoside (3e) and methyl 4-*O*-dodecyl α-D-glucopyranoside (4e): The title compounds were prepared from methyl α-D-glucoside acetal **2e** (5.00 g, 14 mmol) following the procedure **B** to give a 73:27 mixture of **3e** and **4e** (2.52 g, 51%) as a white solid. The mixture of ethers was purified by column chromatography (EtOAc/cyclohexane 50:50 to 100:0 then EtOH/EtOAc 10:90) for the characterization of each regioisomer. **3e**: white solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.87 (3H, t, *J* = 7, CH_3 alkyl), 1.09–1.44 (18H, m, 9(CH_2) alkyl), 1.47–1.70 (2H, m, CH_2 alkyl), 3.41 (3H, s, OCH_3), 3.43–3.84 (7H, m), 4.21 (3H, br s, OH), 4.74 (1H, d, *J* = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.25 (CH_3 alkyl), 22.82 (CH_2 alkyl), 26.17 (CH_2 alkyl), 29.50 (CH_2 alkyl), 29.67 (CH_2 alkyl), 29.73 (CH_2 alkyl), 29.77 (CH_2 alkyl), 29.80 (2CH_2 alkyl), 29.83 (CH_2 alkyl), 32.06 (CH_2 alkyl), 55.35 (OCH_3), 70.33 (CH), 70.51 (CH_2), 71.23 (CH), 72.10 (CH), 72.30 (CH_2), 74.49 (CH), 99.57 (CH-anomeric); IR ν_{max}: 3402 (OH), 2918 (-CH_3), 2851 (-CH_2-), 1467, 1370, 1057, 1015, 902; HRMS (ESI^+) calcd for $C_{19}H_{38}NaO_6$: 385.2561 $[M+Na]^+$; found: 385.2558 (+0.6 ppm); GC: R_t = 26.4 min; Rf = 0.16 (10:1 EtOAc/EtOH). **4e**: white solid. ^{1}H NMR (300 MHz, $CDCl_3$) δ_H: 0.87 (3H, t, *J* = 7, CH_3 alkyl), 1.14–1.42 (18H, m, 9(CH_2) alkyl), 1.47–1.71 (2H, m, CH_2 alkyl), 2.16

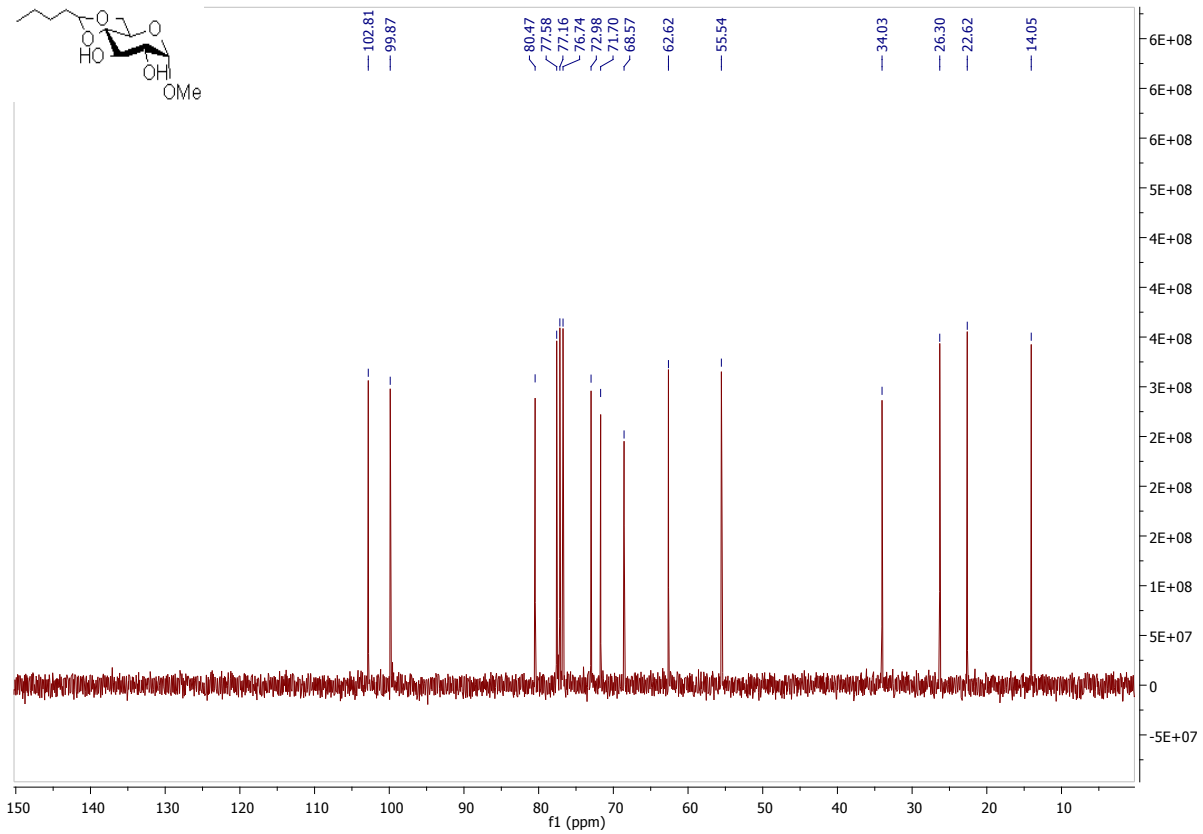
(3H, br s, OH), 3.24 (1H, t, *J* = 10)*;* 3.41 (3H, s, OCH_3), 3.49 (1H, dd, *J* = =10 and 4), 3.54–3.66 (2H, m), 3.69–3.91 (4H, m), 4.74 (1H, d, *J* = 4, CH-anomeric); ^{13}C NMR (75 MHz, $CDCl_3$) δ_C: 14.26 (CH_3 alkyl), 22.83 (CH_2 alkyl), 26.20 (CH_2 alkyl), 29.49 (CH_2 alkyl), 29.64 (CH_2 alkyl), 29.74 ($2CH_2$ alkyl), 29.77 (CH_2 alkyl), 29.80 (CH_2 alkyl), 30.47 (CH_2 alkyl), 32.06 (CH_2 alkyl), 55.46 (OCH_3), 62.15 (CH_2), 70.99 (CH), 72.81 (CH), 73.28 (CH_2), 75.05 (CH), 77.94 (CH), 99.20 (CH-anomeric); IR ν_{max}: 3295 (OH), 2913 (-CH_3), 2848 (-CH_2-), 1739, 1469, 1370, 1114, 1067, 1042, 993; $C_{19}H_{38}NaO_6$: 385.2561 $[M+Na]^+$; found: 385.2574 (-3.5 ppm); GC: R_t = 26.25 min.; Rf = 0.24 (10:1 EtOAc/EtOH).

6. ^{1}H and ^{13}C NMR spectra

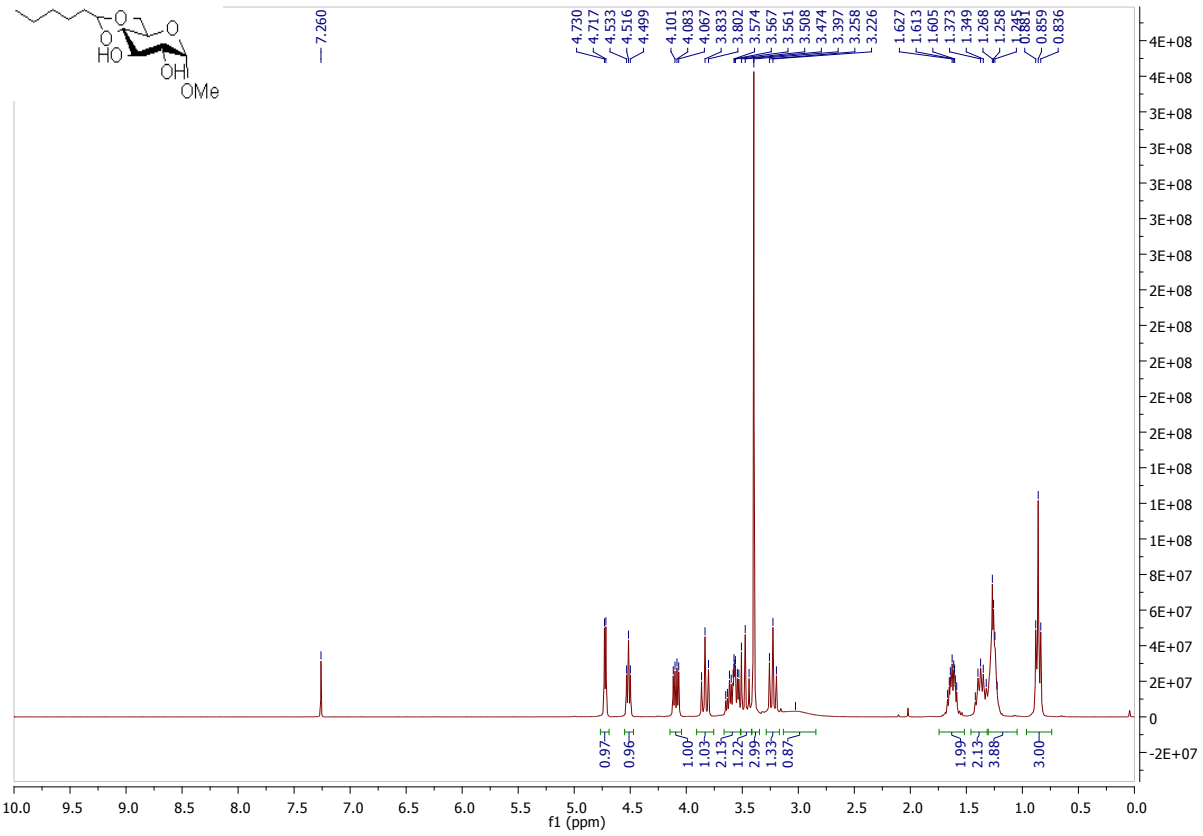
6.1. ^{1}H and ^{13}C spectra of methyl α-D-glucoside acetals **2a-e**



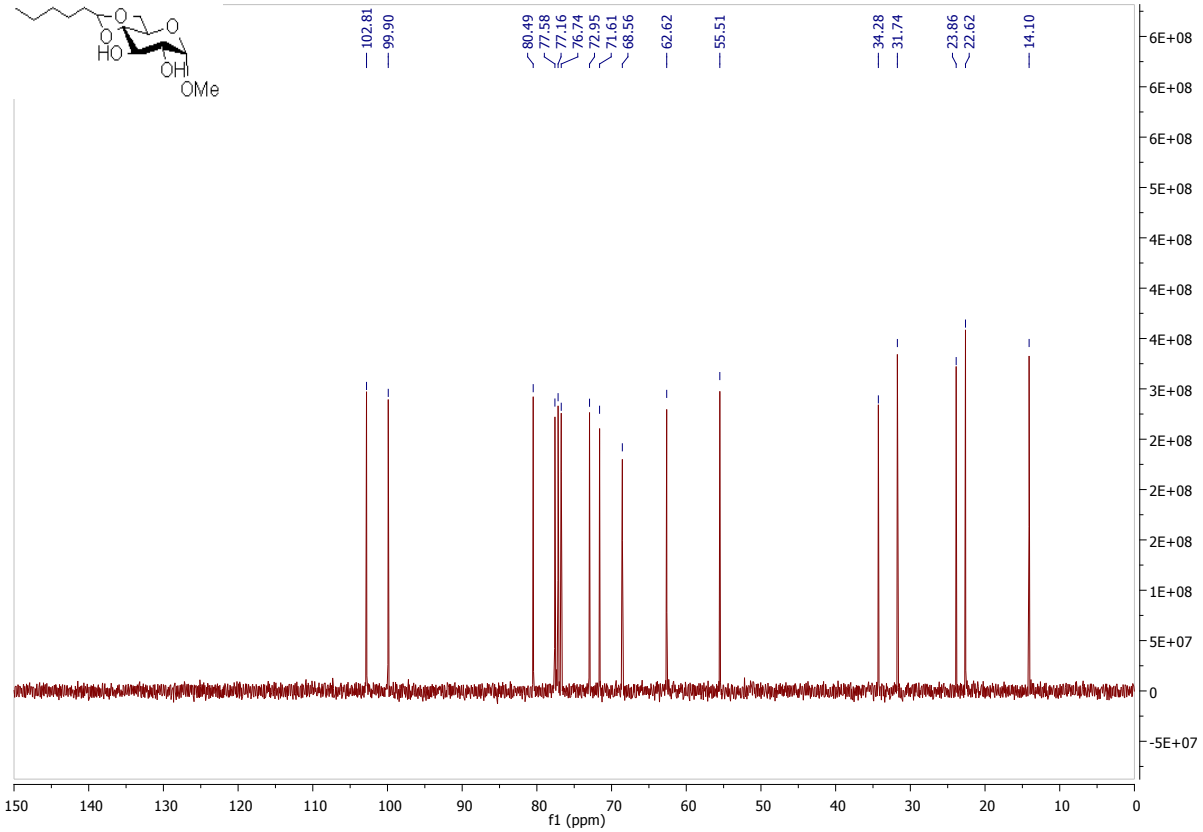
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4,6-*O*-pentylidene α-D-glucoside (**2a**)



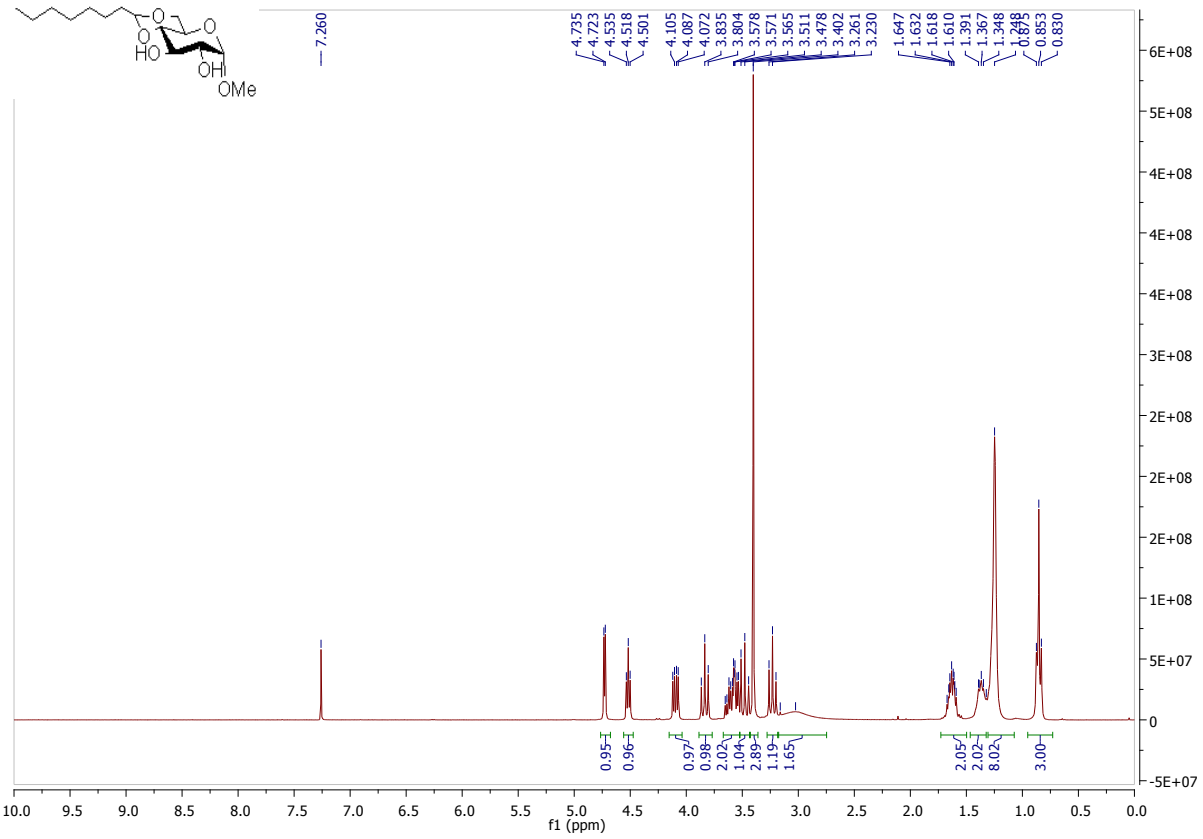
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4,6-*O*-pentylidene α-D-glucoside (**2a**)



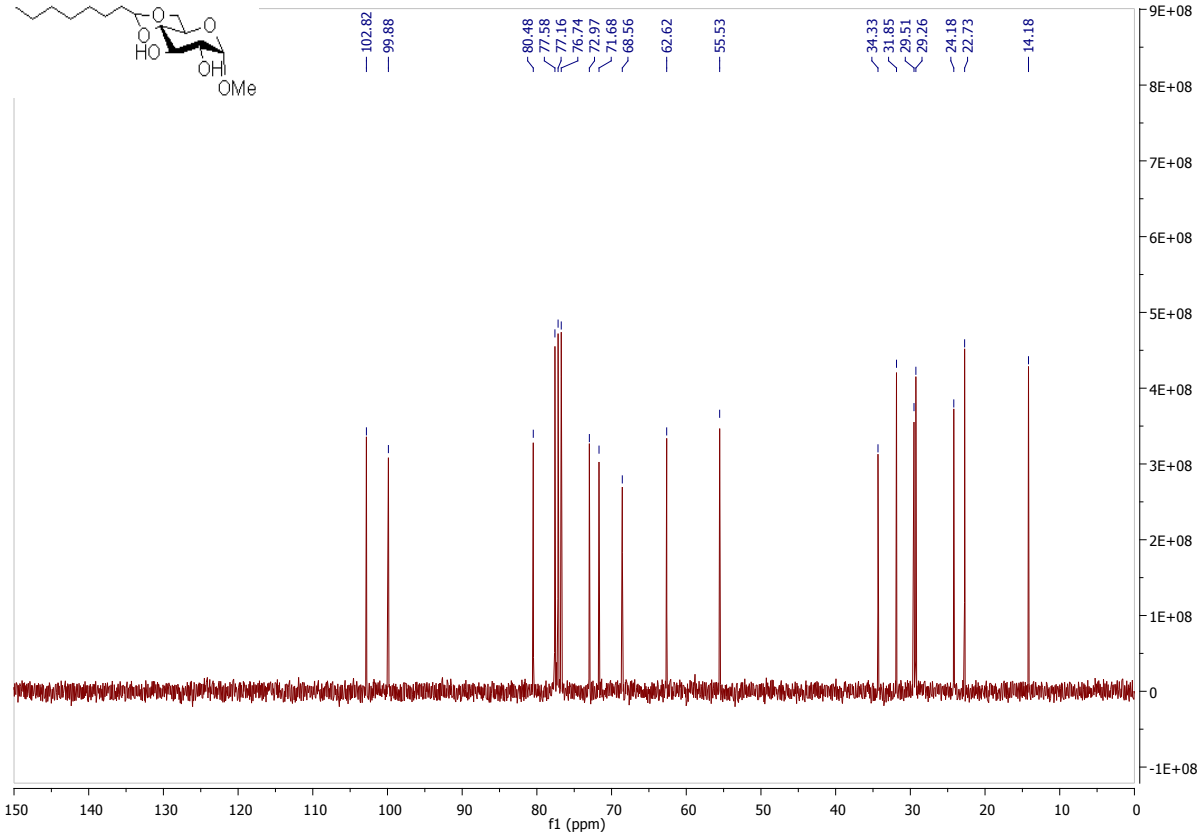
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4,6-*O*-hexylidene α-D-glucoside (**2b**)



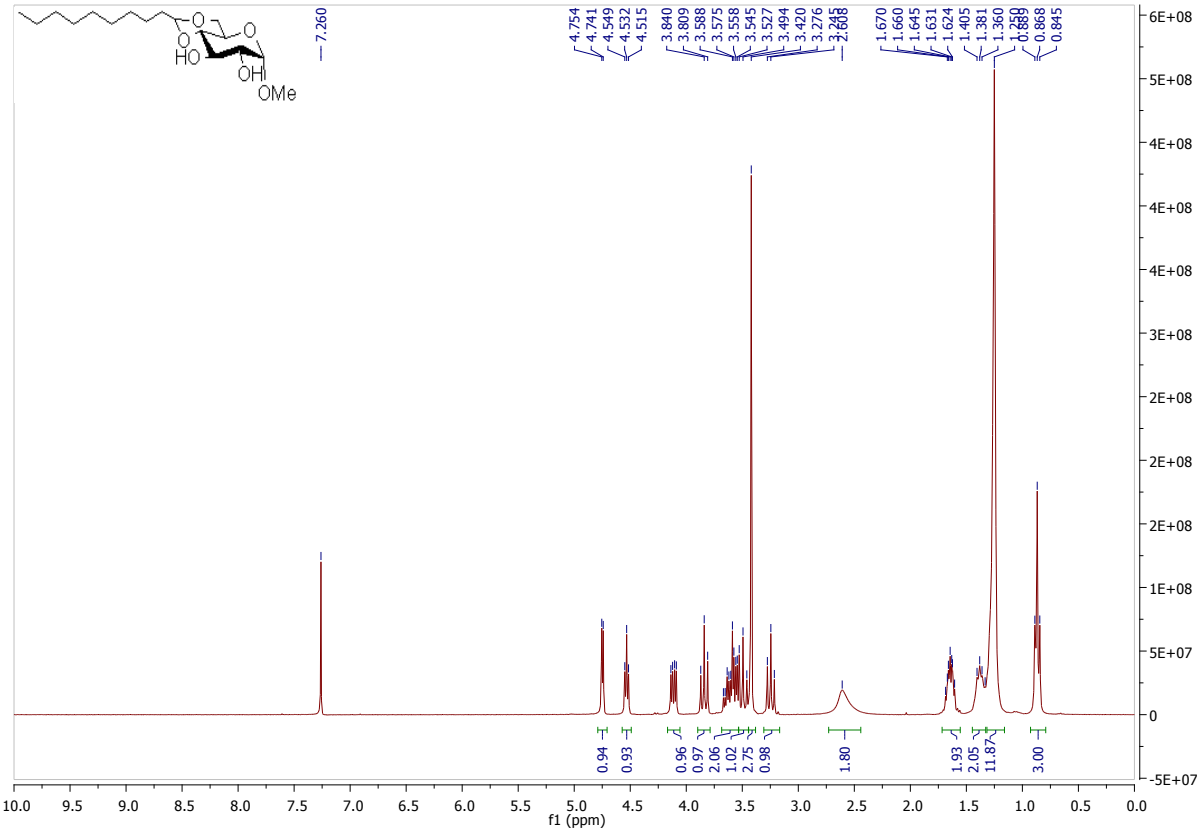
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4,6-*O*-hexylidene α-D-glucoside (**2b**)



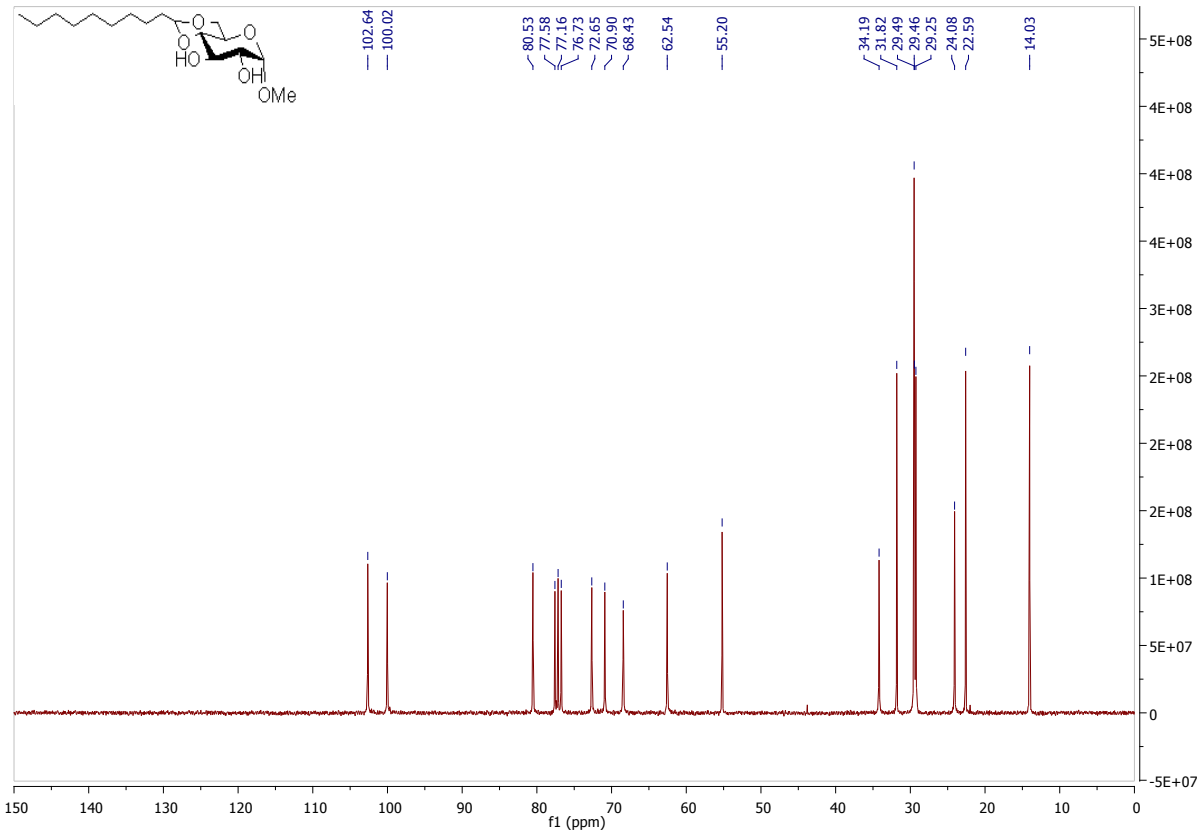
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4,6-*O*-octylidene α-D-glucoside (**2c**)



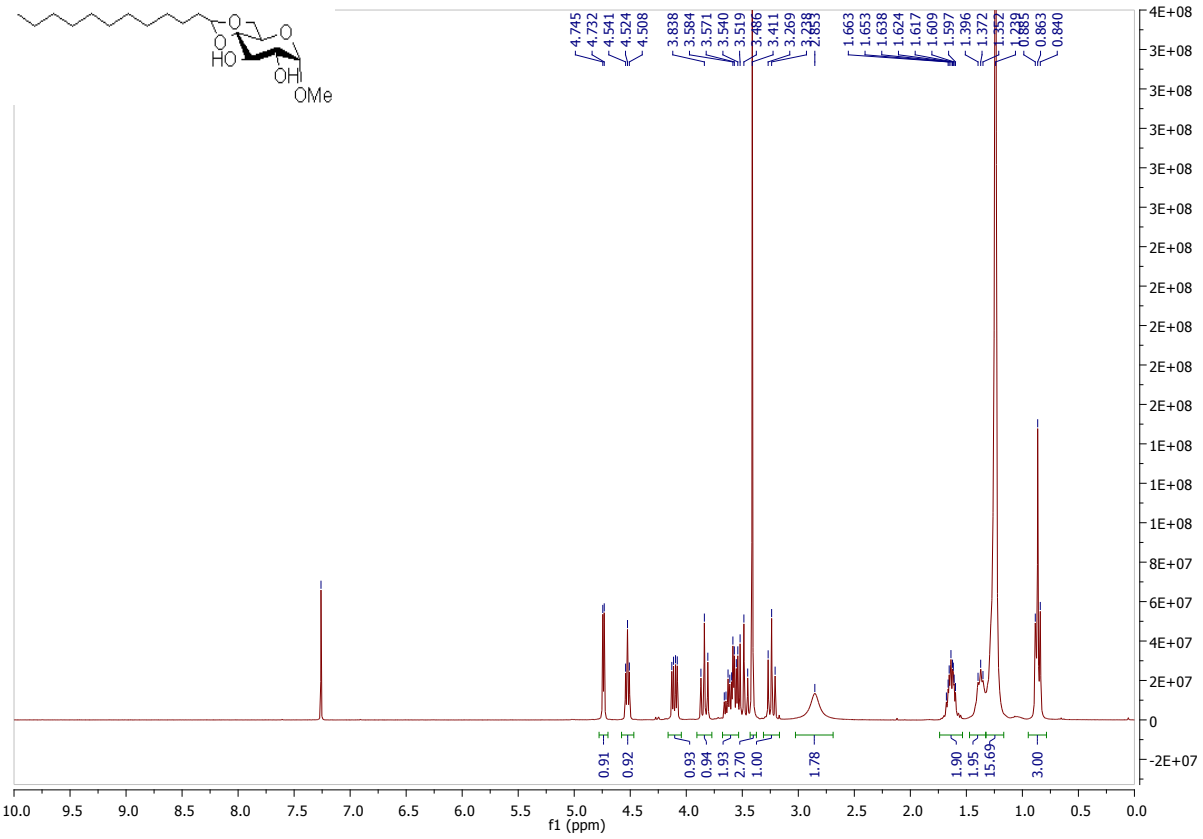
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4,6-*O*-octylidene α-D-glucoside (**2c**)



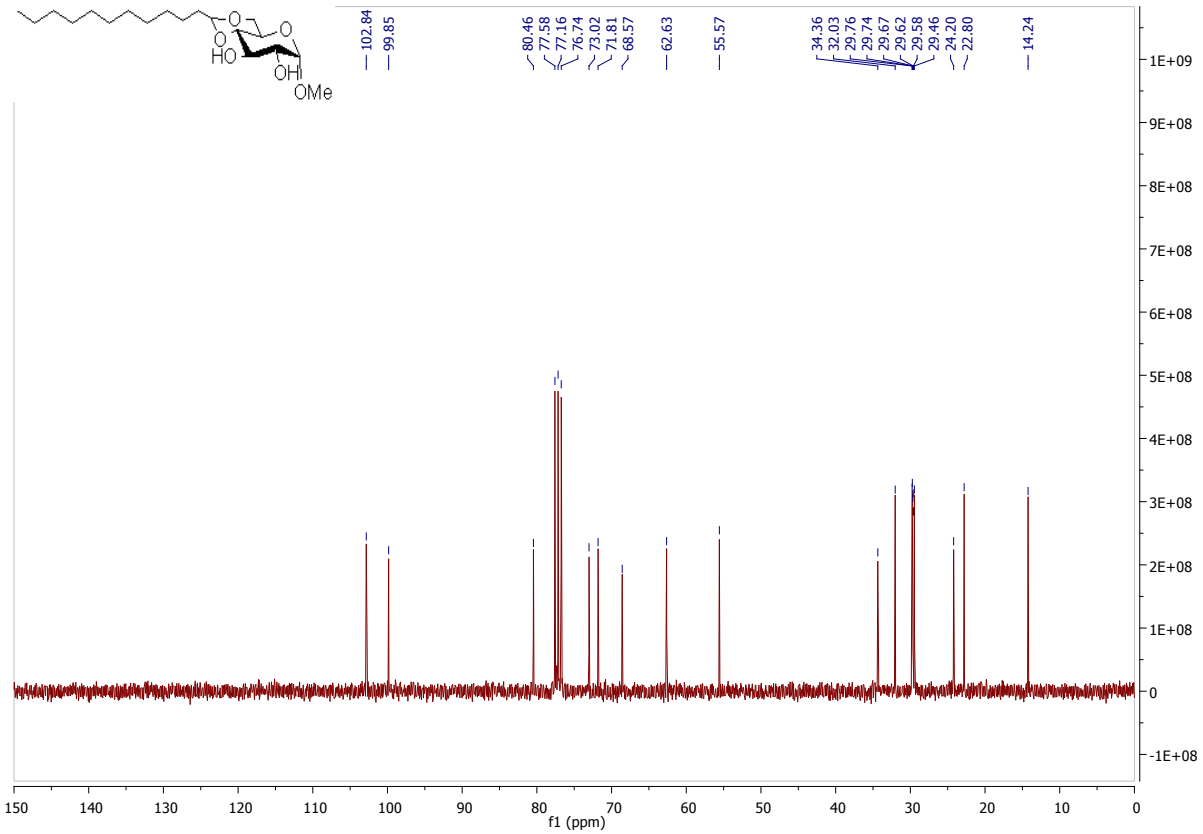
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4,6-*O*-decylidene α-D-glucoside (**2d**)



^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4,6-*O*-decylidene α-D-glucoside (**2d**)

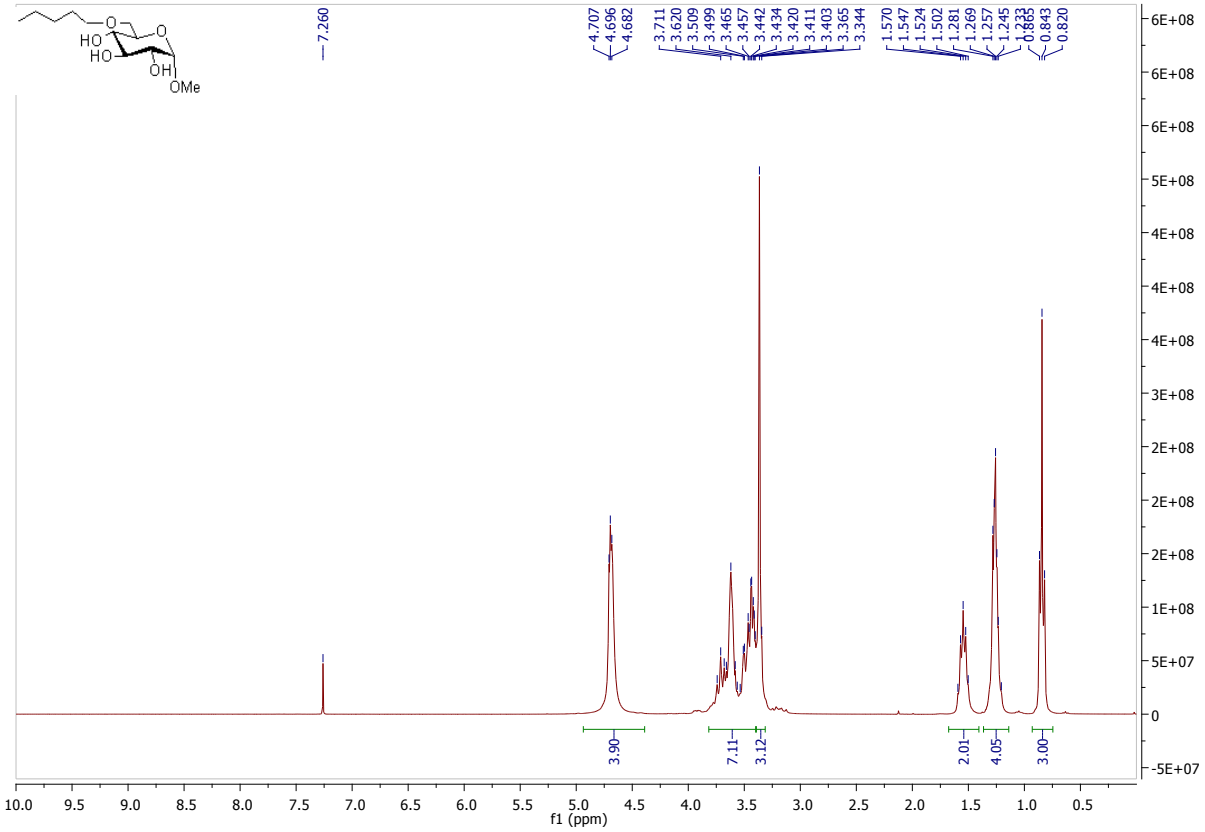


^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4,6-*O*-dodecylidene α-D-glucoside (**2e**)

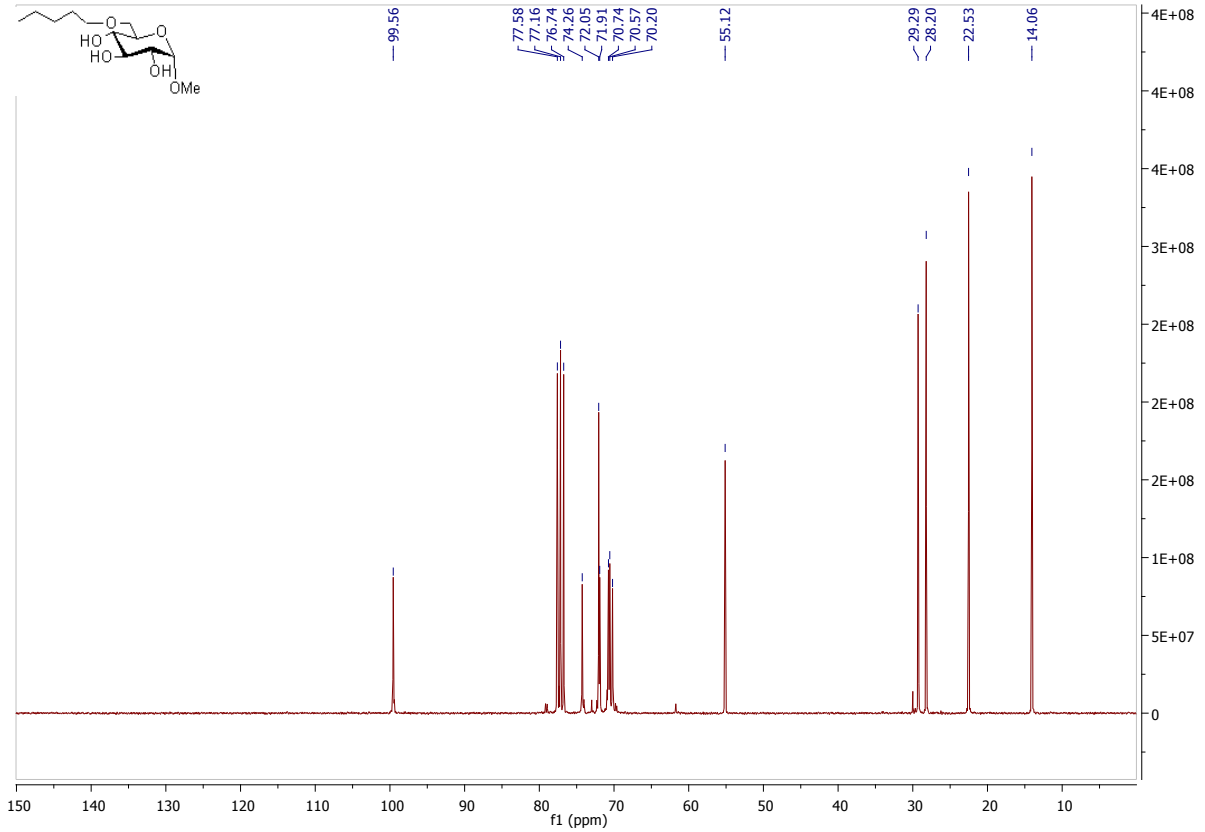


^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4,6-*O*-dodecylidene α-D-glucoside (**2e**)

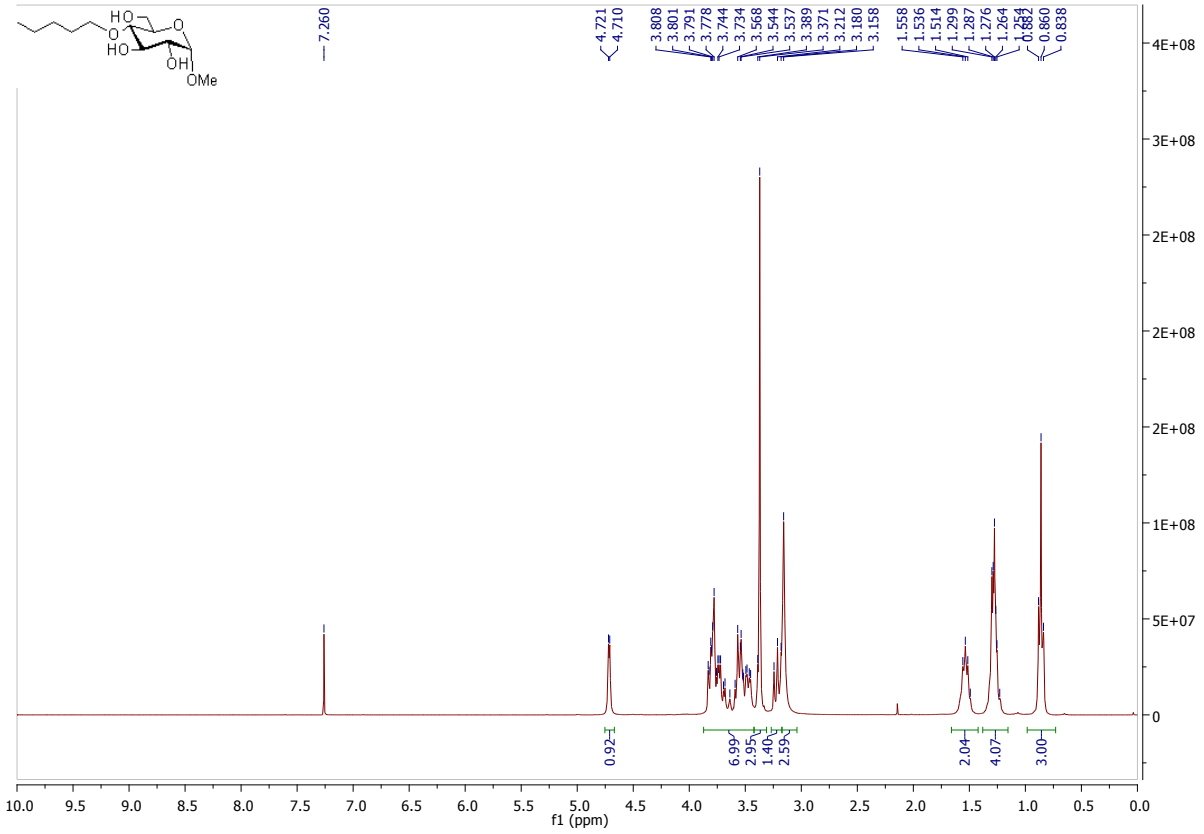
6.2. ^{1}H and ^{13}C spectra of methyl α-D-glucoside ethers **3a-e** and **4a-e**



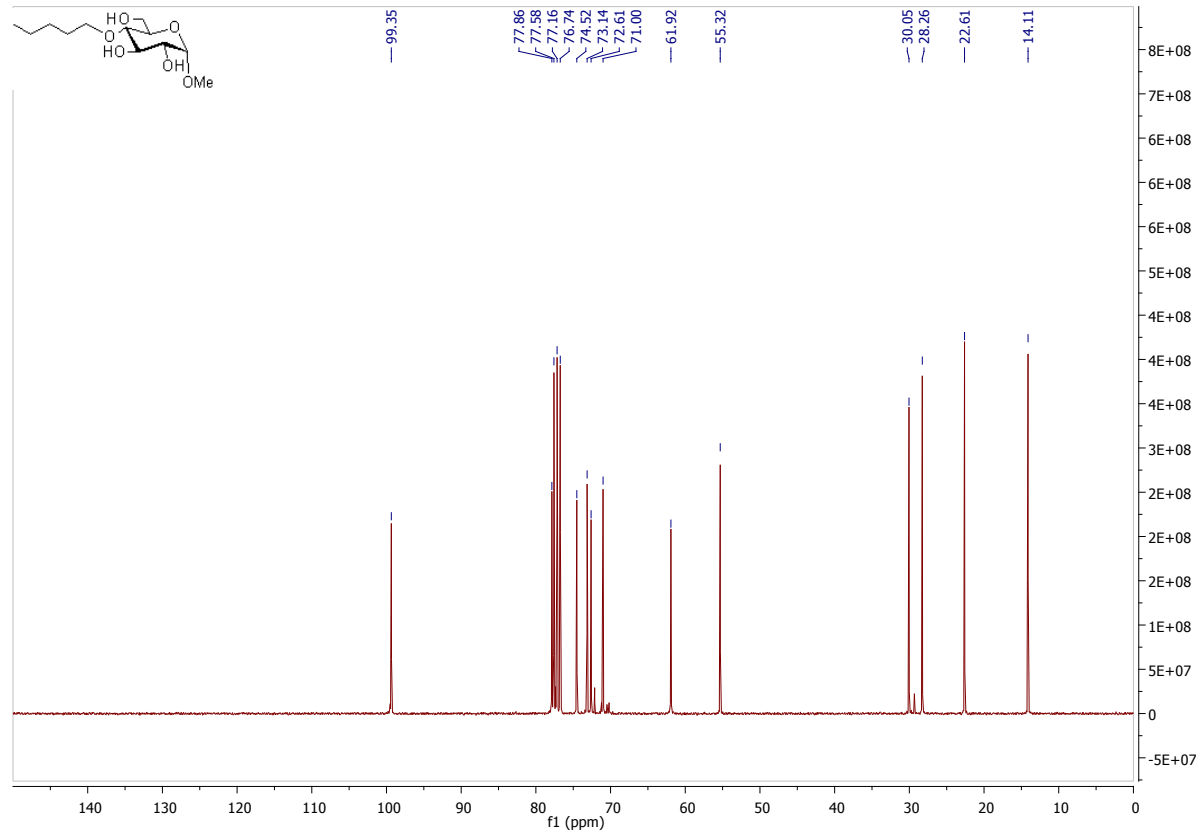
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 6-*O*-pentyl α-D-glucoside (**3a**)



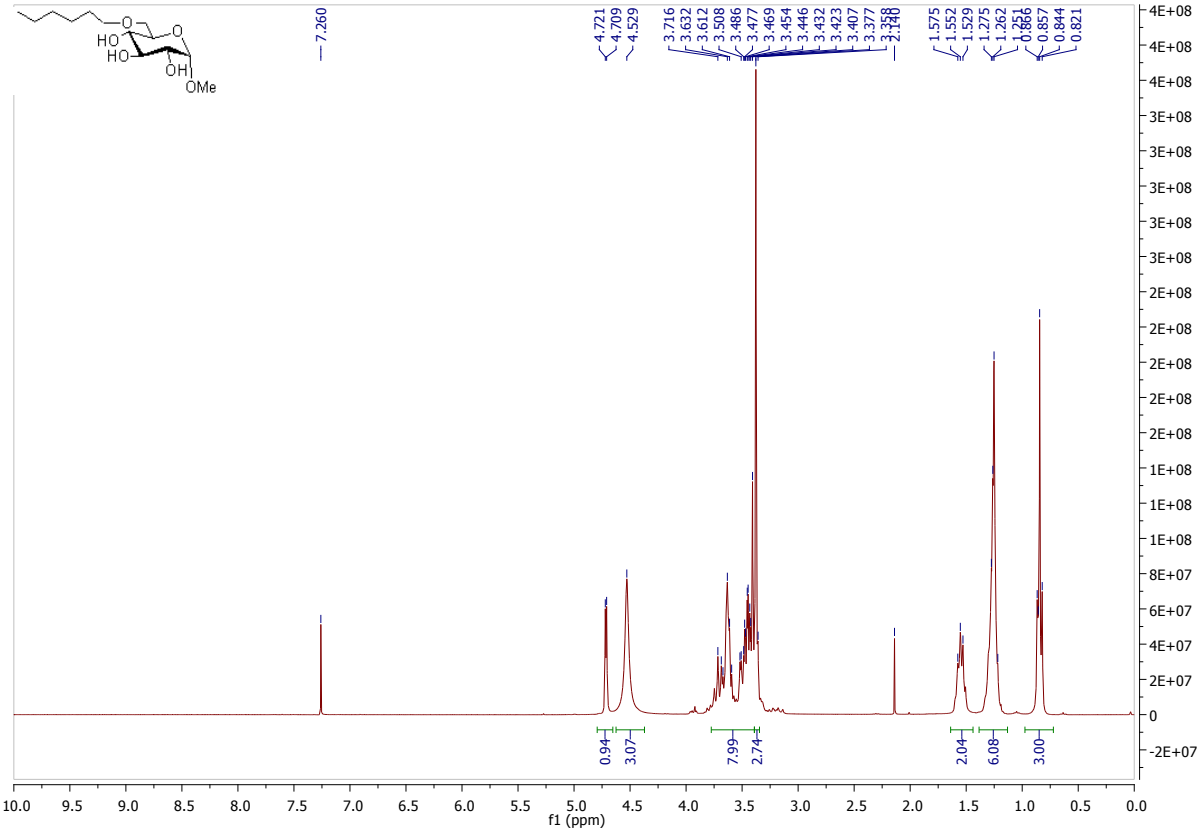
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 6-*O*-pentyl α-D-glucoside (**3a**)



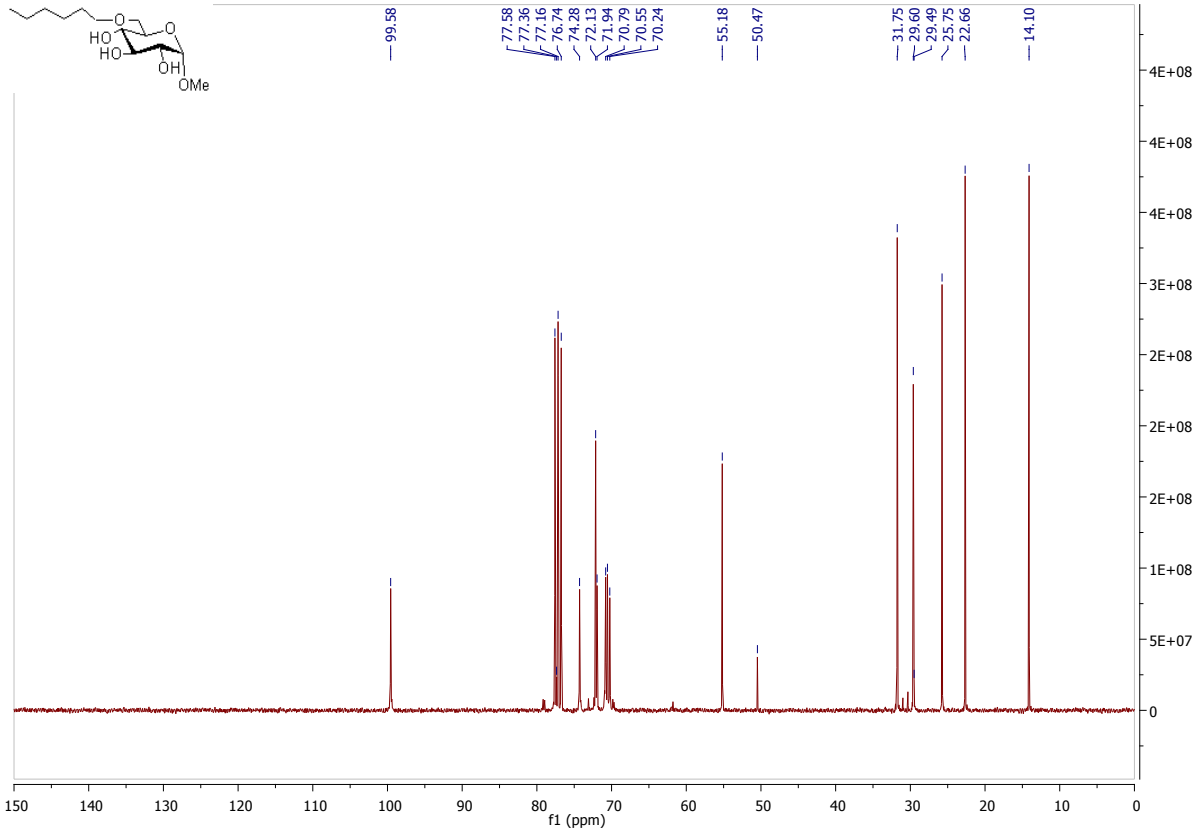
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4-*O*-pentyl α-D-glucoside (**4a**)



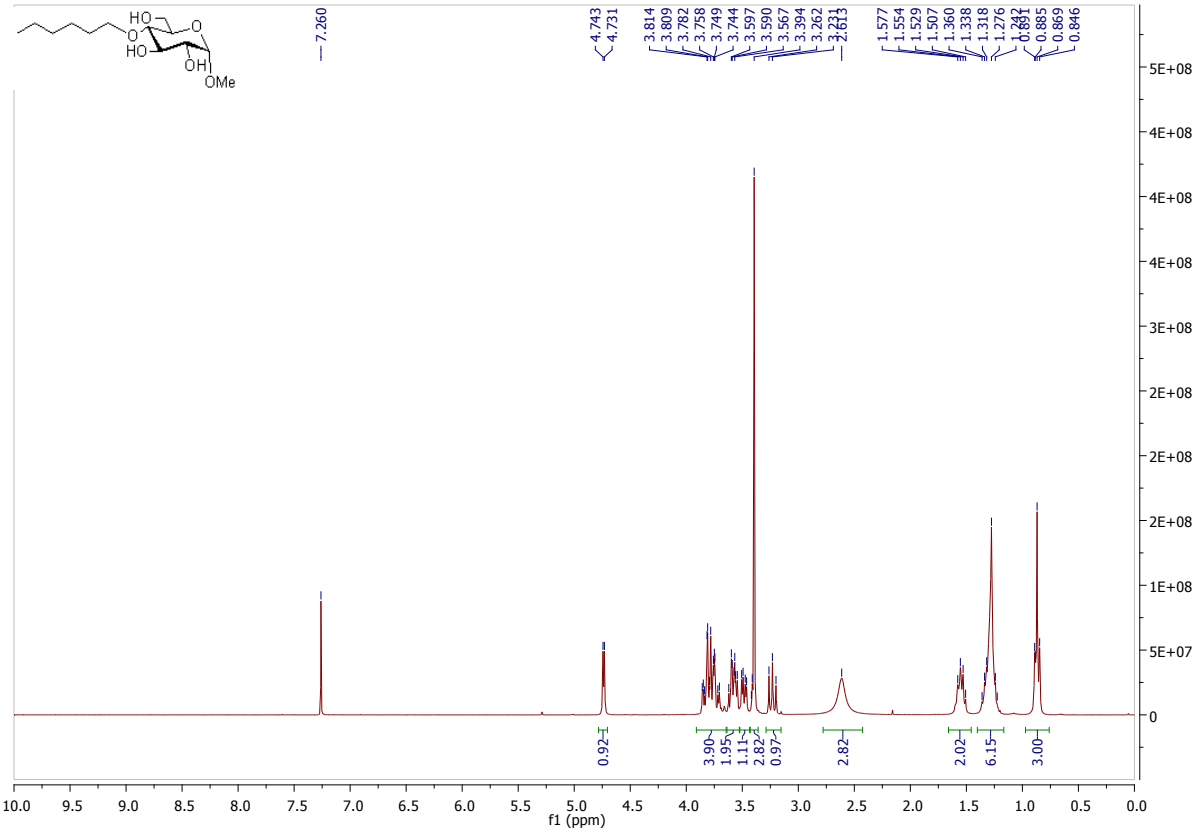
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4-*O*-pentyl α-D-glucoside (**4a**)



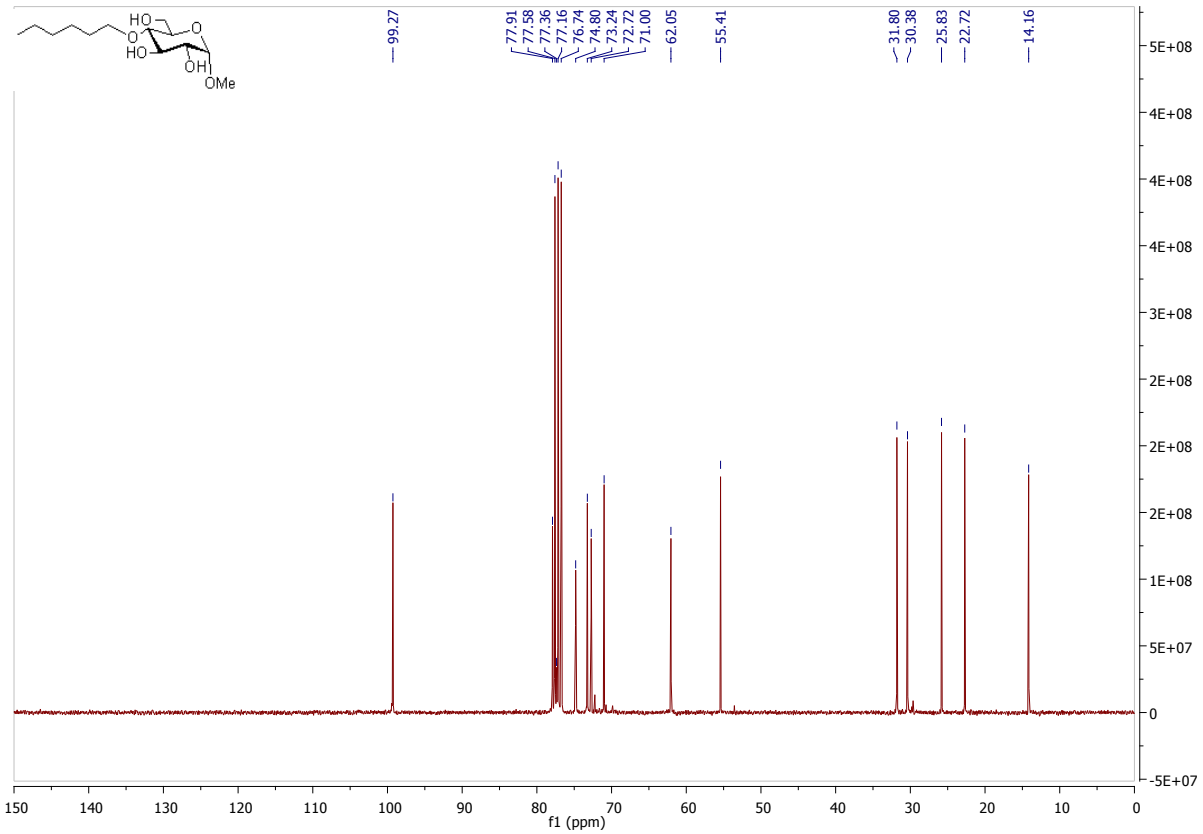
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 6-*O*-hexyl α-D-glucoside (**3b**)



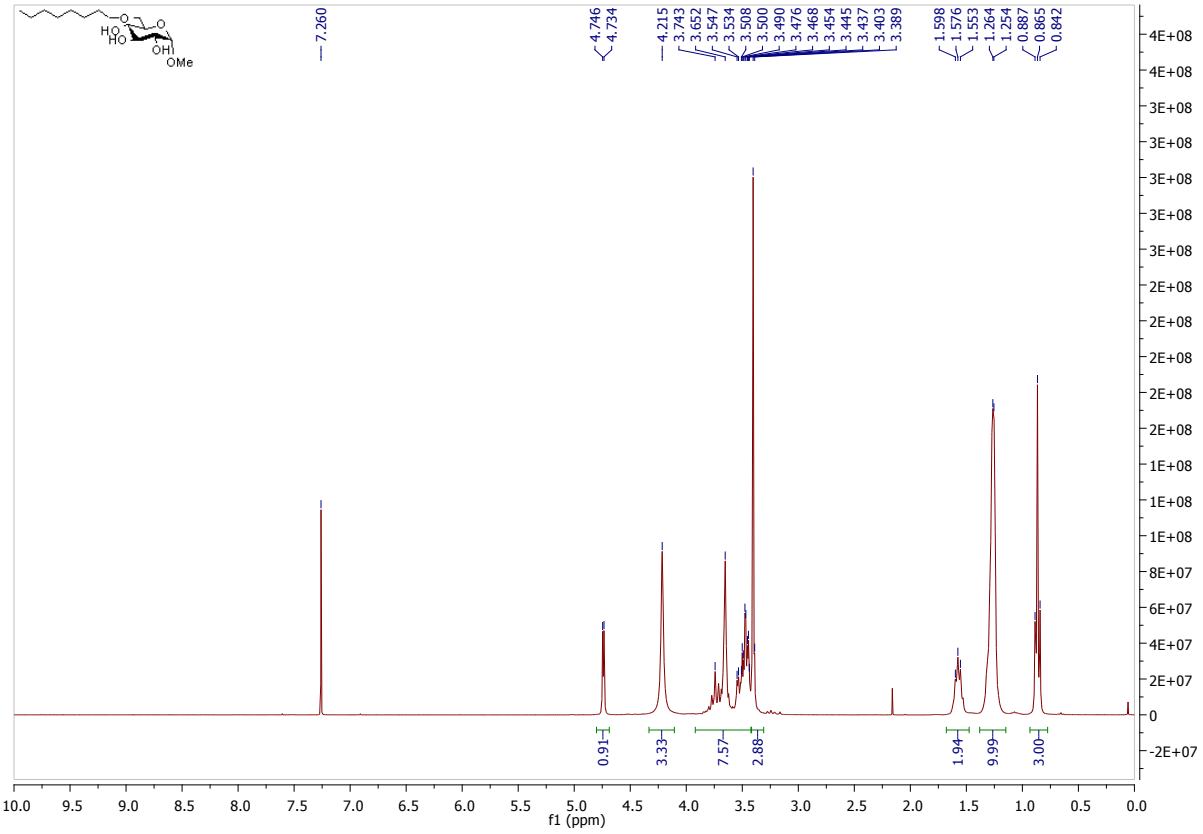
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 6-*O*-hexyl α-D-glucoside (**3b**)



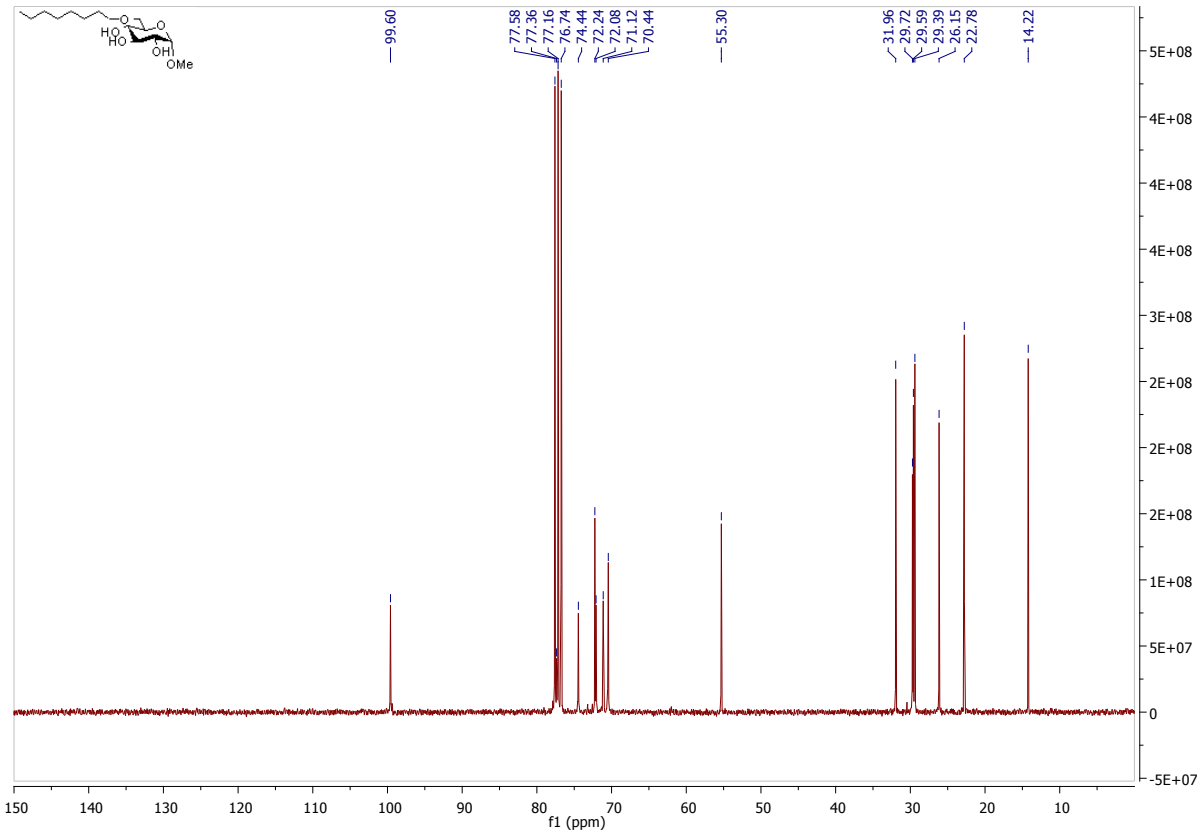
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4-*O*-hexyl α-D-glucoside (**4b**)



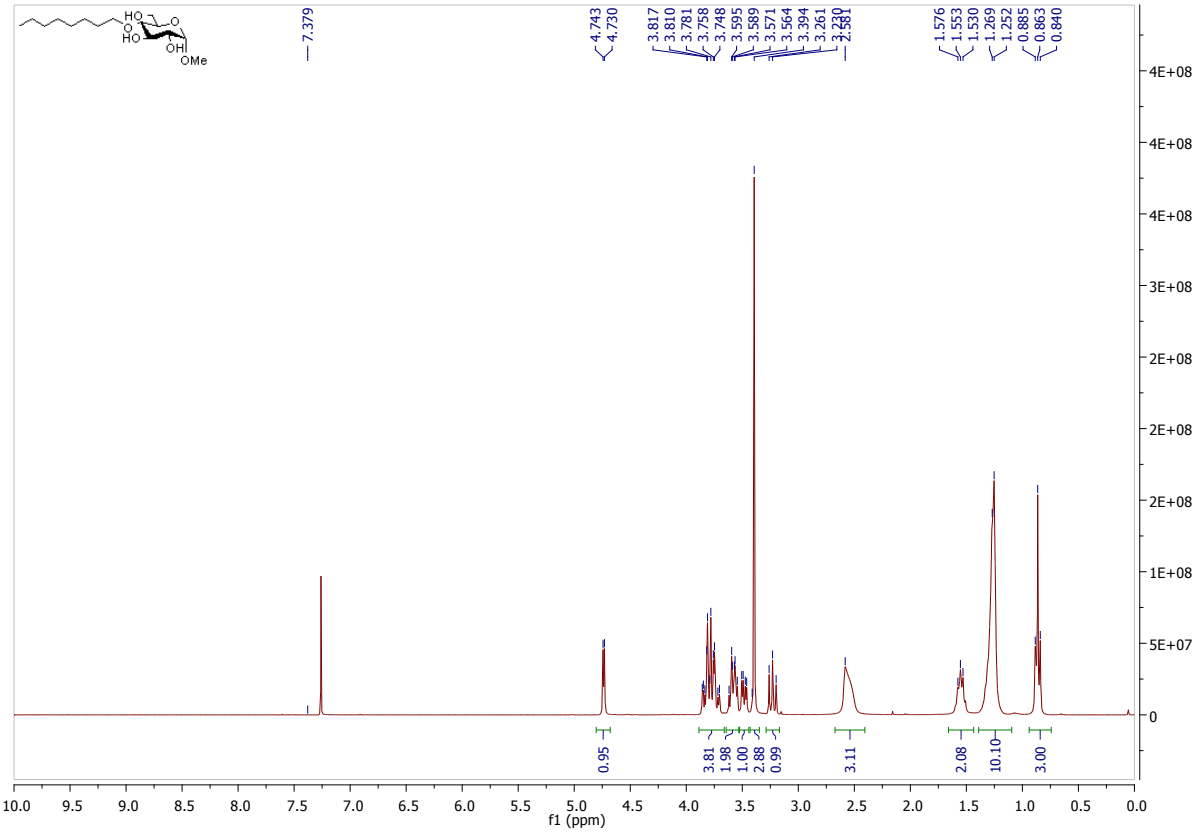
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4-*O*-hexyl α-D-glucoside (**4b**)



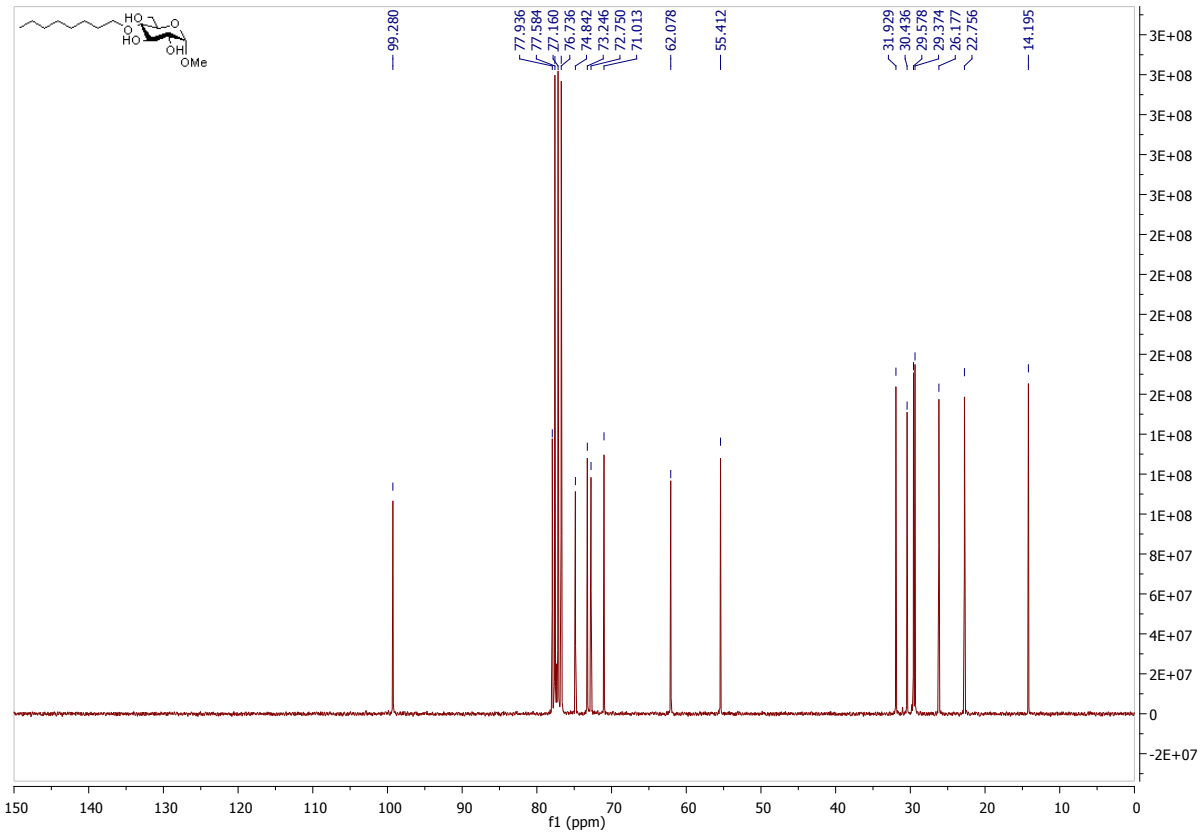
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 6-*O*-octyl α-D-glucoside (**3c**)



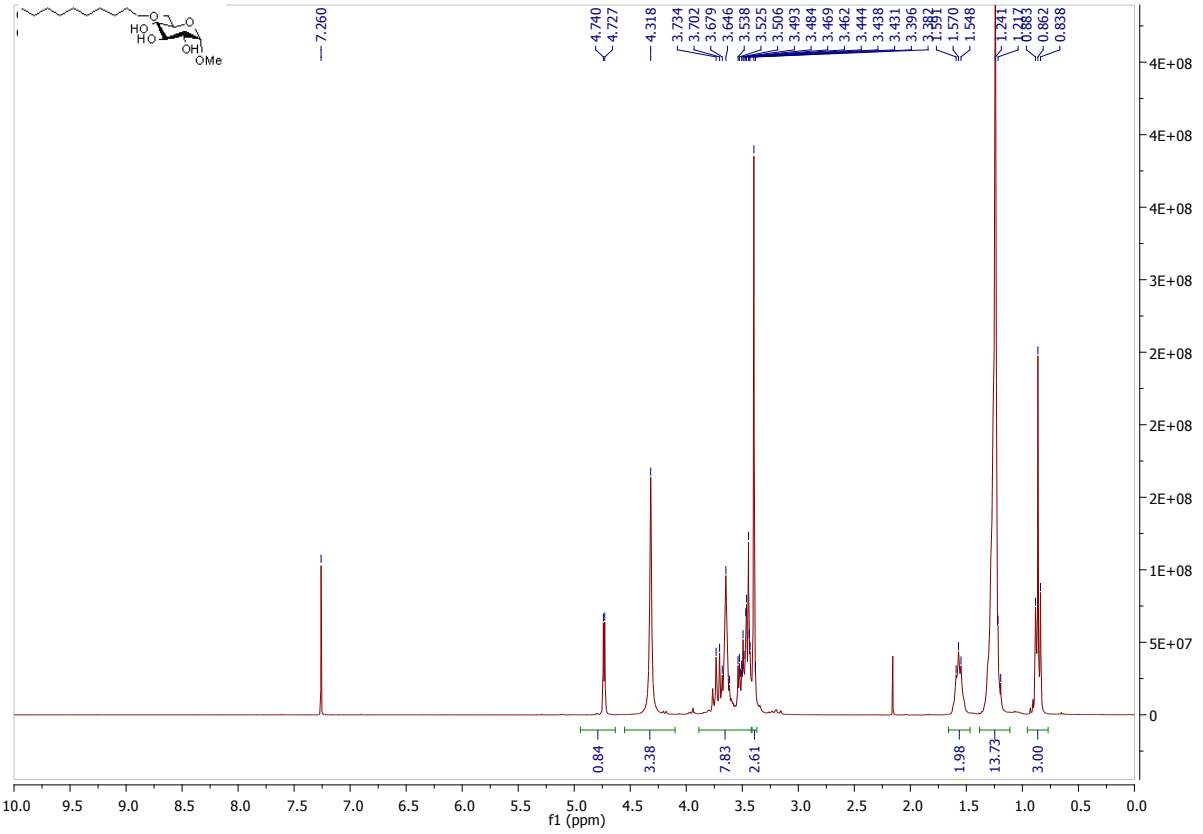
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 6-*O*-octyl α-D-glucoside (**3c**)



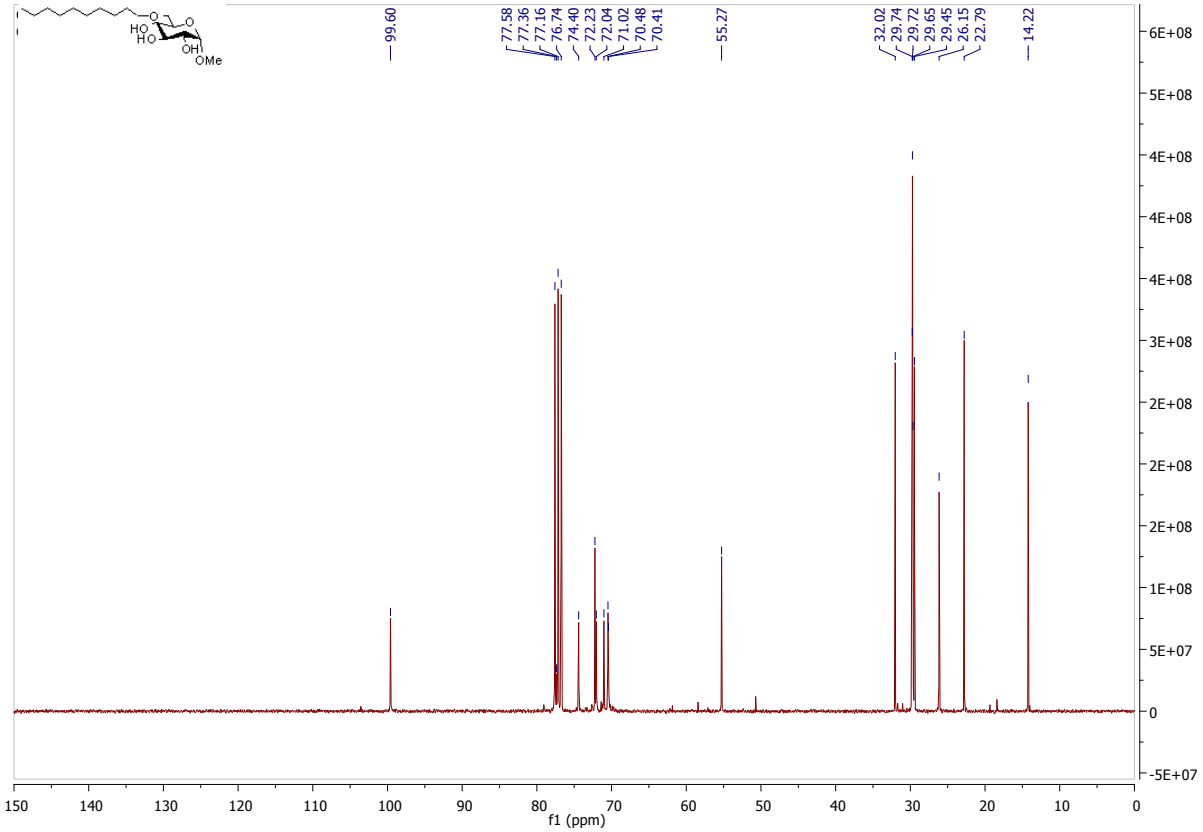
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4-*O*-octyl α-D-glucoside (**4c**)



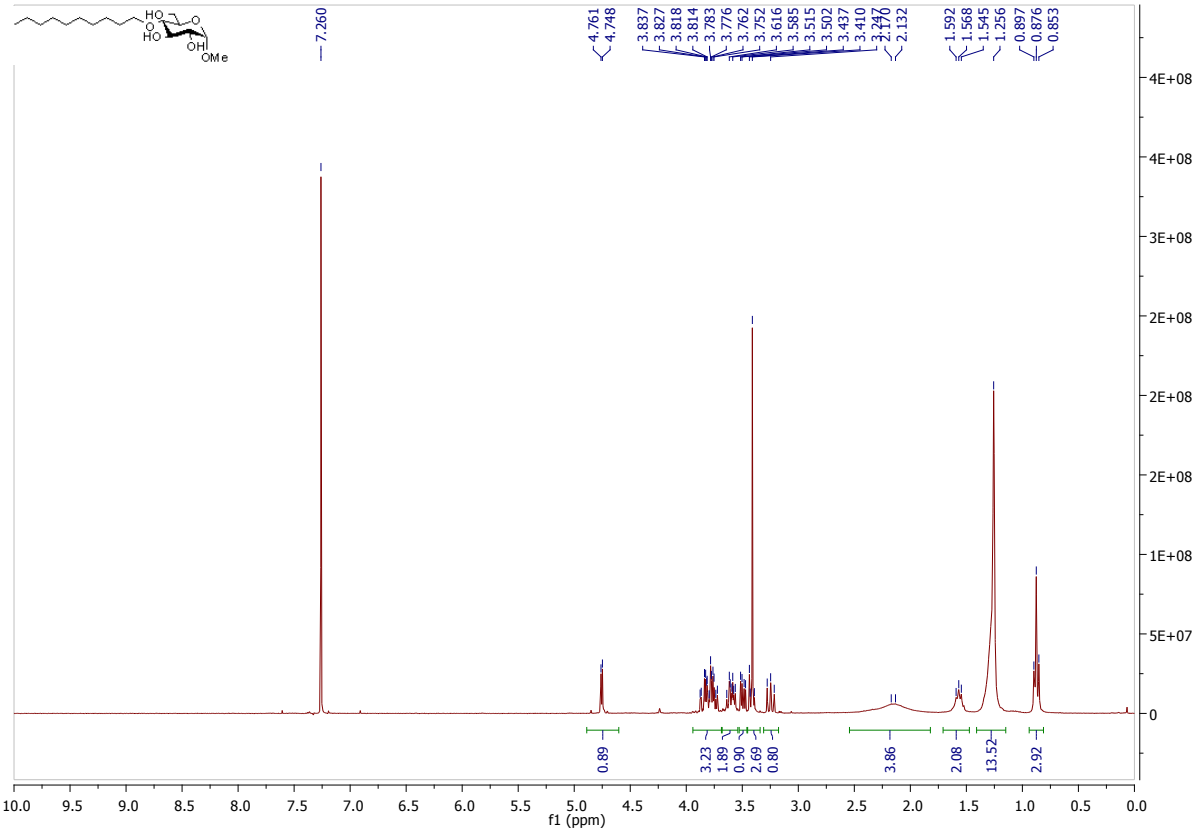
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4-*O*-octyl α-D-glucoside (**4c**)



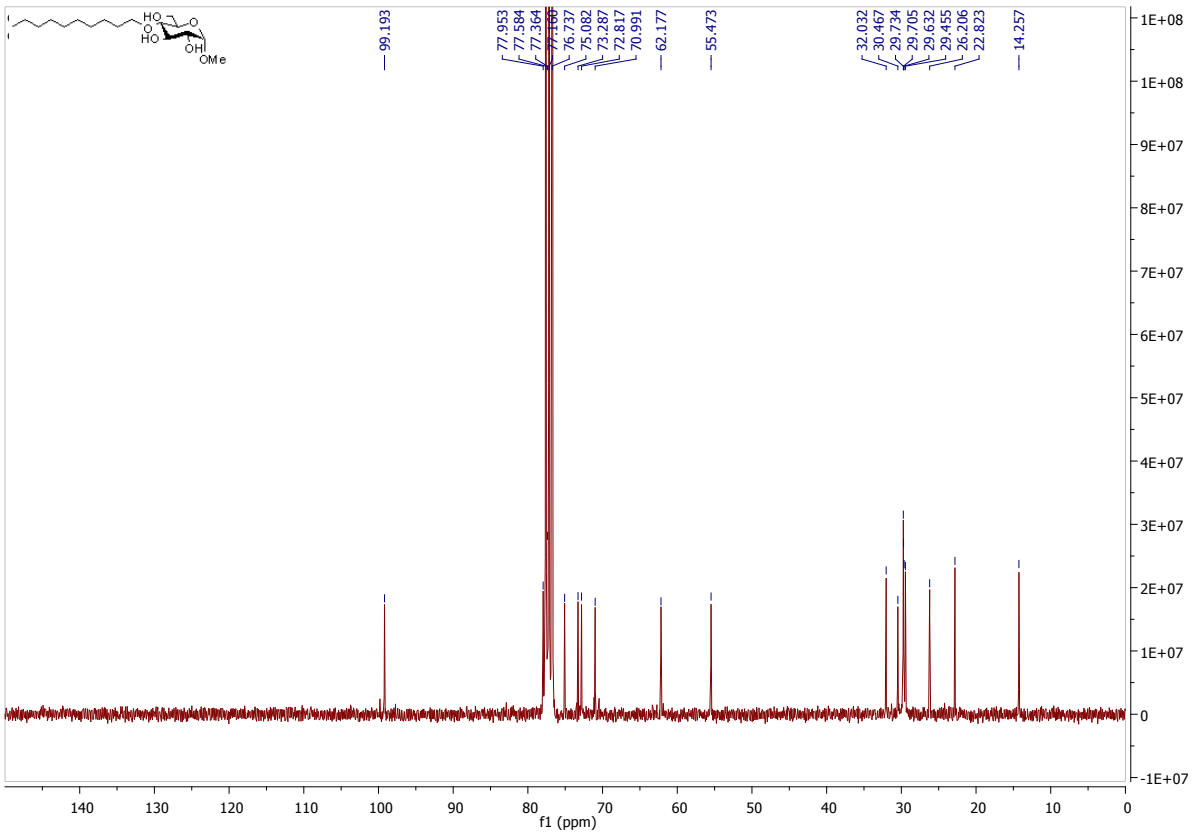
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 6-*O*-decyl α-D-glucoside (**3d**)



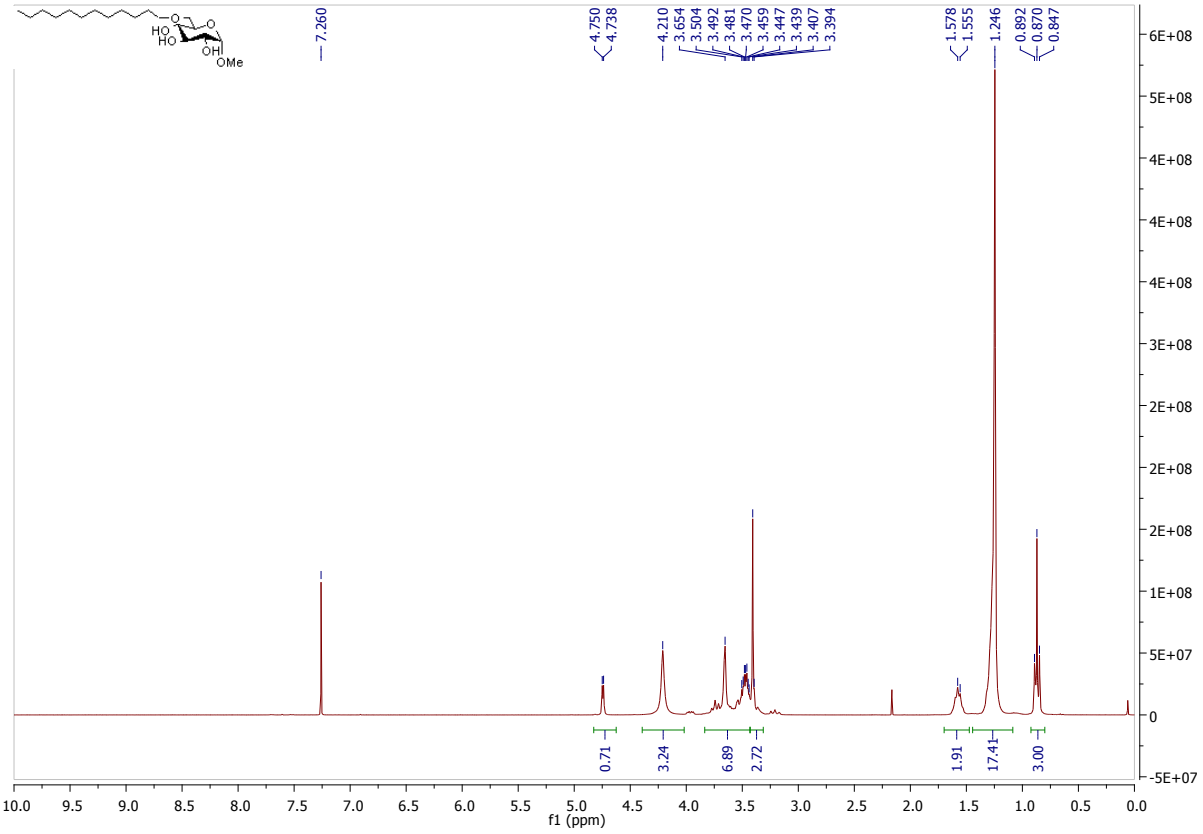
^{13}C NMR(75 MHz, $CDCl_3$) Methyl 6-*O*-decyl α-D-glucoside (**3d**)



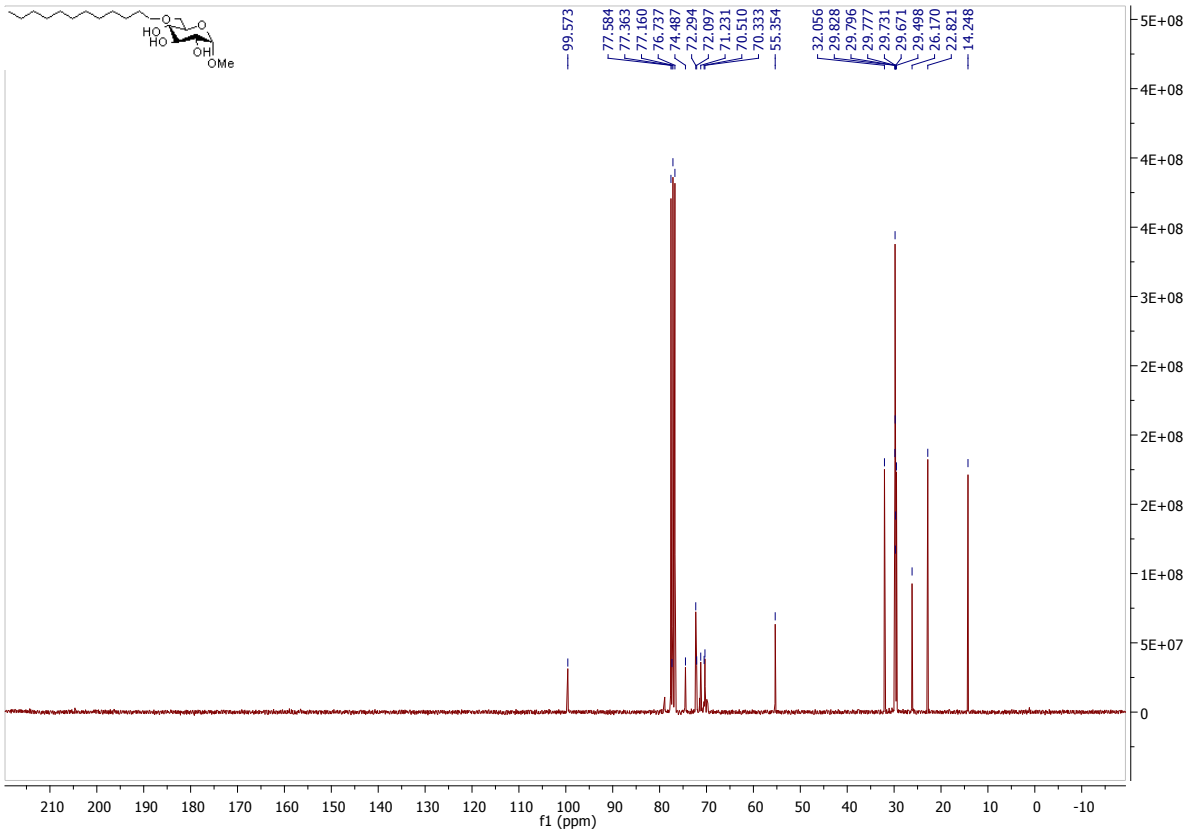
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4-*O*-decyl α-D-glucoside (**4d**)



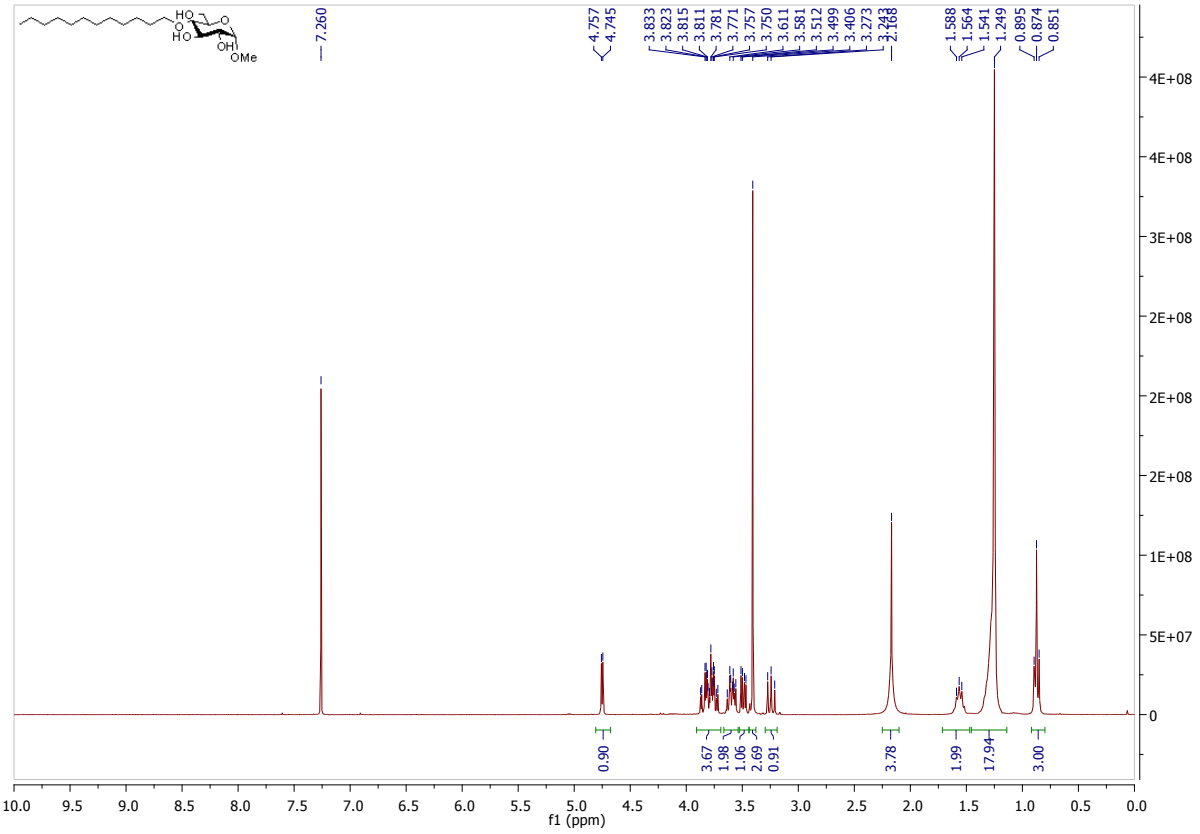
^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4-*O*-decyl α-D-glucoside (**4d**)



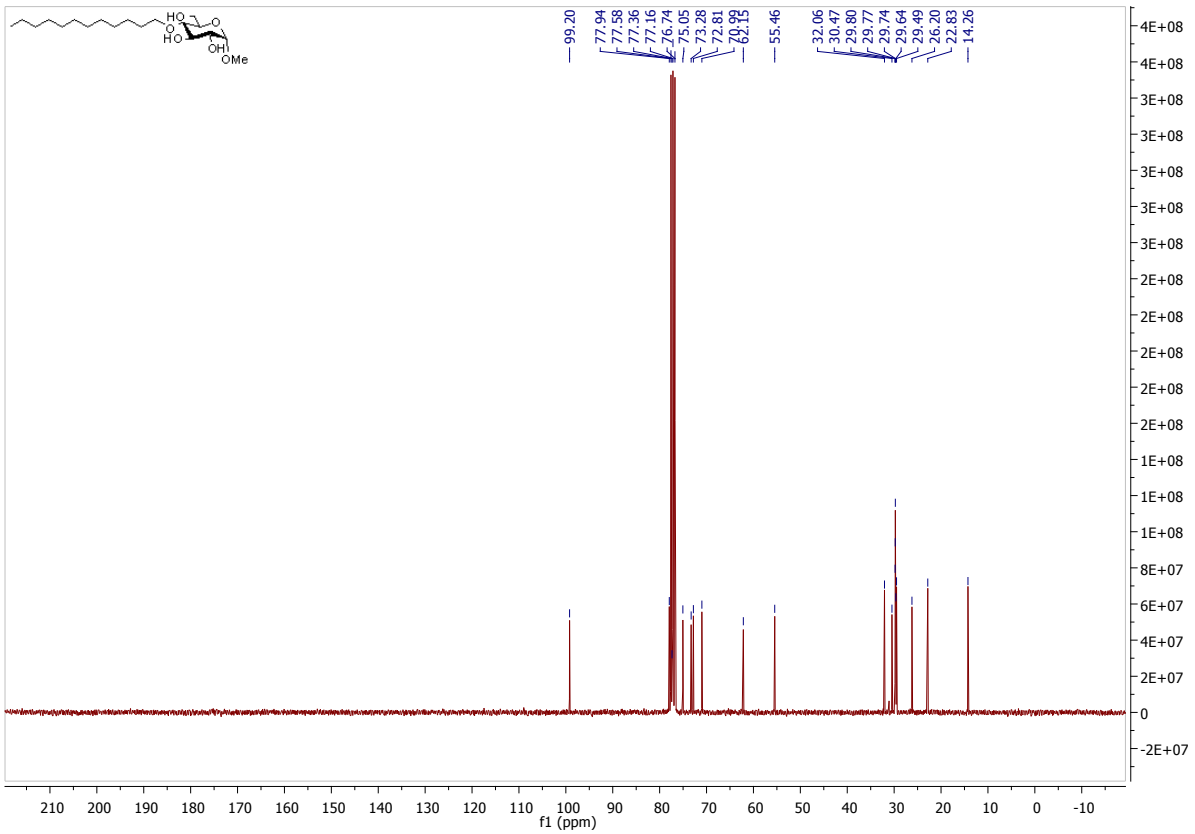
^{1}H NMR (300 MHz, $CDCl_3$) Methyl 6-*O*-dodecyl α-D-glucoside (**3e**)



^{13}C NMR (75 MHz, $CDCl_3$) Methyl 6-*O*-dodecyl α-D-glucoside (**3e**)



^{1}H NMR (300 MHz, $CDCl_3$) Methyl 4-*O*-dodecyl α-D-glucoside (**4e**)



^{13}C NMR (75 MHz, $CDCl_3$) Methyl 4-*O*-dodecyl α-D-glucoside (**4e**)