Development of iminosugar-based glycosidase inhibitors as drug candidates for SARS-CoV-2 virus via molecular modeling and in vitro studies

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Supplementary material

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1. Computational modelling

All structures shown in **Figures S1-S19** can be downloaded as PDB files at the address https://www.chem.bg.ac.rs/~mario/SmartRep/

1.1. Positions of ligands and interactions with the binding site of α-glucosidase II (PNB ID: 5DL0)

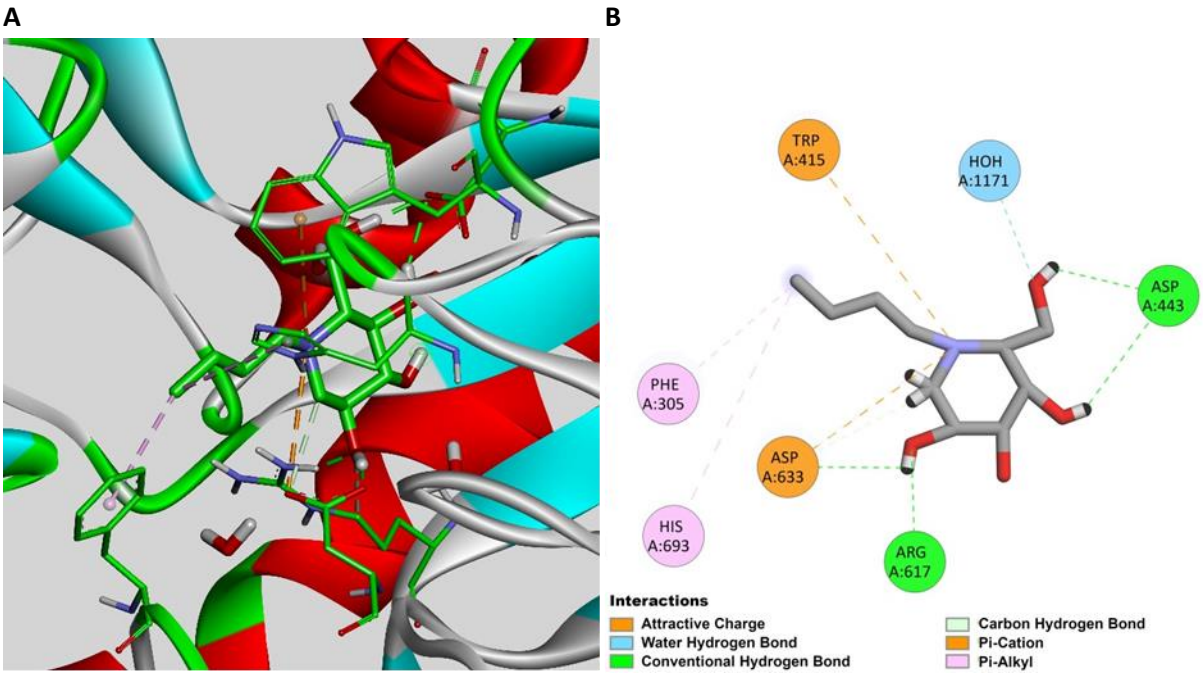


Figure S1 Position of ligand **1** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

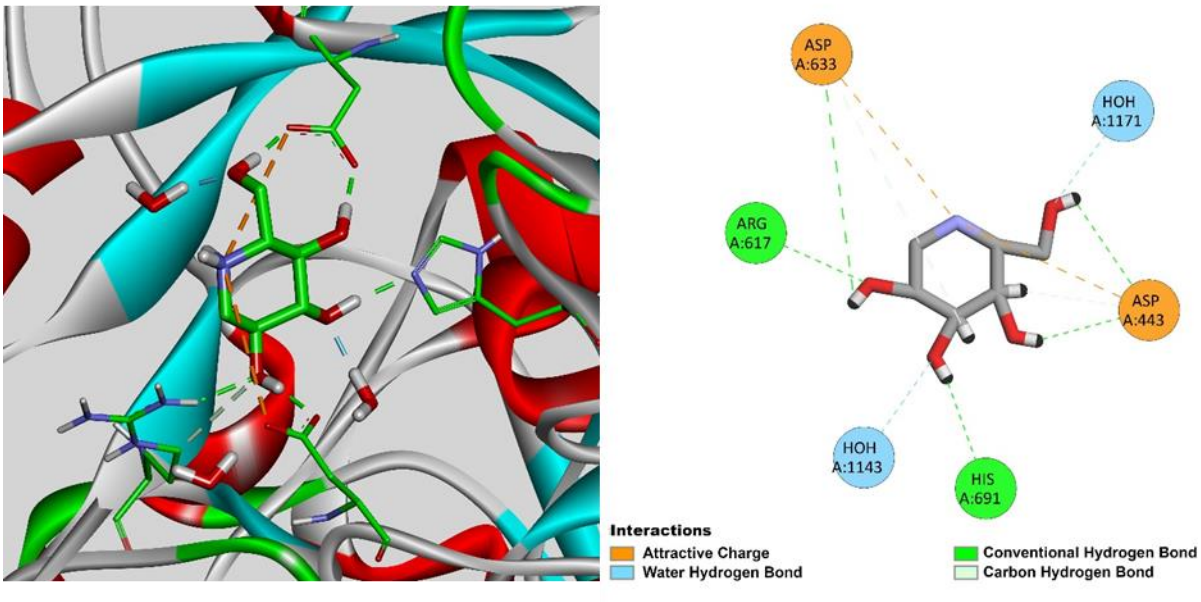


Figure S2 Position of ligand **2** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

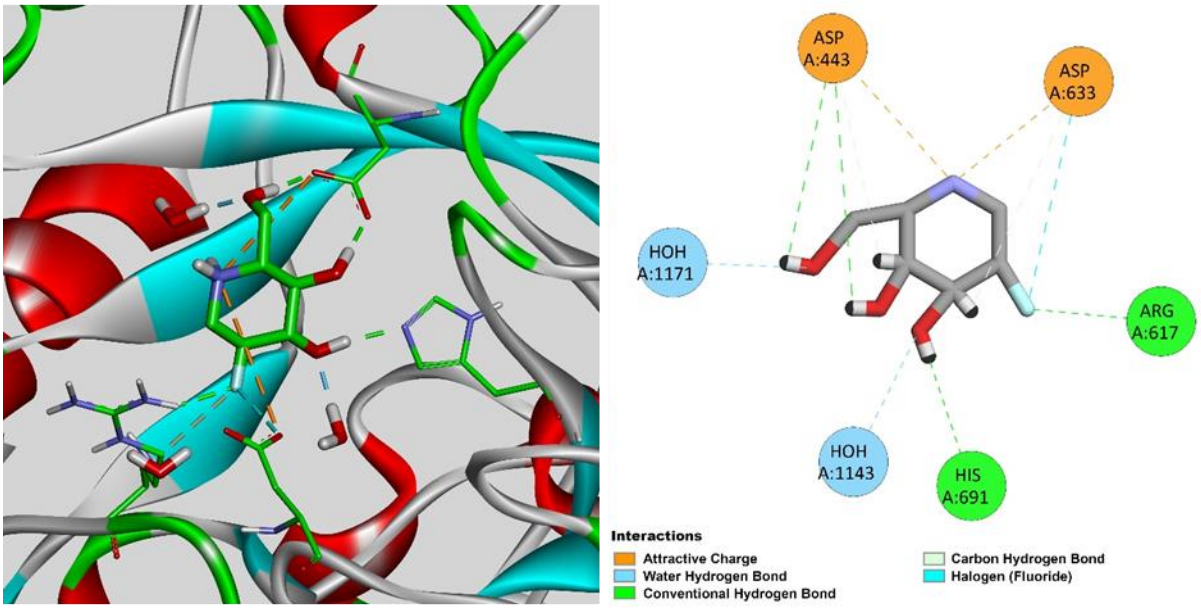


Figure S3 Position of ligand **5** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

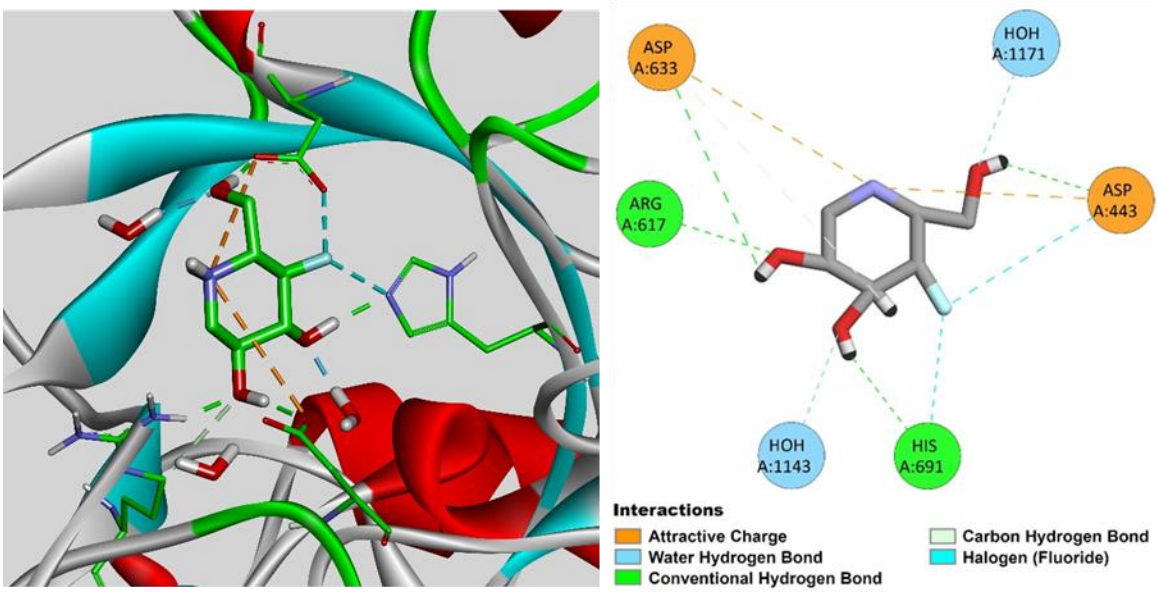


Figure S4 Position of ligand **6** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

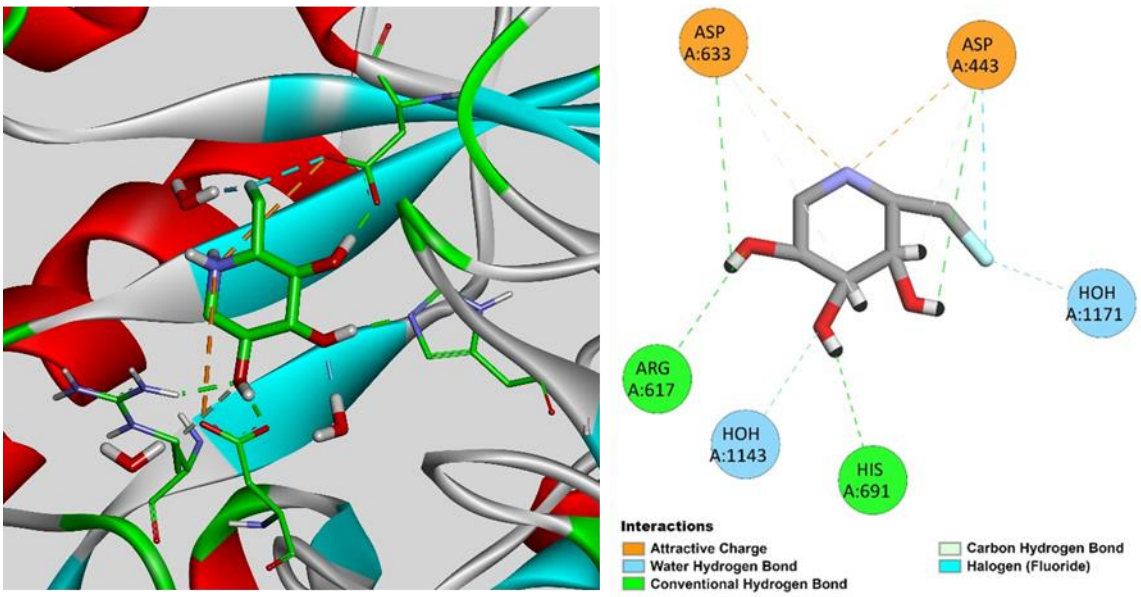


Figure S5 Position of ligand **7** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

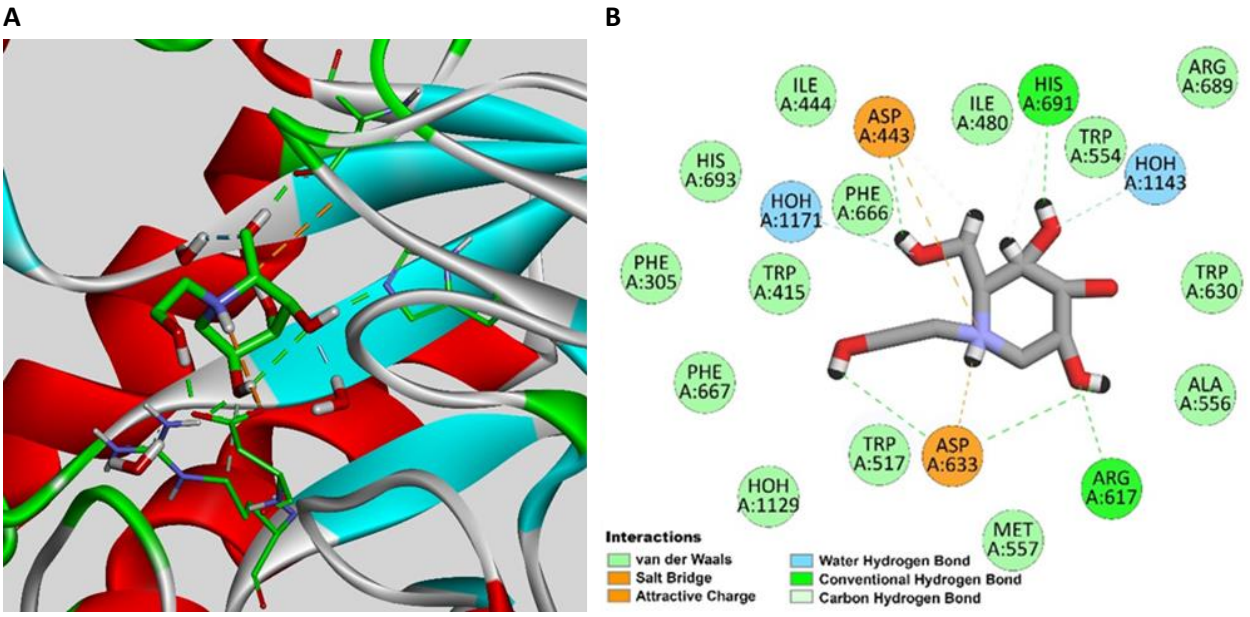


Figure S6 Position of ligand **8** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

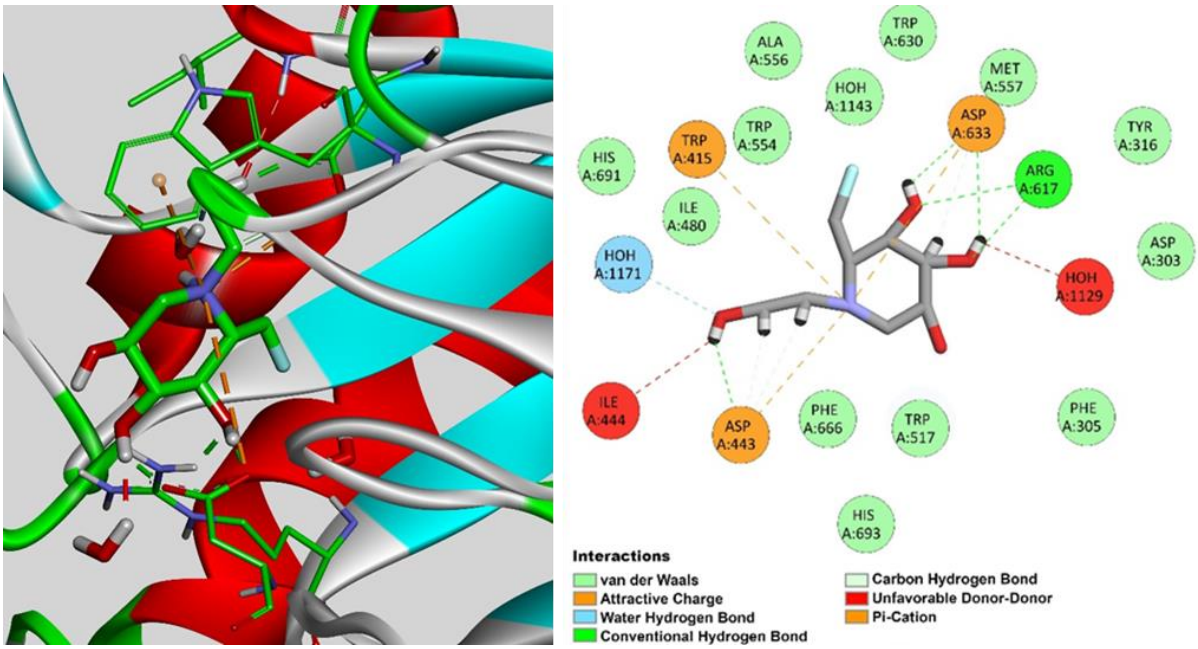
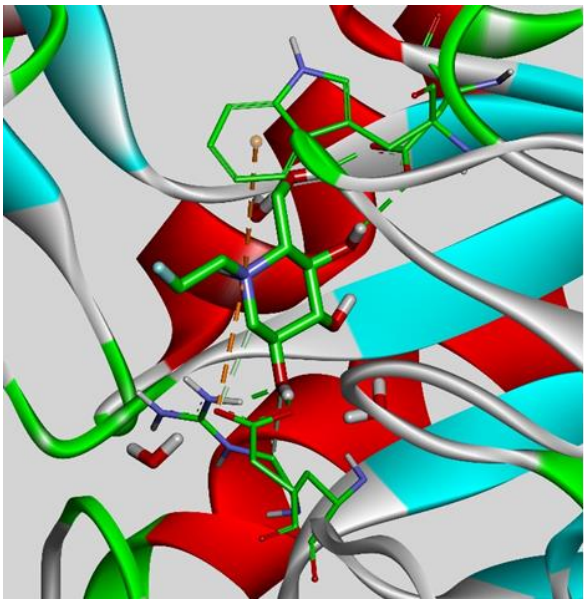


Figure S7 Position of ligand **9** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A



B

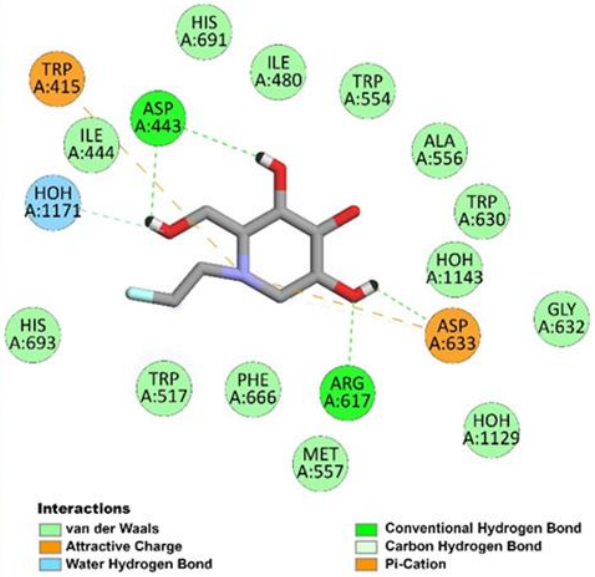
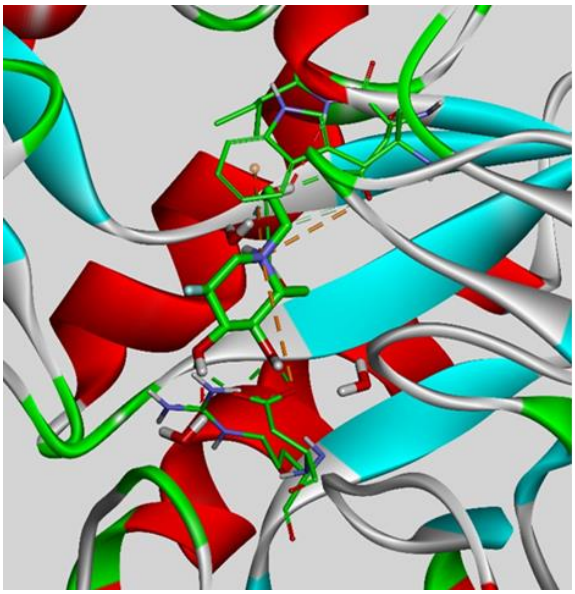


Figure S8 Position of ligand **10** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A



B

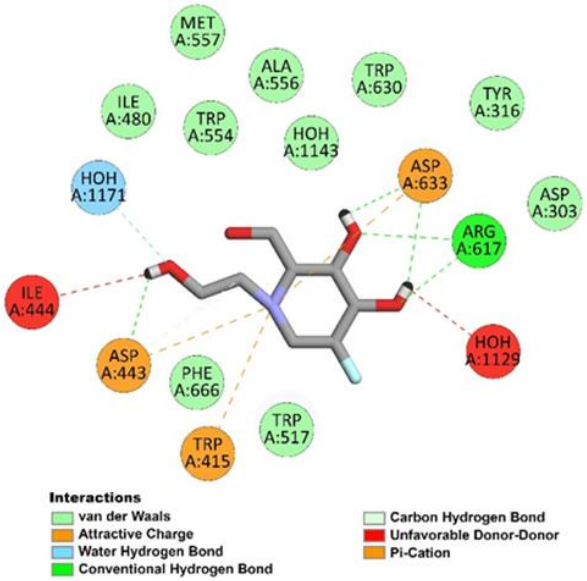


Figure S9 Position of ligand **11** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

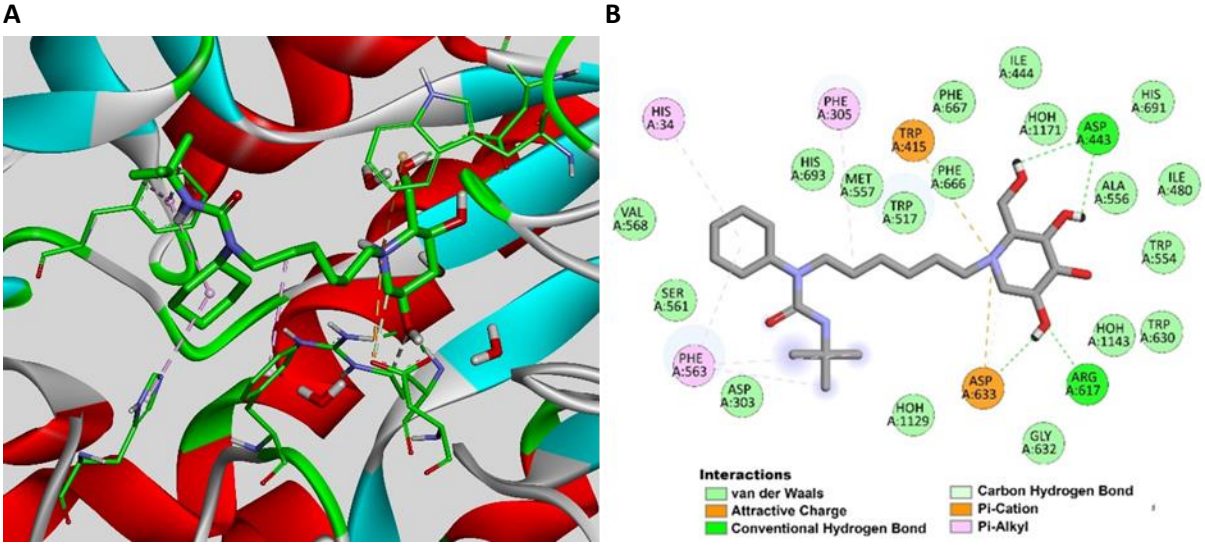


Figure S10 Position of ligand **12** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

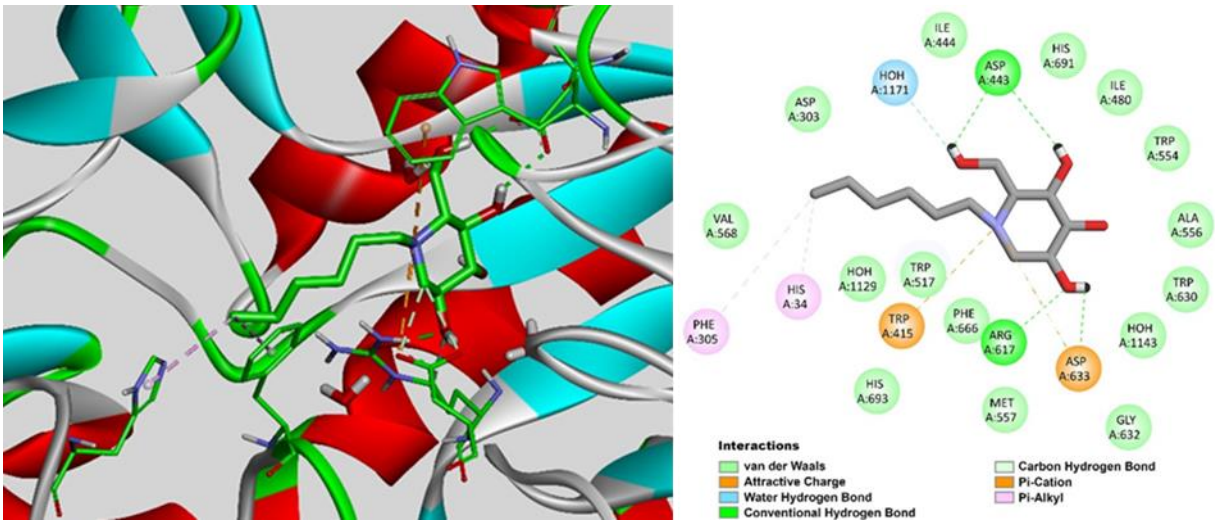


Figure S11 Position of ligand **13** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

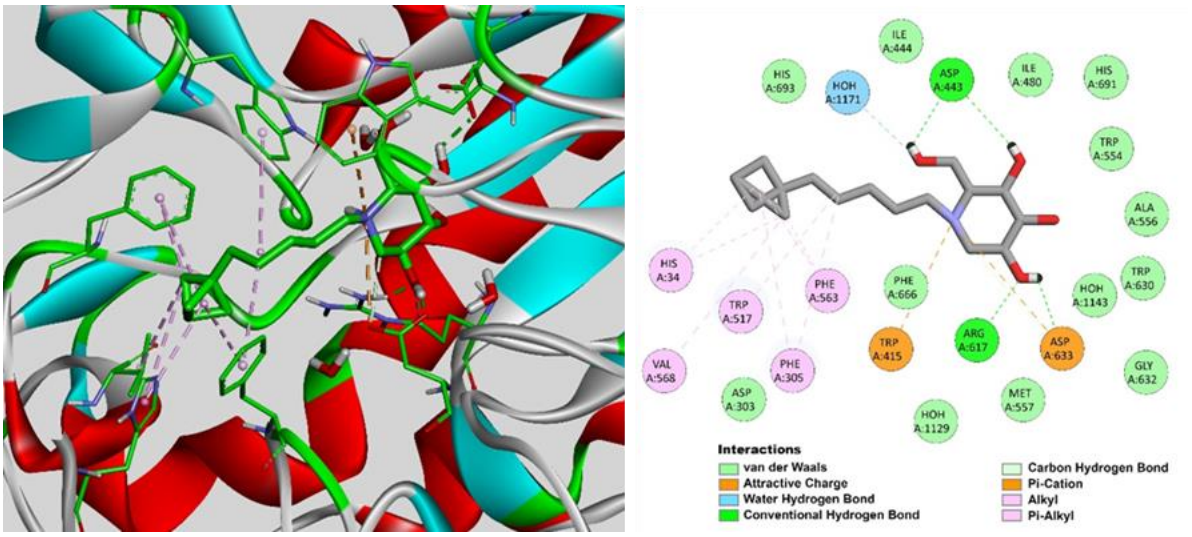


Figure S12 Position of ligand **22** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

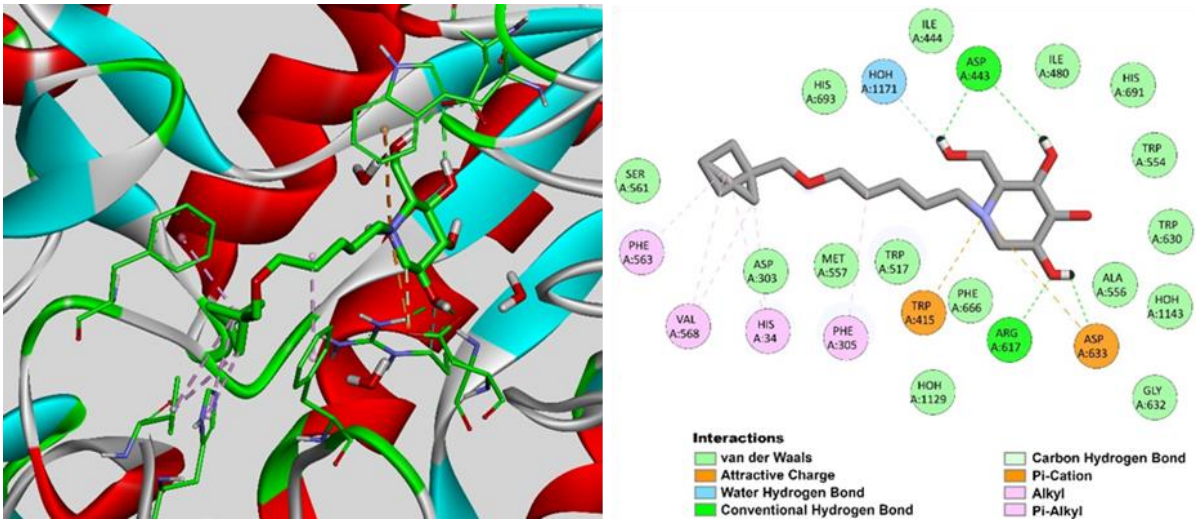


Figure S13 Position of ligand **38** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

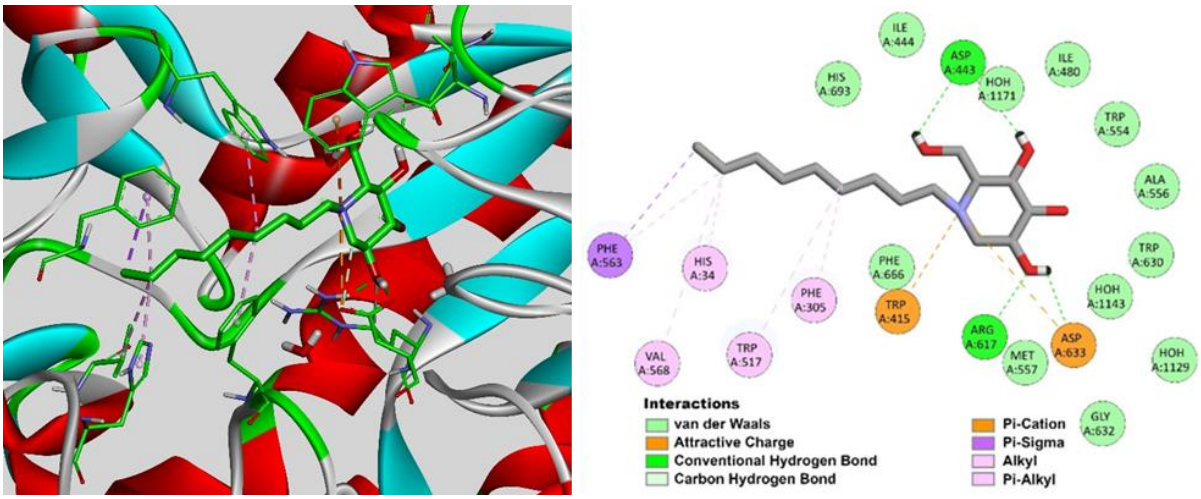


Figure S14 Position of ligand **76** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

A B

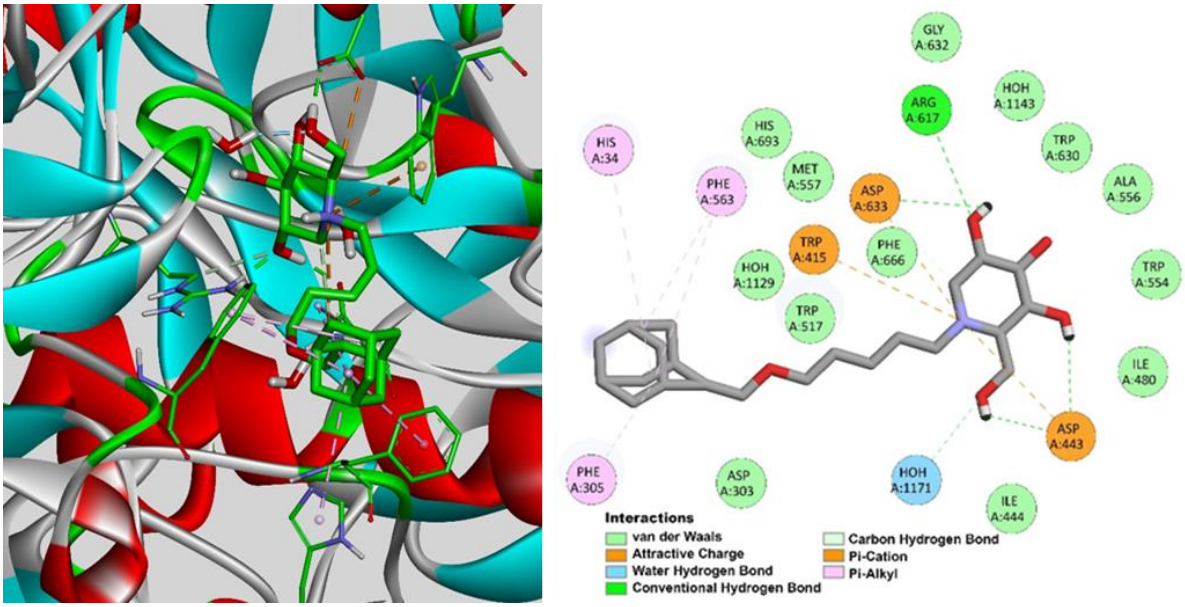


Figure S15 Position of ligand **77** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-glucosidase II.

1.2. Positions of ligands and interactions with the binding site of α-galactosidase A (PNB ID: 6IBK)

A **B**

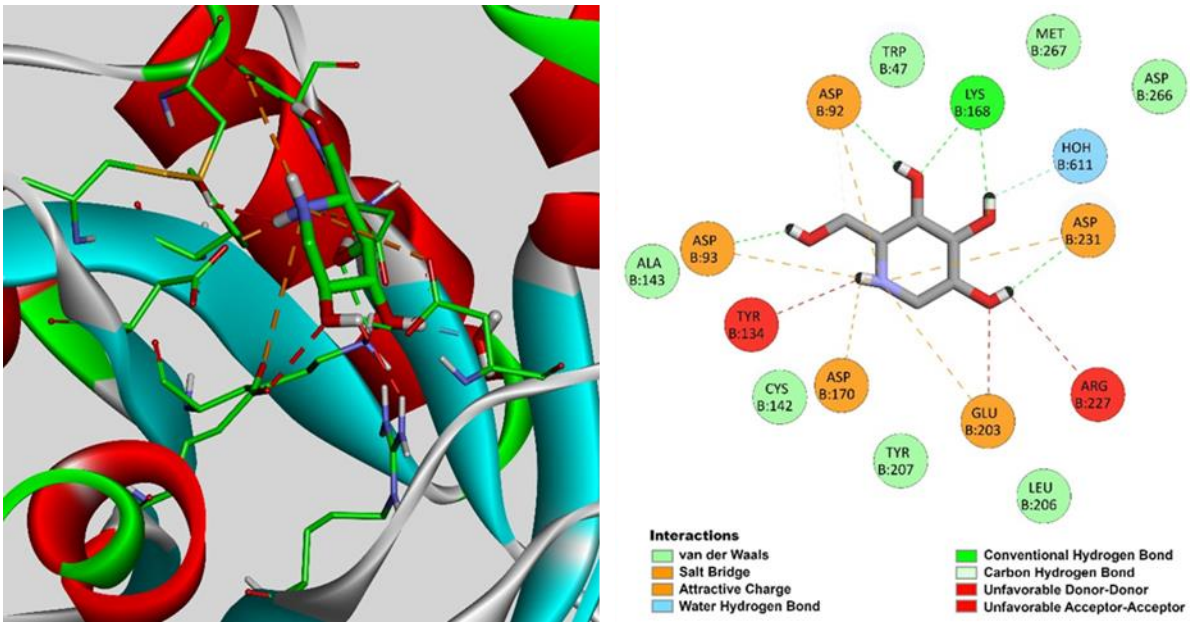


Figure S16 Position of ligand **4** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-galactosidase A.

A **B**

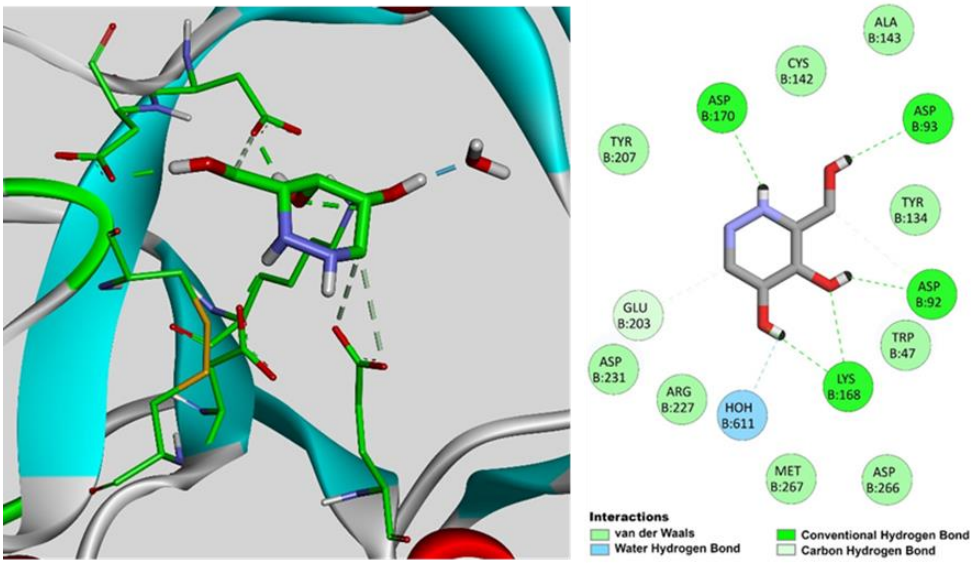


Figure S17 Position of ligand **40** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-galactosidase A.

A B

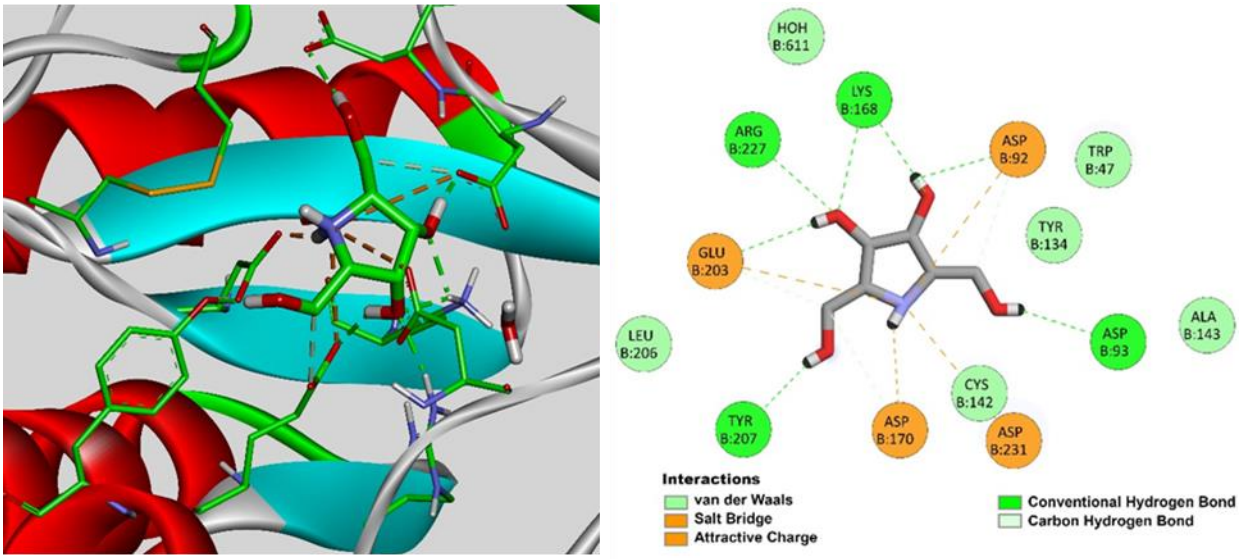


Figure S18 Position of ligand **41** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-galactosidase A.

A B

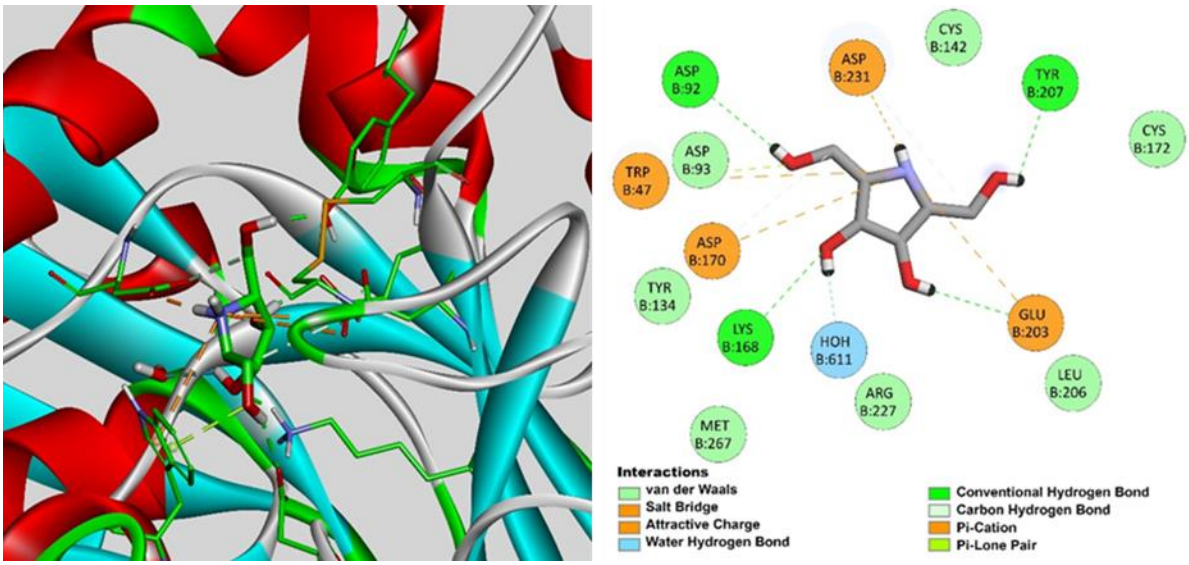


Figure S19 Position of ligand **42** (**A**) and interactions with amino acid residues (**B**) in the binding site of α-galactosidase A.

1.3. Properties of the α-glucosidase II binding site surface

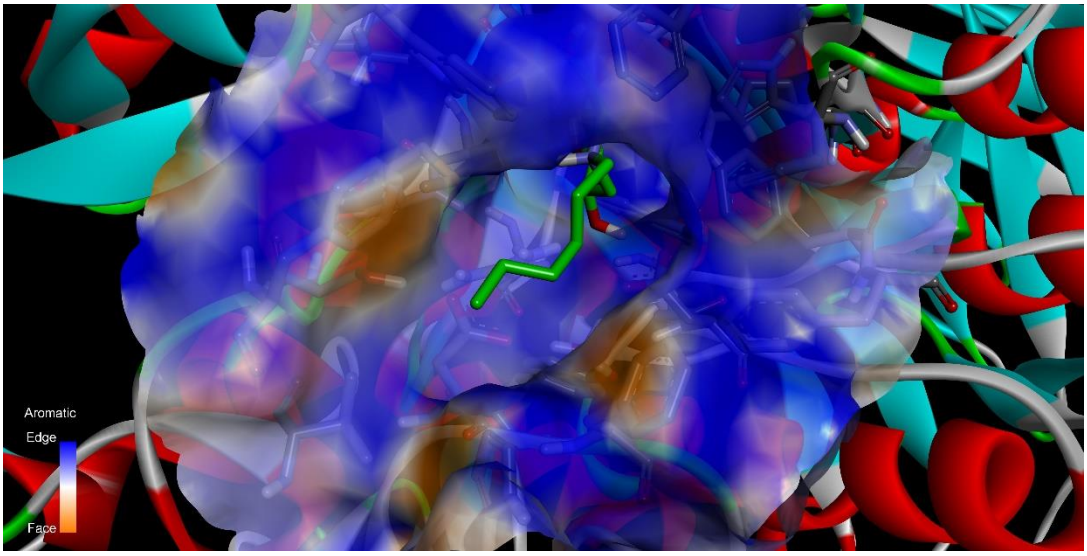


Figure S20 Aromatic properties of the α-glucosidase II binding site surface with compound **1** bound.

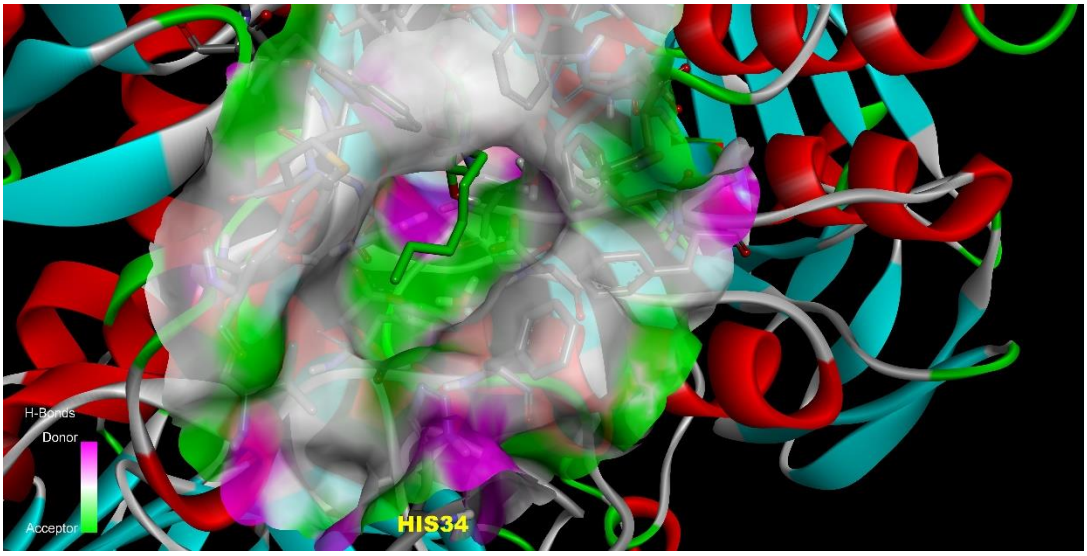


Figure S21 H-bond properties of the α-glucosidase II binding site surface with compound **1** bound.

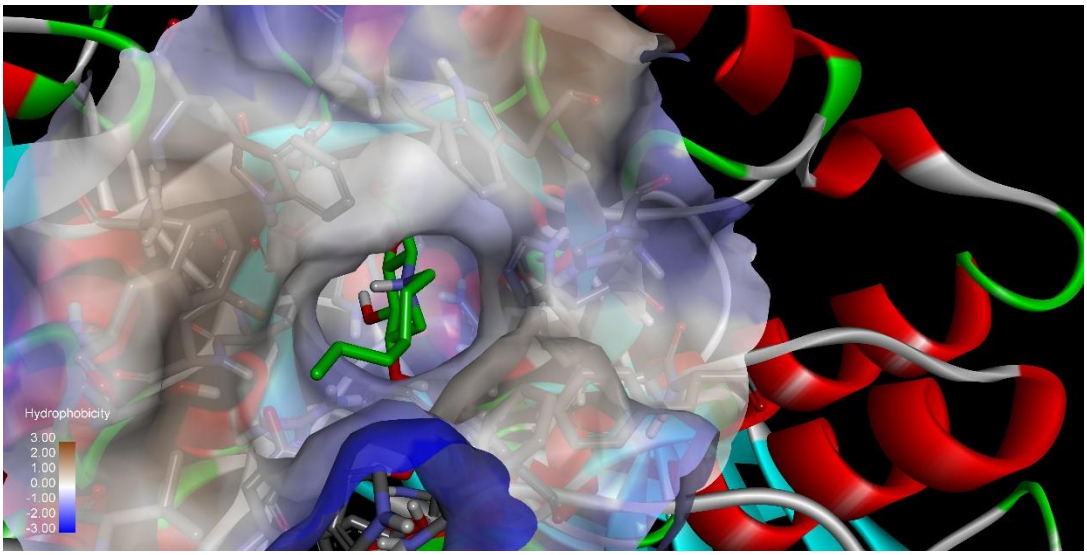


Figure S22 Hydrophobic α-glucosidase II binding site surface with compound **1** bound.

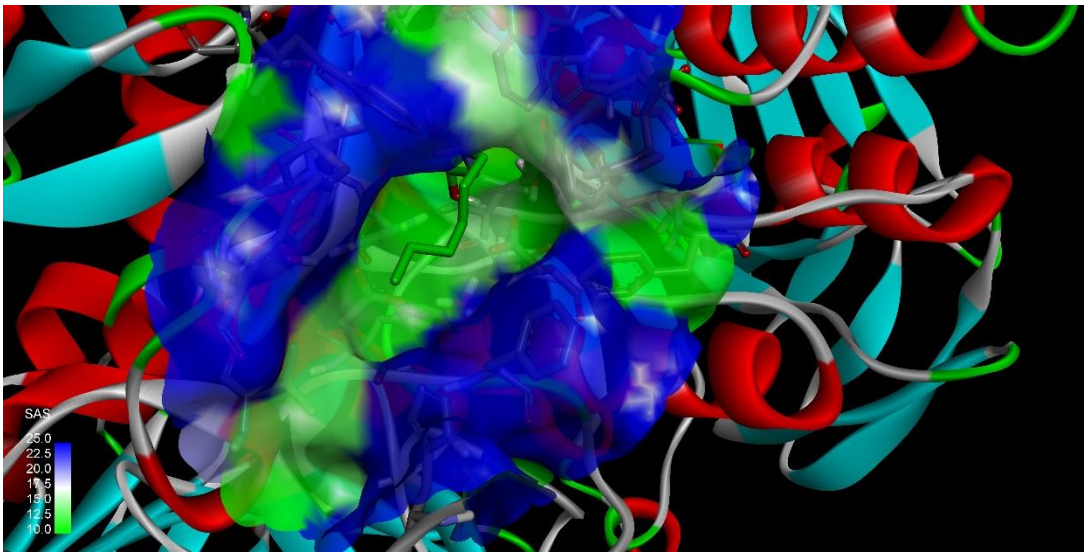


Figure S23 Solvent accesible α-glucosidase II binding site surface with compound **1** bound.

1.4. Supraposition of two molecules bound in α-galactosidase (PDB ID: 6IBK)

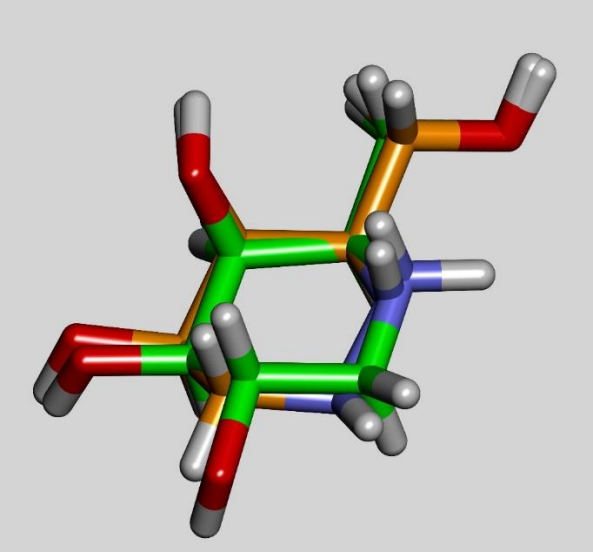


Figure S24 Best binding poses of **4** (green carbons) and **40** (orange carbons). Although they take almost the same position in the binding site of α-galactosidase A, the lack of vital interactions leads to lower binding score for **40.**

1.5. Table 1S: Tabular representation of ligand-protein interactions in the binding pocket of α-Glu II for compounds 1, 22, 76 and 77

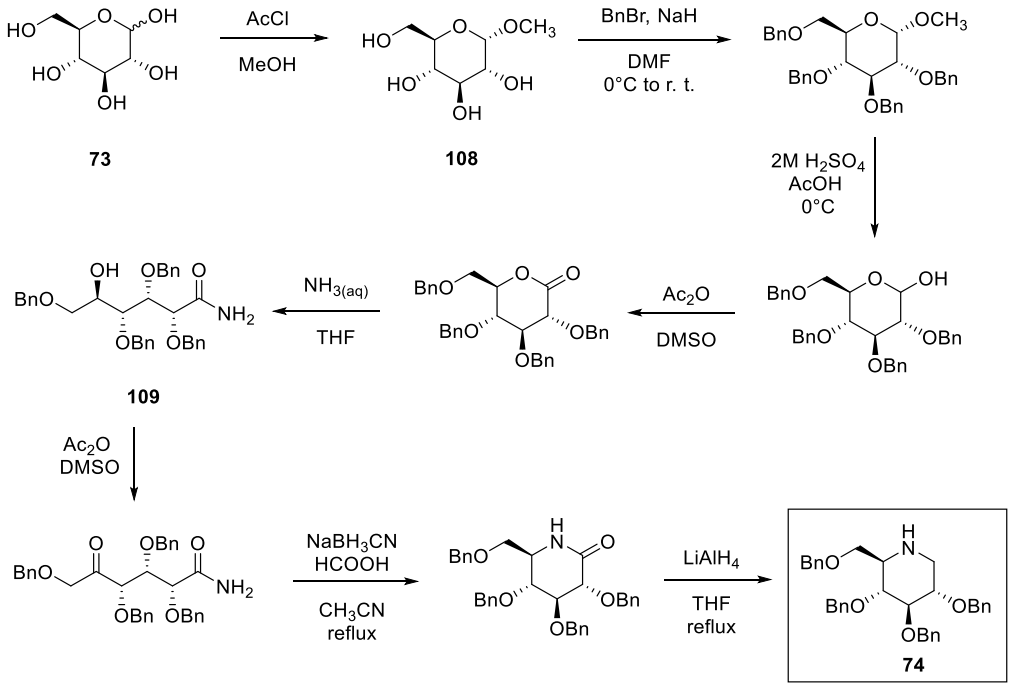
Can be dowloaded at:

https://www.chem.bg.ac.rs/~mario/SmartRep/

(Item #20)

2. Synthesis of α-glucosidase inhibitors

Compound **74** (the key intermediate in synthesis of DNJ) was prepared from *α*-glucose **73** by a modified literature procedure (Scheme 1).[1] The obtained spectral data are in accordance with the literature data.



Scheme S1 Synthesis of the key intermediate **74**.

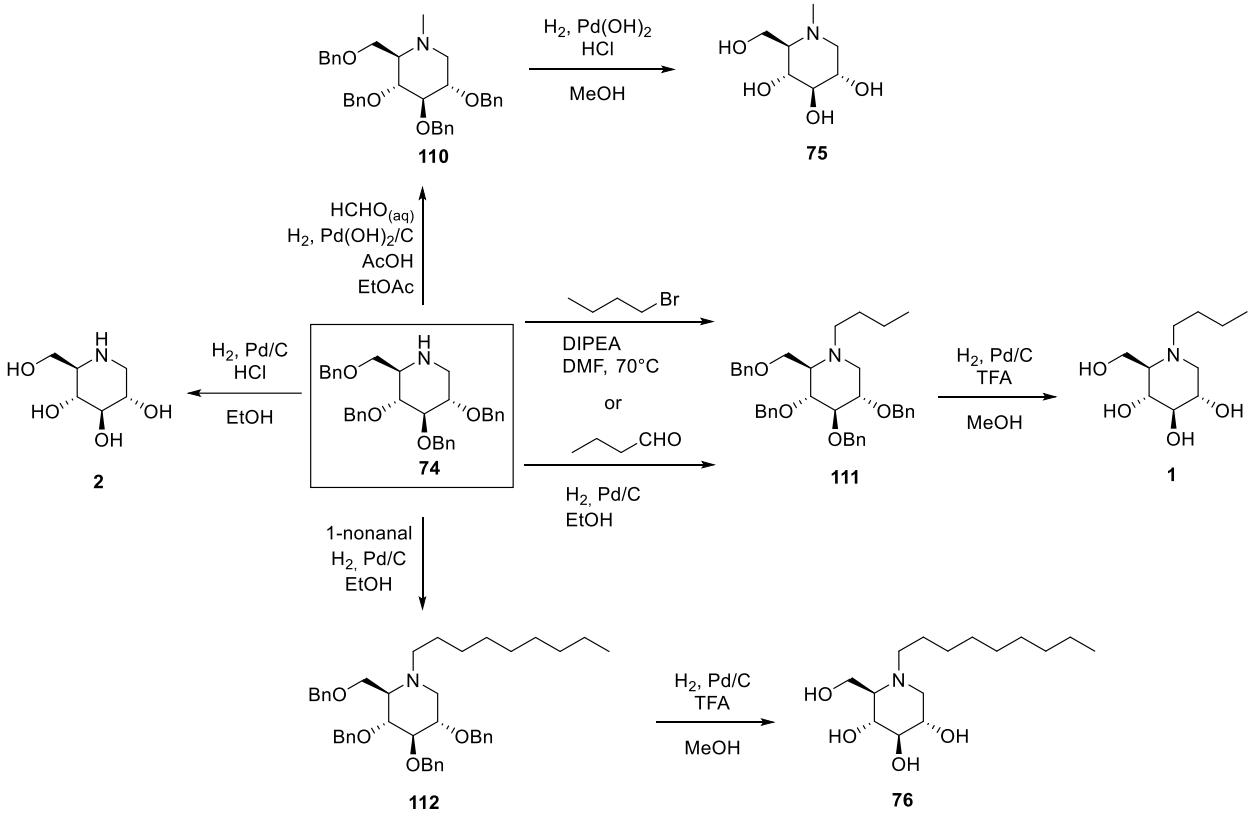
2.1. (2*R*,3*S*,4*S*,5*R*,6*S*)-2-(hydroxymethyl)-6-methoxytetrahydro-2*H*-pyran-3,4,5-triol (108)

To a suspension of *α*-glucose (50.0 g, 0.278 mol) in methanol (250 mL) was added acetyl chloride (2 mL, 28 mmol) dropwise and the reaction mixture was refluxed for 72 h (a clear solution was formed after 15 minutes). After the disapperance of the starting material (monitored by TLC, petroleum ether/ethyl acetate = 4:6), the reaction mixture was concentrated to 1/4 of the volume. A crystal of methyl α-D-glucopyranose was added to the residue, whereupon crystallization occured, affording 40.0 g, (74%) of product **108**, as white cristals, used in the next step without additional purification.

2.2. (2*R*,3*S*,4*R*,5*R*)-2,3,4,6-tetrakis(benzyloxy)-5-hydroxyhexanamide (109)

To a solution of 2,3,4,6-tetra-*O*-benzyl-D-gluconolactone (5.0 g; 9.3 mmol) in THF (21 mL) was added 25% $NH_{3(aq)}$ (99 mL) and the reaction mixture was stirred at room temperature for 16 h. The reaction mixture was diluted with diethyl ether (60 mL) and the aqueous layer was extraced with diethyl ether (3 x 80 mL). The organic layer was dried over anhydrous $MgSO_4$, concentrated under reduced pressure and purified by dry-flash chromatography (eluent: petroleum ether/ethyl acetate = 4:6), to afford 4.8 g (92%) of the

product **109**, as a viscous oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.20-7.35 (m, 20H), 6.59 (s, 1H), 5.58 (s, 1H), 4.73-4.46 (m, 8H), 4.24 (d, J = 3.3 Hz, 1H), 4.07 (dd, J = 5.5, 3.3 Hz, 1H), 3.96-3.83 (m, 2H), 3.64 (dd, J = 9.8, 3.0 Hz, 1H), 3.57 (dd, J = 9.8, 5.3 Hz, 1H), 2.83 (d, J = 4.1 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.1, 138.3, 138.2, 137.9, 136.9, 128.8, 128.5 (2C), 128.4, 128.2, 128.00 (2C), 127.9, 127.8, 80.7, 79.8, 77.8, 75.4, 74.3, 73.9, 73.5, 71.5, 71.2.



Scheme S2 Synthesis of DNJ-derived α-glucosidase inhibitors.

2.3. (2*R*,3*R*,4*R*,5*S*)-2-(hydroxymethyl)piperidine-3,4,5-triol (DNJ, 2)

To a solution of **74** (60.0 mg; 0.115 mmol) in ethanol (4 mL) were added $HCl_{(aq)}$ (1.5 M, to obtain pH=3) and 10% Pd/C (37.0 mg; 0.045 mmol) and the reaction mixture was stirred for 57 h under a hydrogen atmosphere (5 atm). The reaction mixture was then diluted with methanol, filtered, concentrated under reduced pressure and purified by column chromatography (eluent: ethyl acetate/methanol/25% $NH_{3\,(aq)}$= 1:1:0.05), to afford 15.1 mg (81%) of the product **2**, as a viscous oil. ^{1}H (400 MHz, D_2O) δ 3.86 (dd, J = 11.7, 3.0 Hz, 1H), 3.66 (dd, J = 11.7 Hz, 1H), 3.52 (ddd, J = 10.7, 9.0, 5.1 Hz, 1H), 3.35 (t, J = 9.1 Hz, 1H), 3.27 (t, J = 9.4 Hz, 1H), 3.15 (dd, J = 12.3, 5.2 Hz, 1H), 2.61-2.52 (m, 1H), 2.49 (dd, J = 12.1, 11.0 Hz, 1H). ^{13}C (100 MHz, D_2O) δ 78.2, 71.3, 70.7, 61.2, 60.4, 48.5. IR (ATR): $\tilde{\nu}$= 3317, 2892, 2462, 1964, 1377, 1097, 1039, 1017, 747, 596 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_6H_{14}NO_4$: 164.0917, found: 164.0920.

2.4. (2*R*,3*R*,4*R*,5*S*)-3,4,5-tris(benzyloxy)-2-((benzyloxy)methyl)-1-methylpiperidine (110)

To a solution of amine **74** (10.7 mg; 0.02 mmol) in EtOAc (0.2 mL) were added 30% $HCHO_{(aq)}$ (9 µL), AcOH (3 µL) and $Pd(OH)_2$ (7.0 mg) and the reaction mixture was stirred 6.5 h under a hydrogen atmosphere (1 atm). The mixture was filtered, concentrated under reduced pressure and purified by column chromatography (eluent: petroleum ether/ethyl acetate = 3:2), to afford 9.8 mg (91%) of the product **110**, as a viscous oil. $[\alpha]_D^{20}$ −6.6 (*c* 0.01 in $CHCl_3$). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36-7.21 (m, 18H), 7.14-7.09 (m, 2H), 4.95 (d, *J* = 11.0 Hz, 1H), 4.86 (d, *J* = 10.8 Hz, 1H), 4.80 (d, *J* = 11.0 Hz, 1H), 4.66 (dd, *J* = 15.5, 11.6 Hz, 2H), 4.48 (dd, *J* = 19.7, 12.2 Hz, 2H), 4.38 (d, *J* = 10.8 Hz, 1H), 3.75-3.53 (m, 4H), 3.47 (t, *J* = 9.1 Hz, 1H), 3.07 (dd, *J* = 11.1, 4.8 Hz, 1H), 2.31 (s, 3H), 2.10 (t, *J* = 10.8 Hz, 1H), 1.95 (d, *J* = 9.6 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 139.1, 138.7, 138.6, 138.0, 128.6, 128.5 (2C), 128.4 (2C), 128.0 (3C), 127.8, 127.7, 127.6, 87.4, 78.3 (2C), 75.5, 75.3, 73.7, 72.9, 67.3, 65.4, 59.1, 42.1. IR (ATR): $\tilde{\nu}$= 3088, 3063, 3030, 2863, 1605, 1496, 1454, 1362, 1318, 1252 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{35}H_{40}NO_4$: 538.2952, found: 538.2971.

2.5. (2*R*,3*R*,4*R*,5*S*)-2-(hydroxymethyl)-1-methylpiperidine-3,4,5-triol (75)[1,2]

Compound **75** was prepared according to the literature procedure.[1,2]
^{1}H NMR (400 MHz, CD_3OD) δ 3.89 (qd, *J* = 12.1, 2.4 Hz, 1H), 3.60-3.50 (m, 1H), 3.43 (t, *J* = 9.5 Hz, 1H), 3.20 (t, *J* = 9.1 Hz, 1H), 3.05 (dd, *J* = 11.4, 4.9 Hz, 1H), 2.53 (s, 1H), 2.36 (t, *J* = 11.1 Hz, 1H), 2.13 (d, *J* = 9.9 Hz, 1H). ^{13}C NMR (100 MHz, D_2O) δ 79.8, 70.8, 70.0, 69.7, 61.1, 58.1, 42.1.

2.6. (2*R*,3*R*,4*R*,5*S*)-3,4,5-tris(benzyloxy)-2-((benzyloxy)methyl)-1-butylpiperidine (111)

2.6.1. Method 1: Alkylation

To a solution of amine **74** (99.5 mg; 0.19 mmol) and DIPEA (149.0 mg; 1.15 mmol) in DMF (1 mL) was added 1-bromobutane (118.0 mg; 1.15 mmol) and the reaction mixture was stirred at 70 °C for 24 h under an argon atmosphere. The reaction mixture was then diluted with diethyl ether (70 mL), washed with water (2x15 mL) and brine (15 mL), dried over anhydrous $MgSO_4$ and concentrated under reduced pressure. The residue was purified by dry-flash chromatography (eluent: petroleum ether/ethyl acetate = 85:15) to give compound **111** (76.0 mg, 69%) as a colorless oil.

2.6.2. Method 2: Reductive amination

A mixture of amine **74** (70.0 mg; 0.13 mmol), butanal (49.0 mg; 0.67 mmol) and 10% Pd/C (31.0 mg; 0.03 mmol) in ethanol (3.8 mL) was stirred for 24 h under a hydrogen atmosphere (4.2 atm). The reaction mixture was then filtered, concentrated under reduced pressure and purified by column chromatography (eluent: petroleum ether/ethyl acetate = 85:15) to afford compound **111** (55.9 mg, 72%) as a colorless oil. ^{1}H NMR(400 MHz, $CDCl_3$) δ 7.39-7.21 (m, 18H), 7.16-7.10 (m, 2H), 4.95 (d, *J* = 11.1 Hz, 1H), 4.87 (d, *J* = 10.9 Hz, 2H), 4.81 (d, *J* = 11.1 Hz, 1H), 4.72-4.62 (m, 2H), 4.52-4.39 (m, 3H), 3.70-3.50 (m, 4H), 3.45 (t, *J* = 9.1 Hz, 1H), 3.09 (dd, *J* = 11.2, 4.8 Hz, 1H), 2.73-2.50 (m, 2H), 2.33-2.15 (m, 2H), 1.46-1.10 (m, 4H), 0.86 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.2, 138.8 (2C), 138.0, 128.6, 128.5 (2C), 128.4 (4C), 128.0, 127.9, 127.7, 127.6, 127.5, 87.6, 78.8 (2C), 75.4, 73.3, 73.6, 72.9, 65.6, 63.9, 54.6, 52.3, 25.9, 20.8, 14.1.

IR (ATR): $\tilde{\nu}$= 3088, 3061, 3030, 2958, 2910, 2867, 1497, 1453, 1360, 1118, 1089, 1063, 998, 745, 695, 675 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{38}H_{46}NO_4$: 580.3421, found: 580.3439.

2.7. (2*R*,3*R*,4*R*,5*S*)-1-butyl-2-(hydroxymethyl)piperidine-3,4,5-triol (miglustat, 1)

A mixture of amine **111** (127.0 mg; 0.217 mmol), trifluoroacetic acid (44 µL; 0.576 mmol) and 10% Pd/C (150.0 mg; 0.141 mmol) in methanol (3.3 mL) was stirred for 26 h under a hydrogen atmosphere (1 atm). The reaction mixture was then filtered, concentrated under reduced pressure and purified by dry-flash chromatography (eluent: ethyl acetate/methanol/25% $NH_{3\,(aq)}$= 7:3:0.05) to afford compound **1** (39.2 mg, 82%) as a colorless oil. ^{1}H (400 MHz, D_2O) δ 3.91 (qd, *J* = 12.9, 2.6 Hz, 2H), 3.60 (ddd, *J* = 10.8, 9.3, 4.9 Hz, 1H), 3.44 (t, *J* = 9.5 Hz, 1H), 3.31 (t, *J* = 9.2 Hz, 1H), 3.12 (dd, *J* = 11.6, 5.0 Hz, 1H), 2.89-2.80 (m, 1H), 2.75 - 2.65 (m, 1H), 2.48-2.35 (m, 2H), 1.57-1.46 (m, 2H), 1.37-1.27 (m, 2H), 0.93 (t, *J* = 7.4 Hz, 3H). ^{13}C (100 MHz, D_2O) δ 78.0, 69.7, 68.4, 65.0, 57.0, 54.9, 51.8, 24.9, 20.0, 13,1. IR (ATR): $\tilde{\nu}$= 3352, 2958, 2932, 2873, 1665, 1460, 1378, 1086, 1014, 644cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{10}H_{22}NO_4$: 220.1543, found: 220.1547.

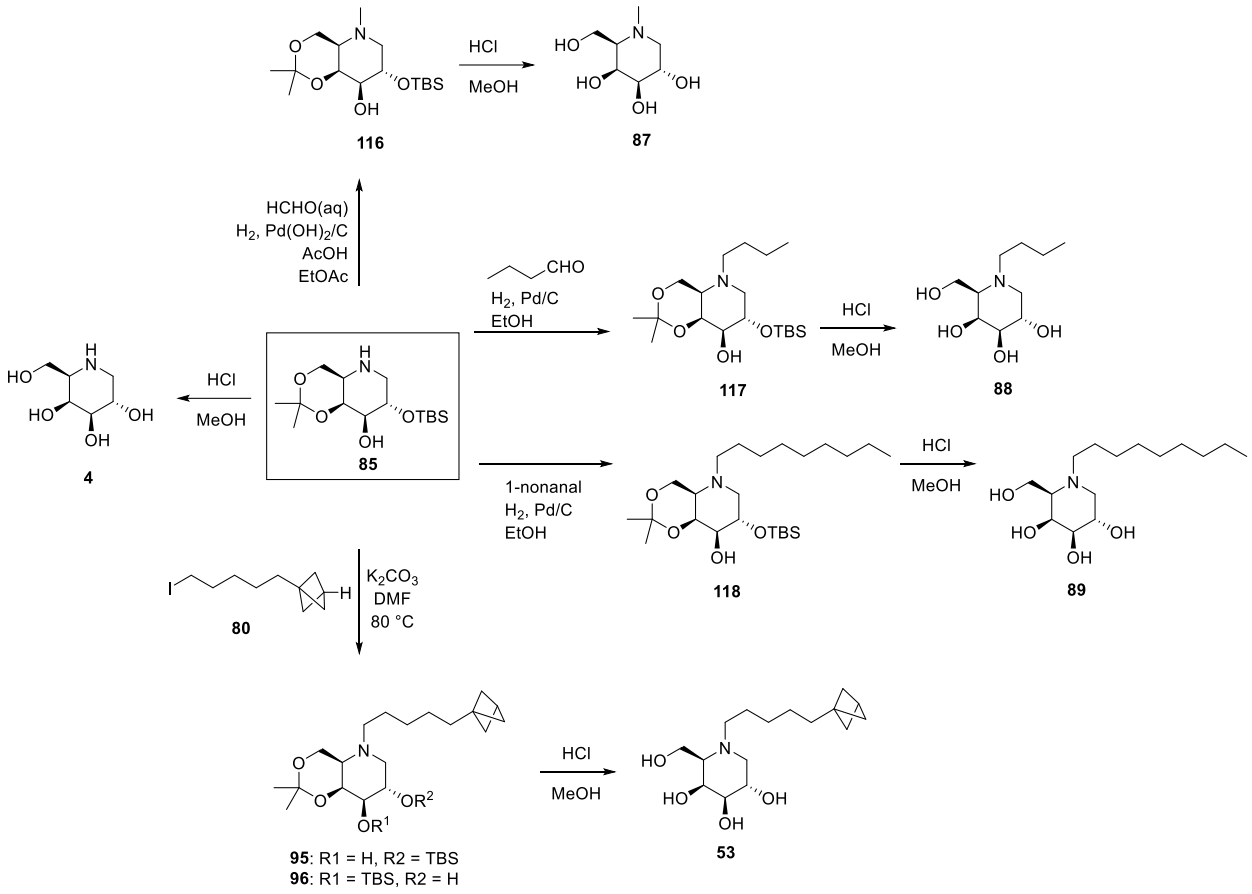
2.8. (2*R*,3*R*,4*R*,5*S*)-3,4,5-tris(benzyloxy)-2-((benzyloxy)methyl)-1-nonylpiperidine (112)

A mixture of amine **74** (140.0 mg; 0.26 mmol), nonanal (218.0 mg; 0.138 mmol) and 10% Pd/C (62.0 mg; 0.06 mmol) in ethanol (7.6 mL) was stirred for 23 h under a hydrogen atmosphere (4.2 atm). The reaction mixture was then filtered, concentrated under reduced pressure and purified by column chromatography (eluent: petroleum ether/ethyl acetate = 85:15) to afford compound **112** (121.0 mg, 70%) as a colorless oil. ^{1}H NMR (400MHz, $CDCl_3$) δ 7.37-7.22 (m, 18H), 7.16-7.11 (m, 2H), 4.95 (d, *J* = 11.1 Hz, 1H), 4.87 (d, *J* = 10.8 Hz, 2H), 4.81 (d, *J* = 11.1 Hz, 1H), 4.71-4.61 (m, 2H), 4.51-4.39 (m, 3H), 3.71-3.51 (m, 4H), 3.45 (t, *J* = 9.1 Hz, 1H), 3.10 (dd, *J* = 11.1, 4.9 Hz, 1H), 2.71-2.52 (m, 2H), 2.36-2.28 (m, 1H), 2.23 (t, *J* = 10.8 Hz, 1H), 1.47-1.06 (m, 14H), 0.9 (t, *J* = 6.7 Hz 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.0, 138.6 (2),137.8, 128.4, 128.3 (4C), 127.8 (2C), 127.6, 127.5, 127.4, 87.4, 78.6, 75.3, 73.4, 72.7, 65.3, 63.7, 54.4, 52.4, 31.9, 29.6, 27.5, 23.5, 22.7, 14.10. IR (ATR): $\tilde{\nu}$= 3091, 3031, 2955, 2920, 2849, 1498, 1454, 1362, 1148, 1177, 1092, 1066, 1053, 734, 696 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{43}H_{56}NO_4$: 650.4204, found: 650.4224.

2.9. (2*R*,3*R*,4*R*,5*S*)-2-(hydroxymethyl)-1-nonylpiperidine-3,4,5-triol (76)

A mixture of amine **112** (87.0 mg; 0.134 mmol), trifluoroacetic acid (27 µL; 0.35 mmol) and 10% Pd/C (93.0 mg; 0.084 mmol) in methanol (1.9 mL) was stirred for 12 h under a hydrogen atmosphere (1 atm). The reaction mixture was then filtered, concentrated under reduced pressure and purified by dry-flash chromatography (eluent: ethyl acetate/methanol/25% $NH_{3\,(aq)}$= 7:3:0.05) to afford compound **76** (27.3 mg, 70%) as a colorless oil. ^{1}H NMR (400 MHz, CD_3OD) δ 3.90 (qd, *J* = 12.2, 2.6 Hz, 2H), 3.60-3.51 (m, 1H), 3.44 (t, *J* = 9.4 Hz, 1H), 3.22 (t, *J* = 9.1 Hz, 4H), 3.16 (dd, *J* = 11.5, 4.9 Hz, 1H), 3.07-2.99 (m, 1H), 2.87-2.78 (m, 1H), 2.53-2.44 (m, 1H), 1.66-1.56 (m, 2H), 1.43-1.21 (m, 12H), 0.90 (t. *J* = 6.3 Hz, 3H). ^{13}C NMR (100 MHz, CD_3OD) δ 79.7, 70.9, 69.7, 67.4, 57.9, 56.6, 53.9, 33.0, 30.6, 30.5, 30.4, 28.3, 24.9, 23.7, 14.4. IR (ATR): $\tilde{\nu}$= 3348, 2956, 2925, 2855,1668,1465,1378, 1089,1031cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{15}H_{32}NO_4$: 290.2325, found: 290.2331.

3. Synthesis of α-galactosidase A inhibitors



Scheme S3 Synthesis of DGJ and the analogues thereof.

3.1. (4a*R*,7*S*,8*S*,8a*S*)-7-((*tert*-butyldimethylsilyl)oxy)-2,2,5-trimethylhexahydro-4*H*-[1,3]dioxino[5,4-*b*]pyridin-8-ol (116)

To a solution of amine **85**[3] (15.5 mg; 0.047 mmol) in EtOAc (0.5 mL) were added 30% $HCHO_{(aq)}$ (28 µL), acetic acid (5 µL) and $Pd(OH)_2$ (15.0 mg) and the reaction mixture was stirred overnight under a hydrogen atmosphere (1 atm). The mixture was filtered, concentrated under reduced pressure and purified by column chromatography (ethyl acetate/methanol/25% $NH_{3\ (aq)}$= 19:1:0.05), to afford 14.8 mg (94%) of product **116**, as a colorless oil. $[\alpha]_D^{20}$ +42.5 (*c* 0.01 in MeOH). ^{1}H NMR (500 MHz, $CDCl_3$) δ 4.23-4.19 (m, 1H), 4.01-3.86 (m, 3H), 3.28 (td, *J* = 8.4, 4.1 Hz, 1H), 2.93 (dd, *J* = 11.2, 4.6 Hz, 1H), 2.35-2.37 (m, 1H), 2.30 (s, 3H), 1.96 (t, *J* = 10.7 Hz, 1H), 1.18 (s, 1H), 1.46 (s, 6H), 0.88 (s, 9H), 0.11 (s, 3H), 0.00 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 99.7, 75.4, 70.1, 69.6, 61.5, 60.9, 60.2, 42.7, 28.9, 26.0, 19.4, 18.2, -4.3, -4.4. IR (ATR): $\tilde{\nu}$= 3570, 2990, 2953, 2929, 2885, 2856, 1462, 1381, 1349, 1280, 1250, 1199 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{16}H_{34}NO_4Si$: 332.2252, found: 332.2259.

3.2. (2*R*,3*S*,4*R*,5*S*)-2-(hydroxymethyl)-1-methylpiperidine-3,4,5-triol (87)[4]

A solution of amine **116** (14.1 mg; 0.043 mmol) in methanol/3M $HCl_{(aq)}$ solvent mixture (0.93 mL, v/v = 3:1) was stirred at room temperature for 5 h. After the volatiles were removed under reduced pressure, the residue was purified by column chromatography (gradient ethyl acetate/methanol/25% $NH_{3\ (aq)}$= 9:1:0.05 to 1:1:0.05) to afford 5.9 mg (78%) of product **87**, as a viscous oil. $[\alpha]_D^{20}$ +0.15 (*c* 0.0067 in MeOH). ^{1}H NMR (500 MHz, CD_3OD) δ 4.04-4.01 (m, 1H), 3.90 (td, *J* = 10.0, 5.0 Hz, 1H), 3.84 (d, *J* = 5.1 Hz, 2H), 3.28 (dd, *J* = 9.4, 3.2 Hz, 1H), 3.01 (dd, *J* = 11.3, 5.0 Hz, 1H), 2.42 (s, 3H), 2.27 (t, *J* = 4.7 Hz, 1H), 2.17 (t, *J* = 11.0 Hz, 1H). ^{13}C NMR (125 MHz, CD_3OD) δ 76.8, 72.0, 68.2 (2C), 62.3, 62.0, 42.6. IR (ATR): $\tilde{\nu}$= 3352, 2924, 2803, 1660, 1569, 1463, 1417, 1161 cm^{-1}.

3.3. (4a*R*,7*S*,8*S*,8a*S*)-7-((*tert*-butyldimethylsilyl)oxy)-2,2-dimethyl-5-nonylhexahydro-4*H*-[1,3]dioxino[5,4-*b*]pyridin-8-ol (118)

A mixture of amine **85**[3] (30.5 mg; 0.096 mmol), nonanal (67.0 mg; 0.66 mmol) and 10% Pd/C (20.0 mg; 0.026 mmol) in ethanol (2.7 mL) was stirred for 2.5 h under a hydrogen atmosphere (4 atm). The mixture was filtered, concentrated under reduced pressure and purified by column chromatography (benzene/ethyl acetate = 7:3), to afford 27.3 mg (64%) of the product **118**, as a colorless oil. $[\alpha]_D^{20}$ −1.35 (*c* 0.01 in $CHCl_3$). ^{1}H NMR (500 MHz, $CDCl_3$) δ 4.18-4.12 (m, 1H), 3.96-3.78 (m, 3H), 3.24 (td, *J* = 8.6, 4.2 Hz, 1H), 2.90 (dd, *J* = 11.2, 4.7 Hz, 1H), 2.64-2.43 (m, 2H), 2.29 (d, *J* = 8.1 Hz, 1H), 2,17 (s, 1H), 2.05 (t, *J* = 10.6 Hz, 1H), 1.41 (s, 6H), 1.32-1.18 (m, 14H), 0.89-0.81 (m, 12H), 0.09 (s, 3H), 0.07 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 99.7, 75.5, 70.6, 69.8, 61.1, 57.4, 56.6, 52.9, 32.0, 29.7 (2C), 29.4, 28.5, 27.6, 26.0, 24.1, 22.8, 20.0, 18.3, 14.2, -4.3 (2C). IR (ATR): $\tilde{\nu}$= 3571, 2990, 2954, 2856, 2797, 1463, 1381, 1252 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{24}H_{50}NO_4Si$: 444.3504, found: 444.3514.

3.4. (2*R*,3*S*,4*R*,5*S*)-2-(hydroxymethyl)-1-nonylpiperidine-3,4,5-triol (89)[5]

A solution of amine **118** (16.0 mg, 0.036 mmol) in methanol/3M $HCl_{(aq)}$ solvent mixture (0.76 mL, v/v = 3:1) was stirred at room temperature for 4.5 h. After the volatiles were removed under reduced pressure, the residue was purified by column chromatography (gradient ethyl acetate/methanol = 19:1 to 1:1), to afford 8.3 mg (80%) of the product **89**, as a viscous oil. ^{1}H NMR (500 MHz, CD_3OD) δ 4.11-4.06 (m, 1H), 3.99-3.84 (m, 3H), 3.41 (dd, *J* = 8.9, 2.8 Hz, 1H), 3.31-3.22 (m, 3H), 3.16-2.95 (m, 3H), 2.68 (t, *J* = 11.1 Hz, 1H), 1.76-1.56 (m, 2H), 1.40-1.20 (m, 10H), 0.88 (t, *J* = 6.6 Hz, 3H). ^{13}C NMR (125 MHz, CD_3OD) δ 75.2,71.3, 67.0, 66.1, 61.0, 55.4 (2C), 33.0, 30.6, 30.3, 28.0, 24.3, 23.7, 14.4.

3.5. (4a*R*,7*S*,8*S*,8a*S*)-5-(5-(bicyclo[1.1.1]pentan-1-yl)pentyl)-7-((*tert*-butyldimethylsilyl)oxy)-2,2-dimethylhexahydro-4*H*-[1,3]dioxino[5,4-*b*]pyridin-8-ol (95) and (4a*R*,7*S*,8*R*,8a*S*)-5-(5-(bicyclo[1.1.1]pentan-1-yl)pentyl)-8-((*tert*-butyldimethylsilyl)oxy)-2,2-dimethylhexahydro-4*H*-[1,3]dioxino[5,4-*b*]pyridin-7-ol (96)

A solution of amine **85**[3] (30.0 mg; 0.095 mmol), iodide **80** (37.0 mg; 0.14 mmol) and K_2CO_3 (46.0 mg; 0.33 mmol) in DMF (0.3 mL) was stirred at 80 °C under an argon atmosphere. After 6 h, the mixture was diluted with diethyl ether, washed with saturated $NaHCO_{3(aq)}$ and H_2O, dried over anhydrous $MgSO_4$, filtered and concentrated under reduced pressure. The crude residue was purified by column chromatography (petroleum ether/ethyl acetate = 7:3), to afford 27.7 mg (63%) of the product **95** and 13.7 mg (31%) of the product **96**, both as viscous oils.

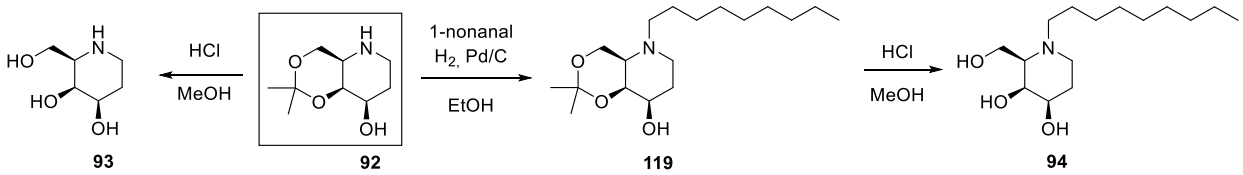
(4a*R*,7*S*,8*S*,8a*S*)-5-(5-(bicyclo[1.1.1]pentan-1-yl)pentyl)-7-((*tert*-butyldimethylsilyl)oxy)-2,2-dimethylhexahydro-4*H*-[1,3]dioxino[5,4-*b*]pyridin-8-ol (**95**): ^{1}H NMR (500 MHz, $CDCl_3$) δ 4.19-4.14 (m, 1H), 3.97-3.79 (m, 3H), 3.26 (td, *J* = 8.5, 4.1 Hz, 1H), 2.92 (dd, *J* = 11.2, 4.7 Hz, 1H), 2.65-2.45 (m, 2H), 2.42 (s, 1H), 2.31 (d, *J* = 8.2 Hz, 1H), 2.19 (br s, 1H), 2.07 (t, *J* = 10.6 Hz, 1H), 1.61 (s, 6H), 1.43 (s, 6H), 1.40-1.17 (m, 8H), 0.89 (s, 9H), 0.10 (d, *J* = 9.3 Hz, 6H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 99.7, 77.5, 70.6, 69.7, 61.1, 57.4, 56.6, 52.8, 50.4, 45.9, 32.7, 28.4, 27.7, 27.5, 26.6, 26.0, 24.2, 20.0, 18.2, -4.3, -4.4. IR (ATR): $\tilde{\nu}$= 3572, 3494, 2958, 2928, 2905, 2867, 1462, 1381, 1278, 1252, 1220 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{25}H_{48}NO_4Si$: 454.3347, found: 454.3359.

(4a*R*,7*S*,8*R*,8a*S*)-5-(5-(bicyclo[1.1.1]pentan-1-yl)pentyl)-8-((*tert*-butyldimethylsilyl)oxy)-2,2-dimethylhexahydro-4*H*-[1,3]dioxino[5,4-*b*]pyridin-7-ol (**96**): ^{1}H NMR (500 MHz, $CDCl_3$) δ 4.06-4.02 (m, 1H), 4.02-3.92 (m, 2H), 3.85 (dd, J = 12.7, 2.9 Hz, 1H), 3.35 (dd, J = 9.3, 3.7 Hz, 1H), 3.14 (dd, J = 10.9, 4.5 Hz, 1H), 2.67-2.56 (m, 1H), 2.48-2.38 (m, 1H), 2.42 (s, 1H), 2.15 (br s, 1H), 2.11-2.02 (m, 2H), 1.61 (s, 6H), 1.48-1.16 (m, 8H), 1.42 (s, 3H), 1.40 (s, 3H), 0.92 (s, 9H), 0.12 (s, 6H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 99.3, 77.7, 70.4, 68.2, 61.5, 57.1, 55.9, 53.0, 50.5, 45.9, 32.7, 28.5, 27.7, 27.5, 26.6, 26.0, 24.9, 20.1, 18.4, -4.1, -4.2. IR (ATR): $\tilde{\nu}$= 3566, 2958, 2929, 2904, 2800, 1463, 1380, 1251, 1195 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{25}H_{48}NO_4Si$: 454.3347, found: 454.3363.

3.6. (2*R*,3*S*,4*R*,5*S*)-1-(5-(bicyclo[1.1.1]pentan-1-yl)pentyl)-2-(hydroxymethyl)piperidine-3,4,5-triol (53)

Described here is the preparation of **53** from **95**; deprotection of **96** also afforded product **53**. A solution of amine **95** (22.1 mg; 0.047 mmol) in methanol/3M $HCl_{(aq)}$ solvent mixture (1.05 mL, v/v = 3.2:1) was stirred at room temperature for 48 h. After the volatiles were removed under reduced pressure, the residue was purified by three consecutive chromatographies: column chromatography (gradient ethyl acetate/methanol/25% $NH_{3\,(aq)}$= 9:1:0.05 to 3:2:0.05), ion exchange chromatography (H_2O then 1M $NH_{3\,(aq)}$) and column chromatography (ethyl acetate/methanol/25% $NH_{3\,(aq)}$= 7:3:0.05) to afford 7.1 mg (50%) of the product **53**, as a viscous oil. $[\alpha]_D^{20}$ −12.9 (*c* 0.0059 in MeOH). ^{1}H NMR (500 MHz, CD_3OD) δ 4.00 (dd, *J* = 3.2, 1.8 Hz, 1H), 3.86-3.79 (m, 3H), 3.25 (dd, *J* = 9.2, 3.3 Hz, 1H), 3.03 (dd, *J* = 11.3, 4.9 Hz, 1H), 2.82-

2.74 (m, 1H), 2.64-2.55 (m, 1H), 2.54-2.49 (m, 1H), 2.43 (s, 1H), 2.23 (t, *J* = 10.8 Hz, 1H), 1.67 (s, 5H), 1.58-1.48 (m, 2H), 1.45-1.39 (m, 2H), 1.35-1.24 (m, 5H). ^{13}C NMR (125 MHz, CD_3OD) δ 76.9, 72.0, 68.6, 65.4, 62.1, 57.5, 54.1, 51.2, 46.8, 33.6, 28.7, 28.2, 27.5, 24.9. IR (ATR): $\tilde{\nu}$= 3366, 2960, 2867, 2241, 2078, 1622, 1423, 1354, 1194 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{16}H_{30}NO_4$: 300.2169, found: 300.2177.



Scheme S4 Synthesis of 4-*epi*-fagomine and the *N*-alkylated analogue.

3.7. (2*R*,3*S*,4*R*)-2-(hydroxymethyl)piperidine-3,4-diol (93)[6]

The compound **93** was prepared from **92**[6] (made using D-proline as the catalyst) according to the literature procedure.[6]

^{1}H NMR (500 MHz, CD_3OD) δ 3.97-3.94 (m, 1H), 3.86-3.73 (m, 3H), 3.37-3.29 (m, 1H), 3.27-3.20 (m, 1H), 3.01 (td, *J* = 13.4, 3.4 Hz, 1H), 2.14-2.00 (m, 1H), 1.90-1.81 (m, 1H). ^{13}C NMR (125 MHz, CD_3OD) δ 69.2, 67.8, 62.1, 61.2, 43.7, 26.2.

3.8. (4a*R*,8*R*,8a*S*)-2,2-dimethyl-5-nonylhexahydro-4*H*-[1,3]dioxino[5,4-*b*]pyridin-8-ol (119)

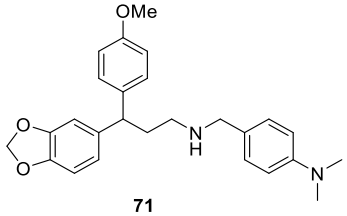
A mixture of amine **92**[6] (made using D-proline as the catalyst) (25.5 mg; 0.136 mmol), nonanal (95.0 mg; 0.66 mmol) and 10% Pd/C (28.0 mg; 0.026 mmol) in ethanol (3.8 mL) was stirred for 3 h under a hydrogen atmosphere (4 atm). The mixture was filtered, concentrated under reduced pressure and purified by column chromatography (gradient methylene chloride/methanol = 49:1 to 7:3), to afford 23.2 mg (54%) of the product **119**, as a colorless oil. $[\alpha]_D^{20}$ −24.8 (*c* 0.01 in MeOH). ^{1}H NMR (500 MHz, CD_3OD) δ 4.14-4.07 (m, 1H), 4.01-3.88 (m, 2H), 3.49 (dt, *J* = 11.9, 4.1 Hz, 1H), 2.93 (dt, *J* = 11.6, 3.0 Hz, 1H), 2.72-2.62 (m, 1H) 2.52-2.42 (m, 1H), 2.26 (t, *J* = 11.8 Hz, 1H), 2.10 (s, 1H), 1.95 (qd, *J* = 12.3, 3.8 Hz, 1H), 1.66-1.56 (m, 1H), 1.53-1.36 (m, 8H), 1,36-1.18 (m, 12H), 0.87 (t, *J* = 6.6 Hz, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 101.4, 71.8, 71.3, 62.8, 58.6, 55.3, 52.2, 33.9, 31.6, 31.5, 31.3, 30.6, 29.8, 28.7, 25.6, 24.6, 20.5, 15.3. IR (ATR): $\tilde{\nu}$= 3580, 3442, 2989, 2926, 2855, 2792, 1465, 1380, 1346, 1270, 1228 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{18}H_{36}NO_3$: 314.2690, found: 314.2699.

3.9. (2*R*,3*S*,4*R*)-2-(hydroxymethyl)-1-nonylpiperidine-3,4-diol (94)

A solution of amine **119** (18.4 mg, 0.059 mmol) in methanol/3M $HCl_{(aq)}$ solvent mixture (1.2 mL, v/v = 3:1) was stirred at room temperature for overnight. After the volatiles were removed under reduced pressure, the residue was purified by column chromatography (gradient methylene chloride/methanol = 49:1 to 1:1), to afford 11.3 mg (70%) of the product **94**, as a viscous oil. $[\alpha]_D^{20}$ −5.8 (*c* 0.0093 in MeOH). ^{1}H NMR (500 MHz, CD_3OD) δ 4.08-4.03 (m, 1H), 4.01-3.89 (m, 2H), 3.80-3.71 (m, 1H), 3.40-3.35 (m, 1H), 3.25-2.95

(m, 4H), 2.11 (qd, *J* = 13.1, 4.3 Hz, 1H), 1.91-1.81 (m, 1H), 1.80-1.61 (m, 2H), 1.45-1.25 (m, 12H), 0.92 (t, *J*=6.6, 3H). ^{13}C NMR (125 MHz, CD_3OD) δ 69.3, 65.9, 33.0, 30.5, 30.3, 27.9, 23.7, 14.4. IR (ATR): $\tilde{\nu}$= 3342, 2956, 2925, 2855, 1575, 1467 cm^{-1}. HRMS (m/z) $[M+H]^+$ calcd. for $C_{15}H_{32}NO_3$: 274.2377, found: 274.2384.

4. Synthesis of non-iminosugar-type mannosidase inhibitors



71

The compound **AR 524, 71** was prepared according to the literature procedure.[7]
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.17-7.09 (m, 4H), 6.80 (d, *J* = 8.3 Hz, 2H), 6.72-6.64 (m,5H), 5.88 (s, 2H), 3.88 (t, *J* = 7.8 Hz, 1H), 3.76 (s, 3H), 3.63 (s, 2H), 2.93-2.88 (s, 7H), 2.59 (t, *J* = 7.3 Hz, 2H), 2.16 (dt, *J* = 4.6 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.0, 150.0, 147.8, 145.9, 139.3, 137.1, 129.4, 128.7, 120.7, 114.0, 112.8, 108.3, 108.2, 100.9, 55.3, 53.2, 47.9, 47.3, 40.8, 35.7. IR (ATR) $\tilde{\nu}$= 2992, 2834, 2804, 1613, 1511, 1486, 1440, 1247, 1179, 1038, 936, 807, 807. HRMS (ESI) m/z calcd. for $C_{26}H_{30}N_2O_3$ 419.2329 $[M+H]^+$; found 419.2319.

5. Biochemical tests

5.1. Inhibition assay for α-glucosidase

5.1.1. Yeast α-glucosidase expression and purification

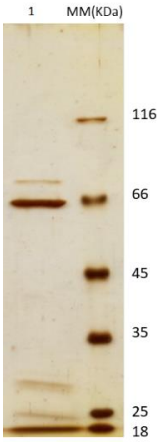
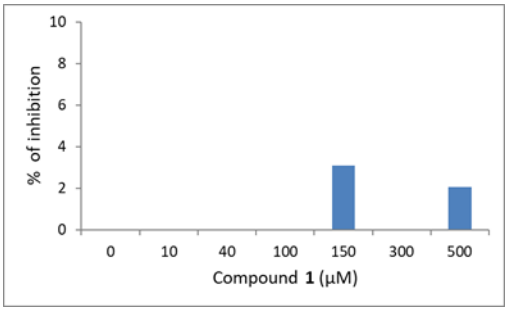
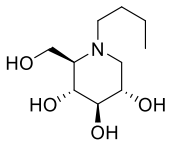


Figure S25 Silver-stained SDS electrophoregram: Sample 1 is α-glucosidase; MM stands for molecular markers

5.1.2. Inhibition assay for α-glucosidase





1
miglustat

Figure S26 Dependence of percentage of inhibition of α-glucosidase on concentration of compound **1.**

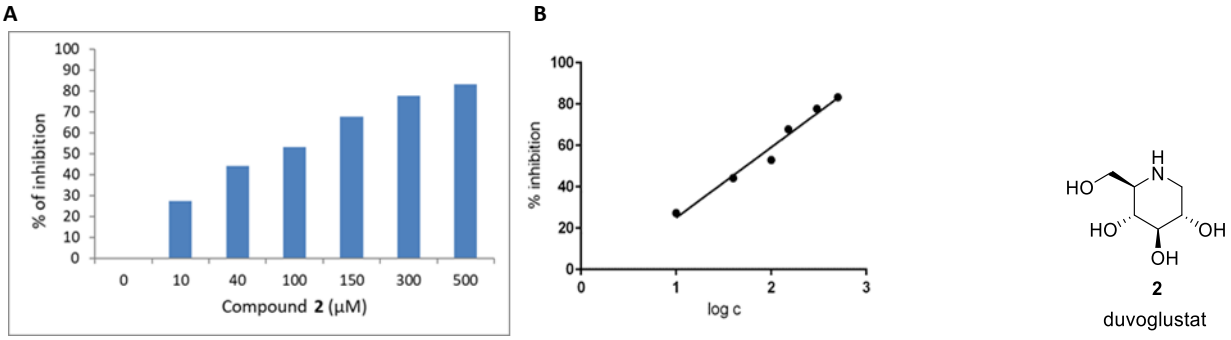


Figure S27 Dependence of percentage of inhibition of α-glucosidase on concentration (**A**) and logc (**B**) of compound **2**.

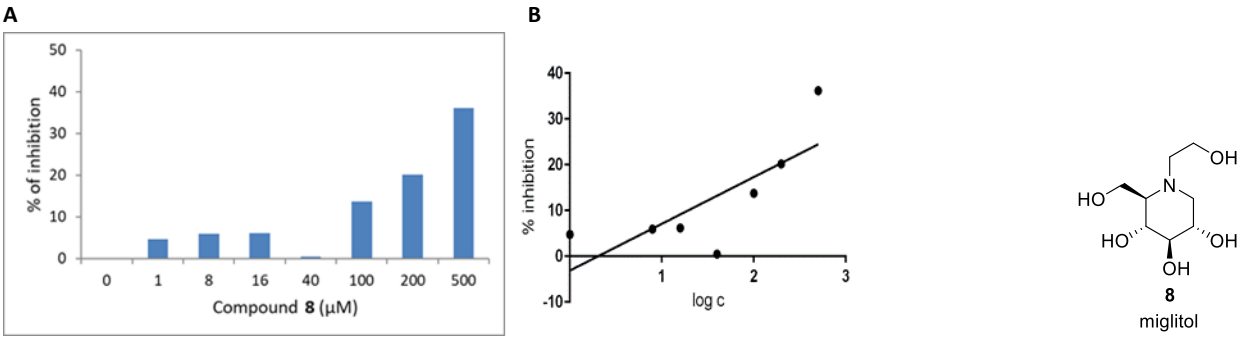


Figure S28 Dependence of percentage of inhibition of α-glucosidase on concentration (**A**) and logc (**B**) of compound **8**.

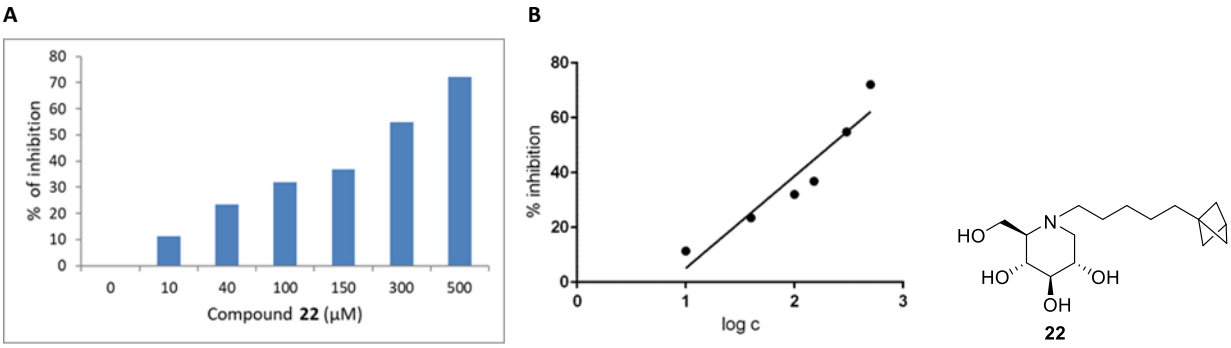


Figure S29 Dependence of percentage of inhibition of α-glucosidase on concentration (**A**) and logc (**B**) of compound **22**.

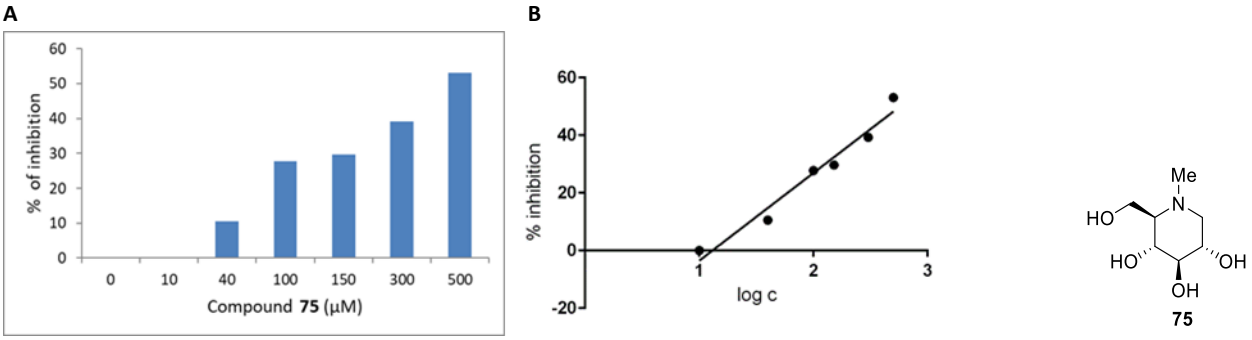


Figure S30 Dependence of percentage of inhibition of α-glucosidase on concentration (**A**) and logc (**B**) of compound **75**.

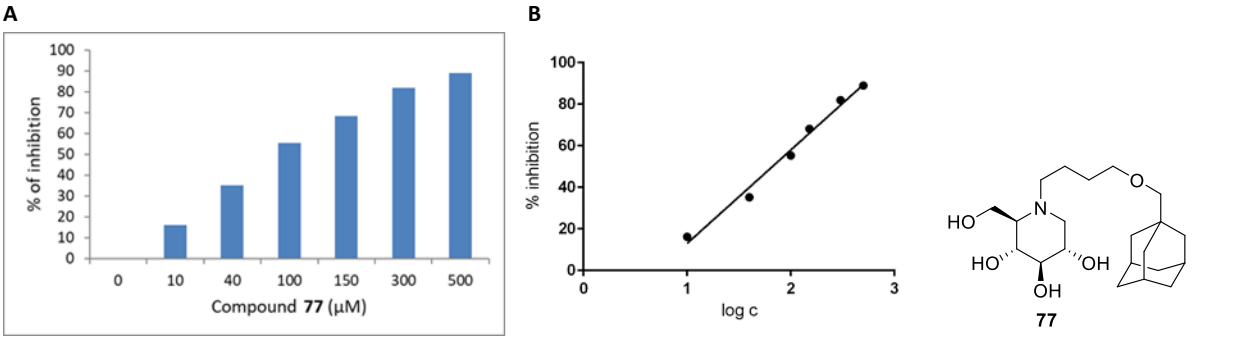


Figure S31 Dependence of percentage of inhibition of α-glucosidase on concentration (**A**) and logc (**B**) of compound **77**.

5.2. Inhibition assay for α-galactosidase

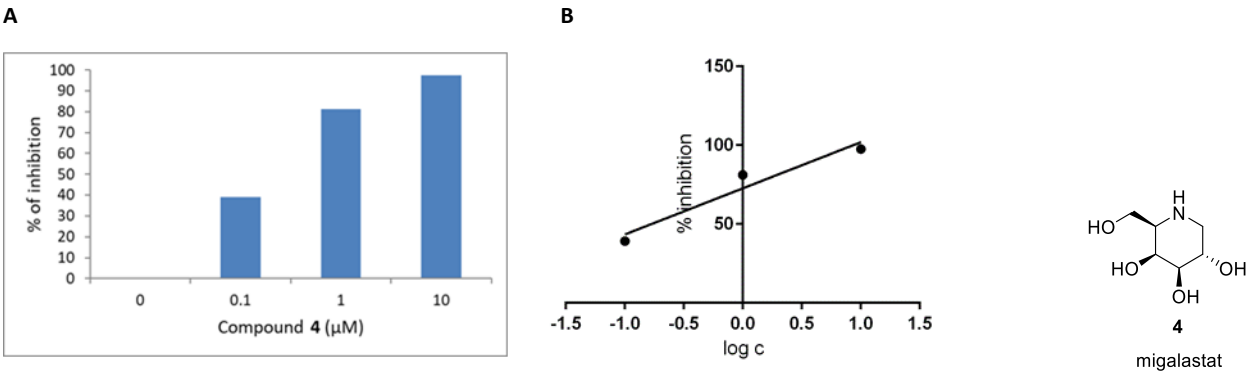


Figure S32 Dependence of percentage of inhibition of α-galactosidase A on concentration (**A**) and logc (**B**) of compound **4**.

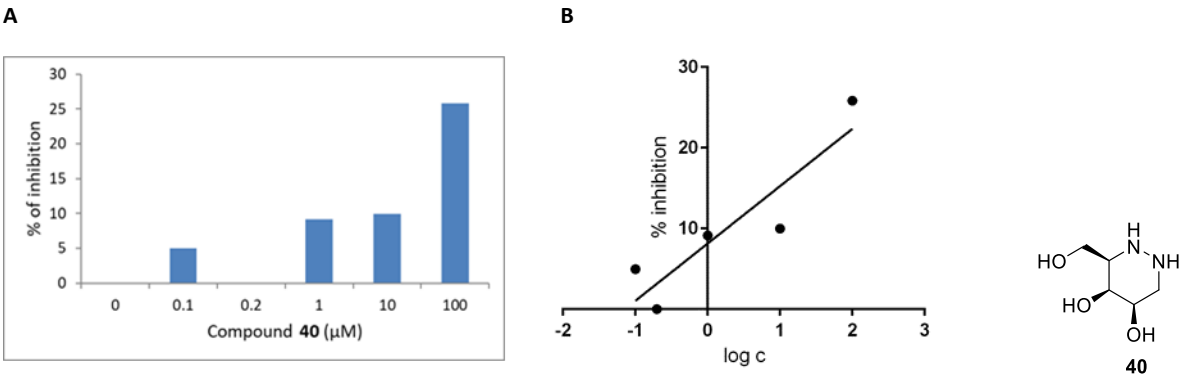


Figure S33 Dependence of percentage of inhibition of α-galactosidase A on concentration (**A**) and logc (**B**) of compound **40**.

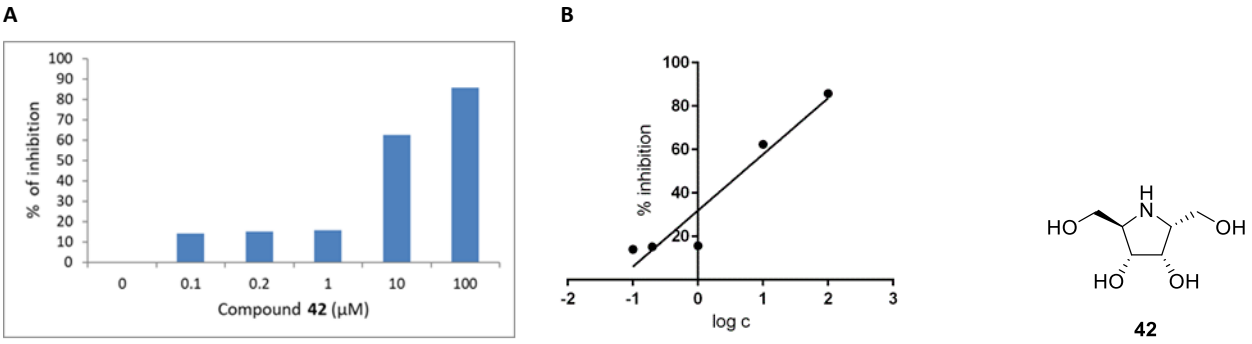


Figure S34 Dependence of percentage of inhibition of α-galactosidase A on concentration (**A**) and logc (**B**) of compound **42**.

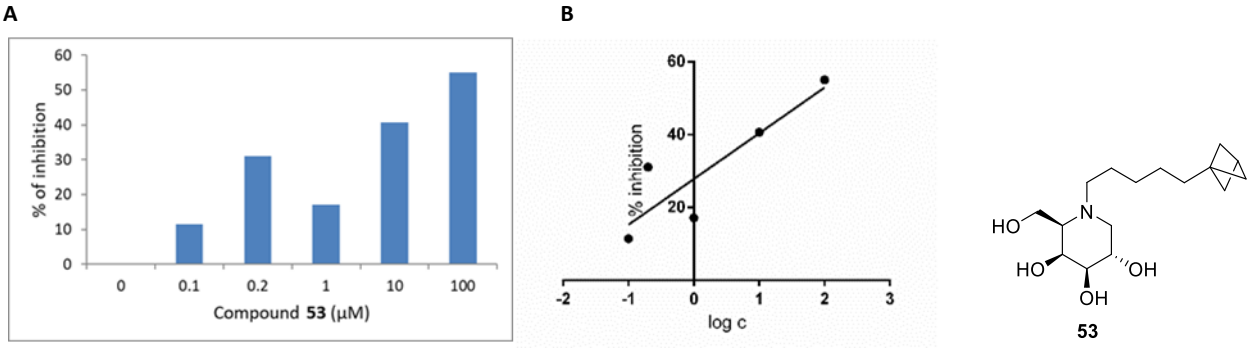


Figure S35 Dependence of percentage of inhibition of α-galactosidase A on concentration (**A**) and logc (**B**) of compound **53**.

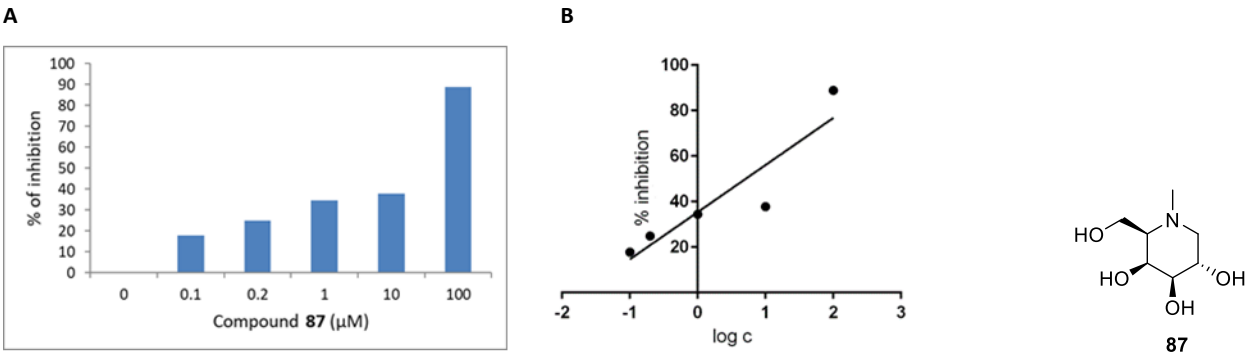


Figure S36 Dependence of percentage of inhibition of α-galactosidase A on concentration (**A**) and logc (**B**) of compound **87**.

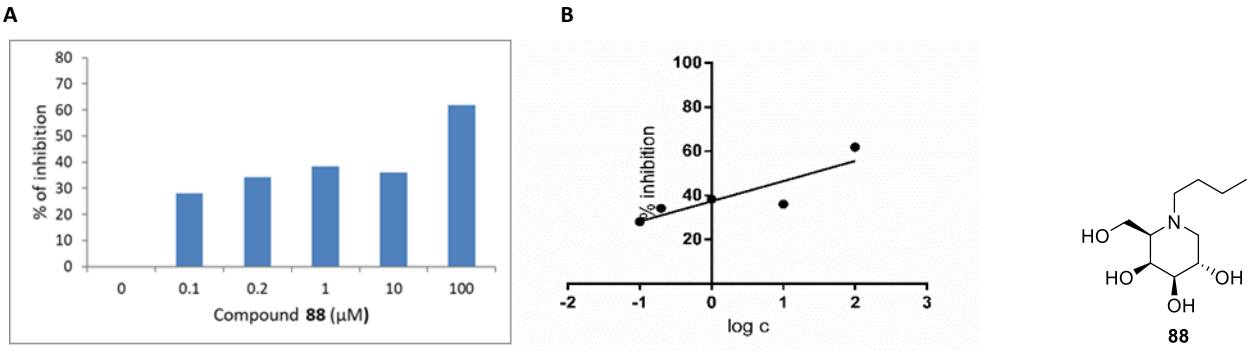
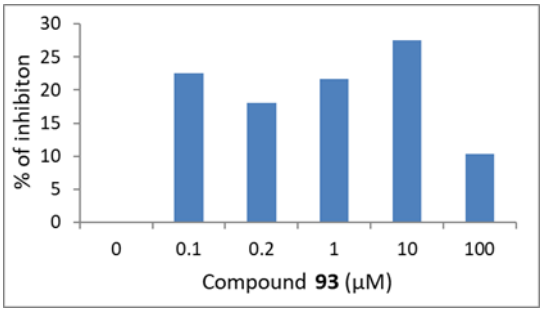
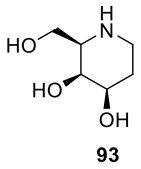


Figure S37 Dependence of percentage of inhibition of α-galactosidase A on concentration (**A**) and logc (**B**) of compound **88**.

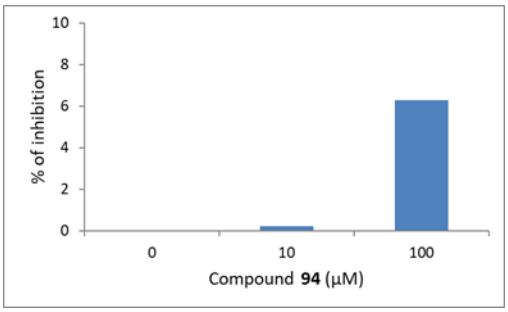
Figure S38 Dependence of percentage of inhibition of α-galactosidase A on concentration of compound **89**.

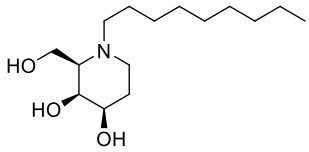




93

Figure S39 Dependence of percentage of inhibition of α-galactosidase A on concentration of compound **93**.

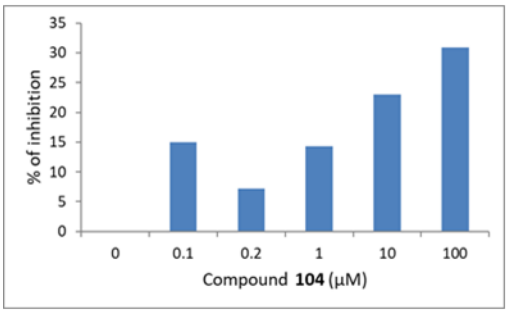




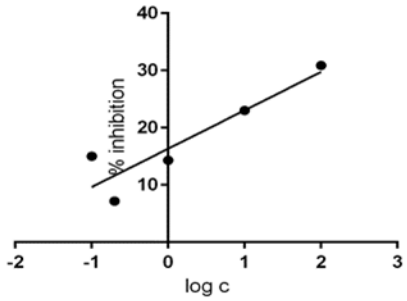
94

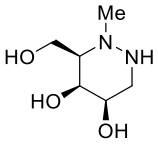
Figure S40 Dependence of percentage of inhibition of α-galactosidase A on concentration of compound **94.**

A



B





104

Figure S41 Dependence of percentage of inhibition of α-galactosidase A on concentration (**A**) and logc (**B**) of compound **104**.

6. Virology

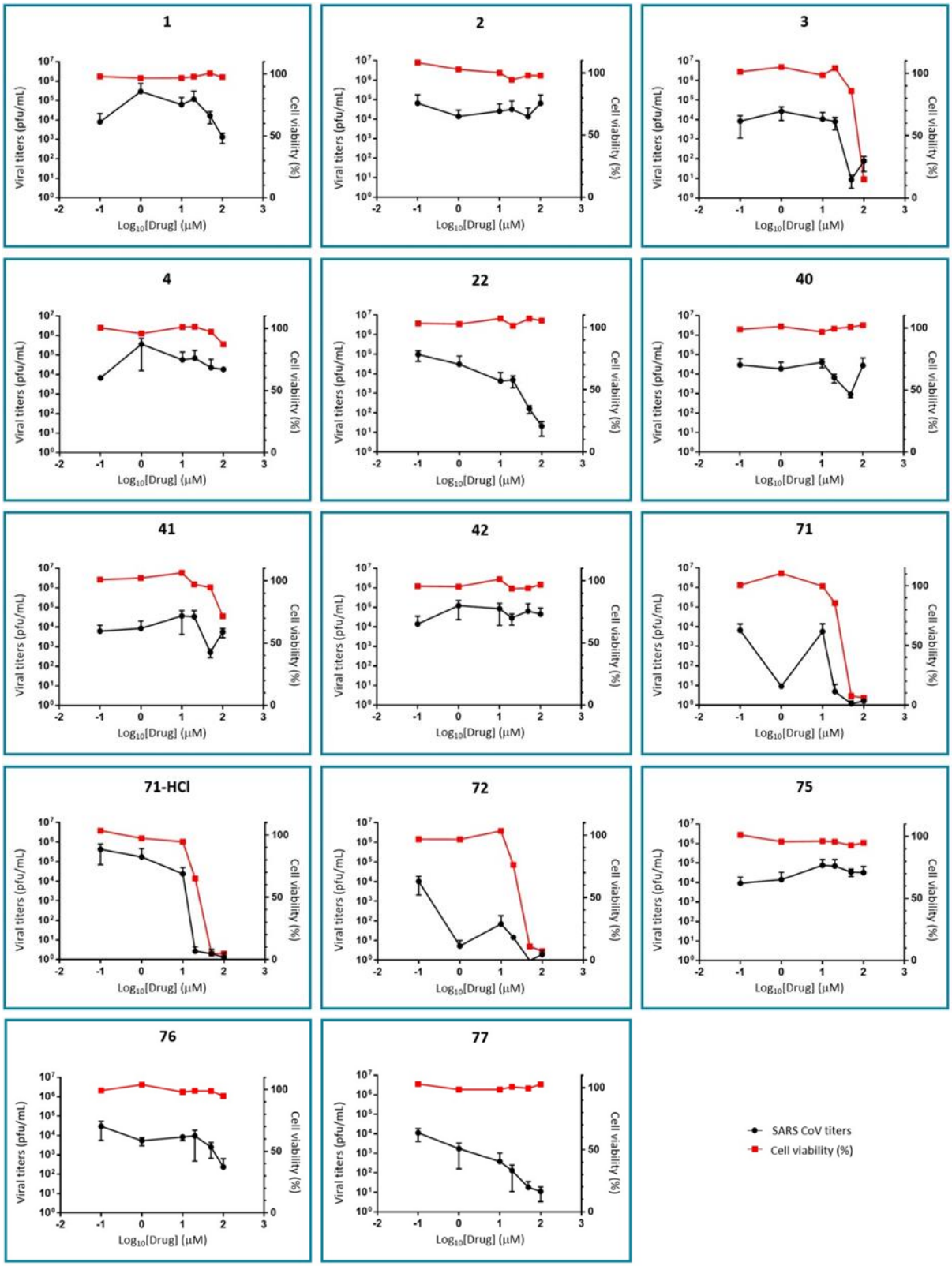


Figure S42 Antiviral activities and cell viabilities for all samples.

The numeric data for the antiviral assays can be downloaded as .xlsx file at the address:

https://www.chem.bg.ac.rs/~mario/SmartRepPVP/

The numeric data for the cytotoxicity assays can be downloaded as .xlsx file at the address:

https://www.chem.bg.ac.rs/~mario/SmartRepCyt/

7. References

[1] L. Yu, K. Ikeda, A. Kato, I. Adachi, G. Godin, P. Compain, O. Martin, N. Asano, α-1-C-Octyl-1-deoxynojirimycin as a pharmacological chaperone for Gaucher disease, *Bioorg. Med. Chem*. **2006**, 14, 7736. doi: 10.1016/j.bmc.2006.08.003.

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[4] N. Asano, S. Ishii, H. Kizu, K. Ikeda, K. Yasuda, A. Kato, O. R. Martin, J.-Q. Fan, In vitro inhibition and intracellular enhancement of lysosomal alpha-galactosidase A activity in Fabry lymphoblasts by 1-deoxygalactonojirimycin and its derivatives, *Eur. J. Biochem*. **2000**, 267, 4179. doi: 10.1046/j.1432-1327.2000.01457.x.

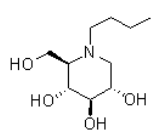
[5] C. Boucheron, P. Compain, O. R. Martin, A stereodivergent approach to 1-deoxynojirimycin, 1-deoxygalactonojirimycin and 1-deoxymannojirimycin derivatives, *Tetrahedron. Lett*. **2006**, 47, 18, 3081. doi: 10.1016/j.tetlet.2006.02.157.

[6] J. Marjanovic Trajkovic, V. Milanovic, Z. Ferjancic, R. N. Saicic, Organocatalyzed synthesis of (−)-4-epi-fagomine and the corresponding pipecolic acids, *Tetrahedron*. **2015**, 71, 6784. doi: 10.1016/j.tet.2015.07.036.

[7] R. Koyama, Y. Kano, K. Kikushima, A. Mizutani, Y. Soeda, K. Miura, T. Hirano, T. Nishio, W. Hakamata, A novel Golgi mannosidase inhibitor: Molecular design, synthesis, enzyme inhibition, and inhibition of spheroid formation, *Bioorg. Med. Chem.* **2020**, 28, 115492. doi: 10.1016/j.bmc.2020.115492.

8. Copies of NMR spectra for selected compounds

(ordered by increasing compound numbers)



1

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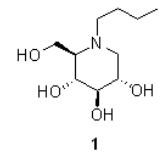
10	Nucleus	1H



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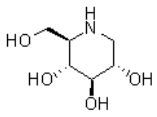

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9	Spectrometer Frequency	399.73
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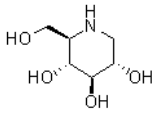

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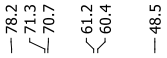

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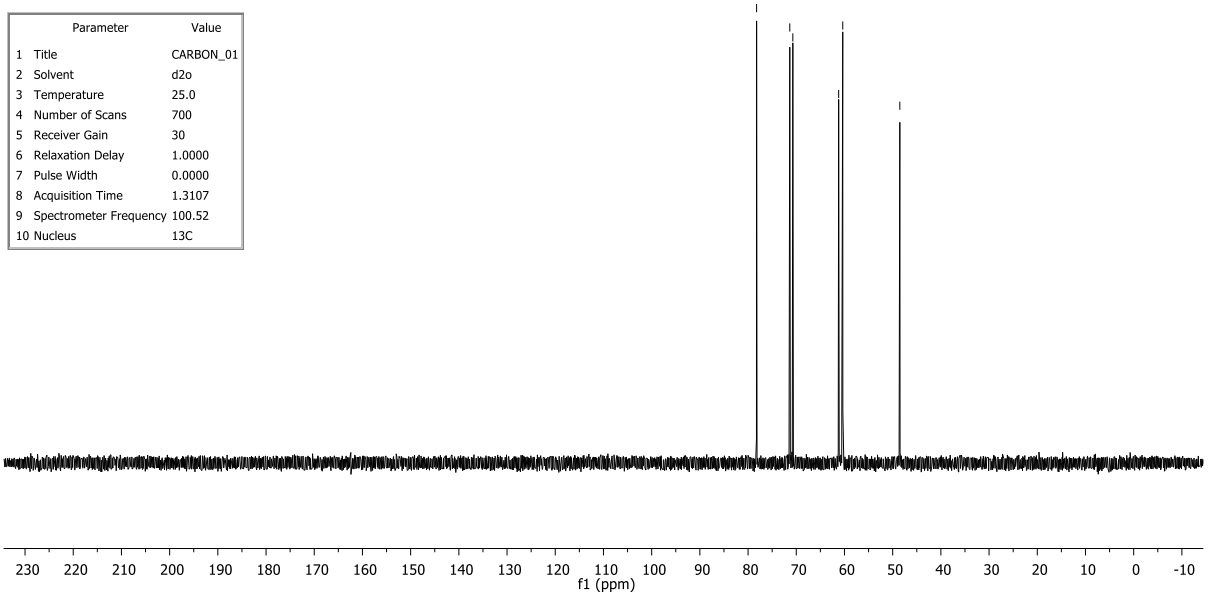
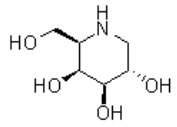
9	Spectrometer Frequency	100.52
10	Nucleus	13C





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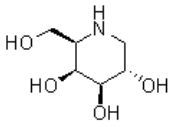
9	Spectrometer Frequency	399.73
10	Nucleus	1H



4

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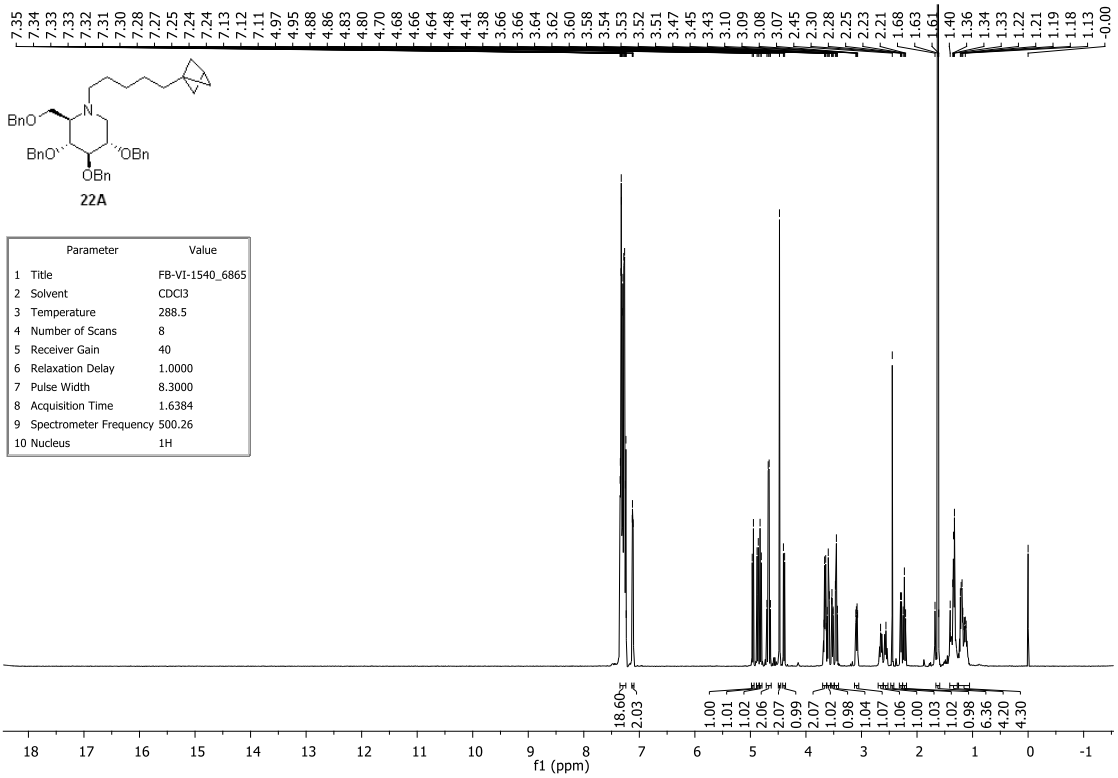
10	Nucleus	13C


BnO
BnO
OBn
OBn
22A
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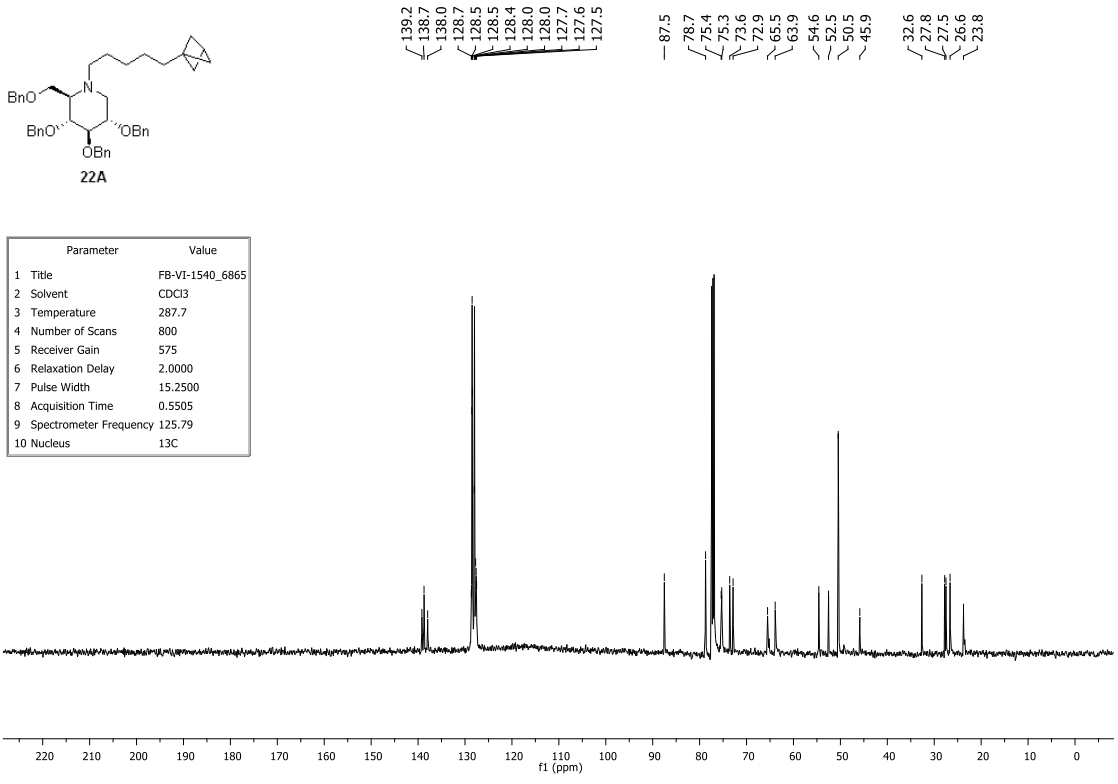
9 Spectrometer Frequency 500.26
10 Nucleus 1H
f1 (ppm)


BnO
BnO
OBn
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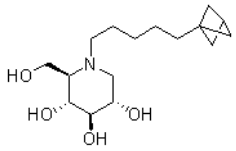
f1 (ppm)



22

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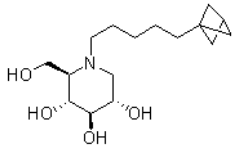
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



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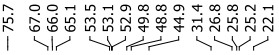

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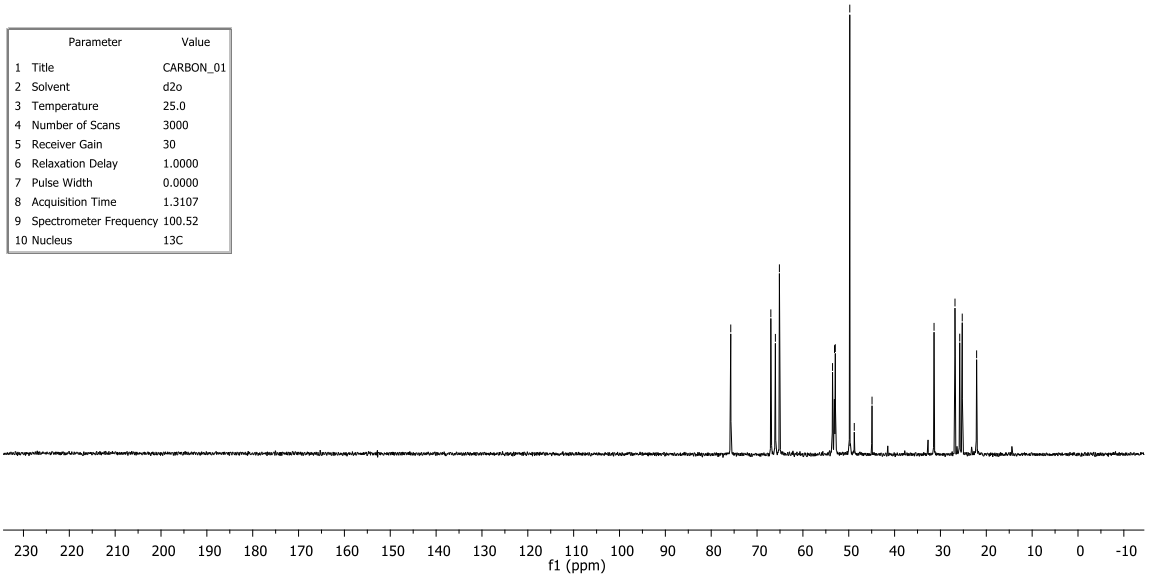

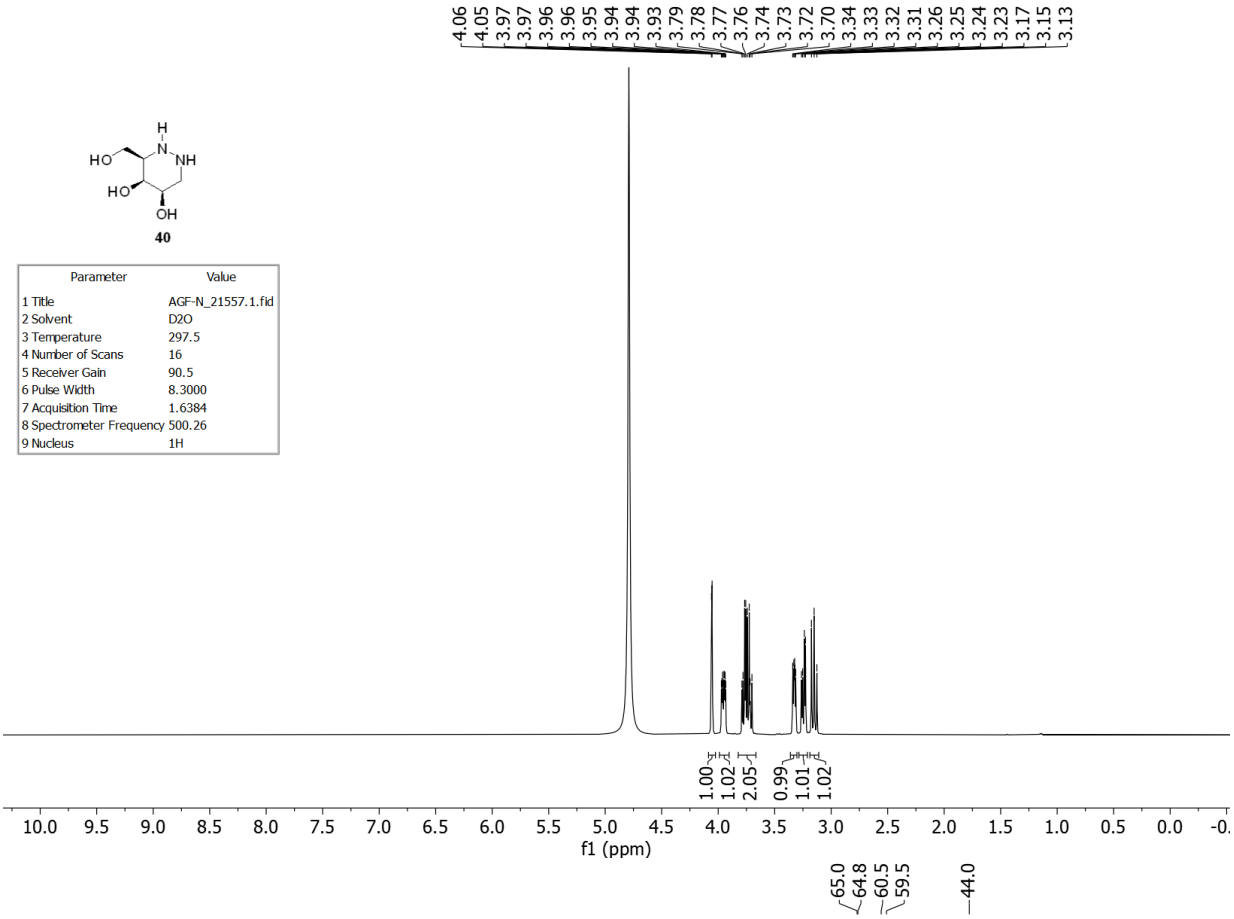

40

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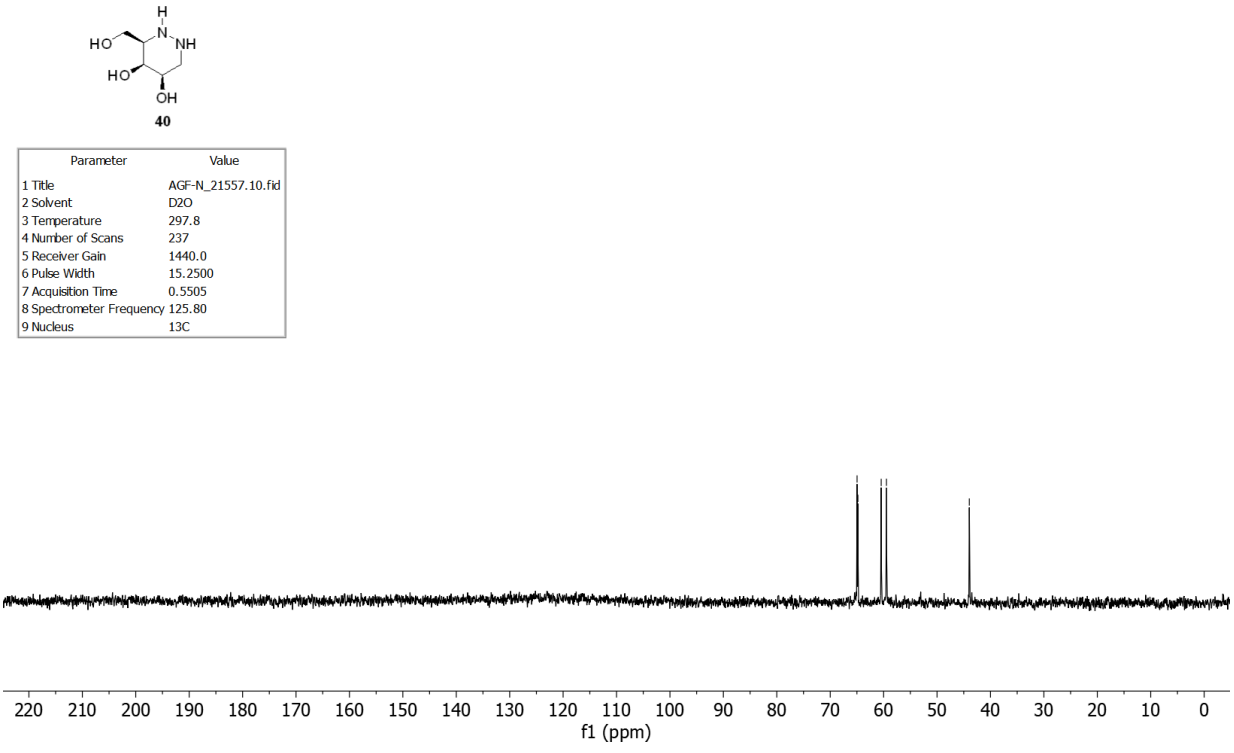
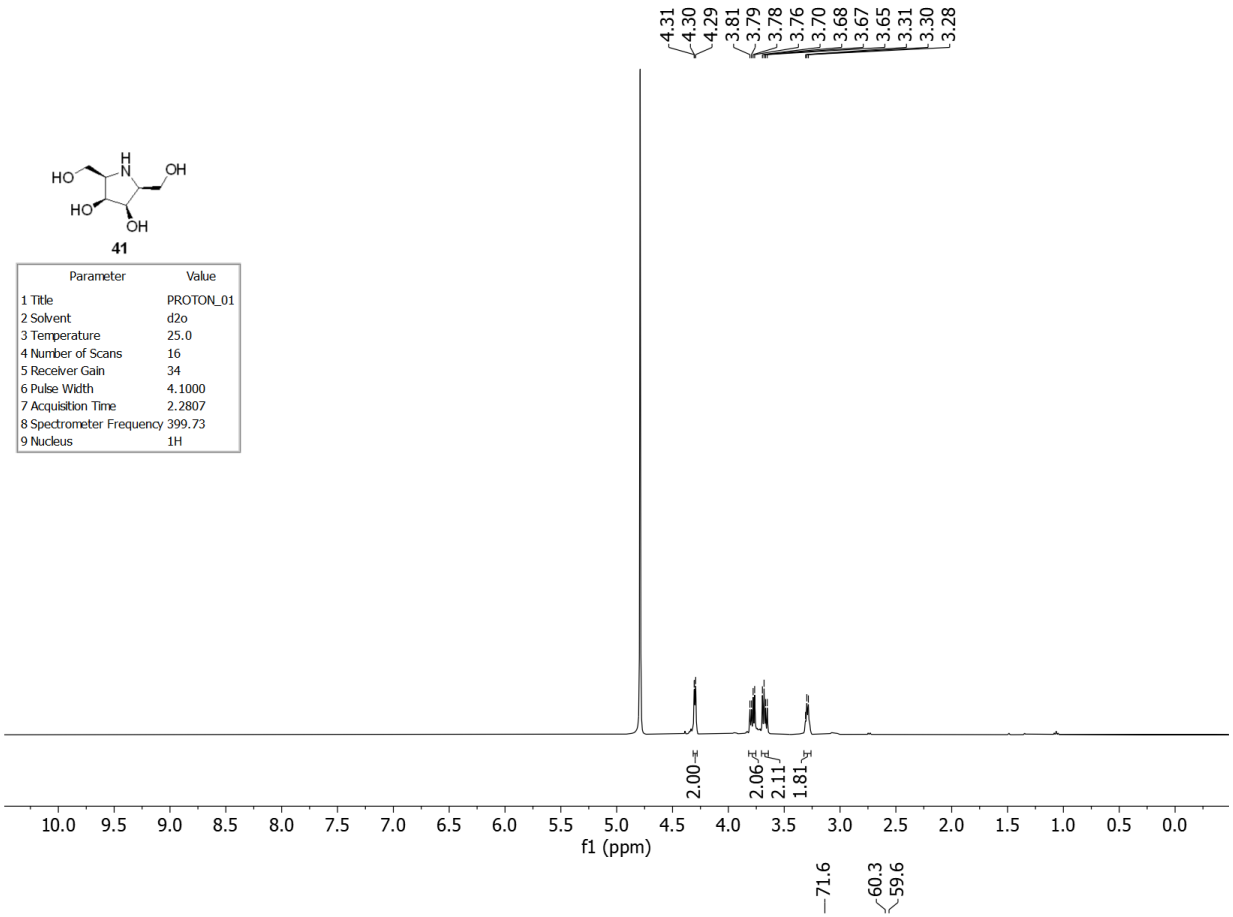
8 Spectrometer Frequency	500.26
9 Nucleus	1H



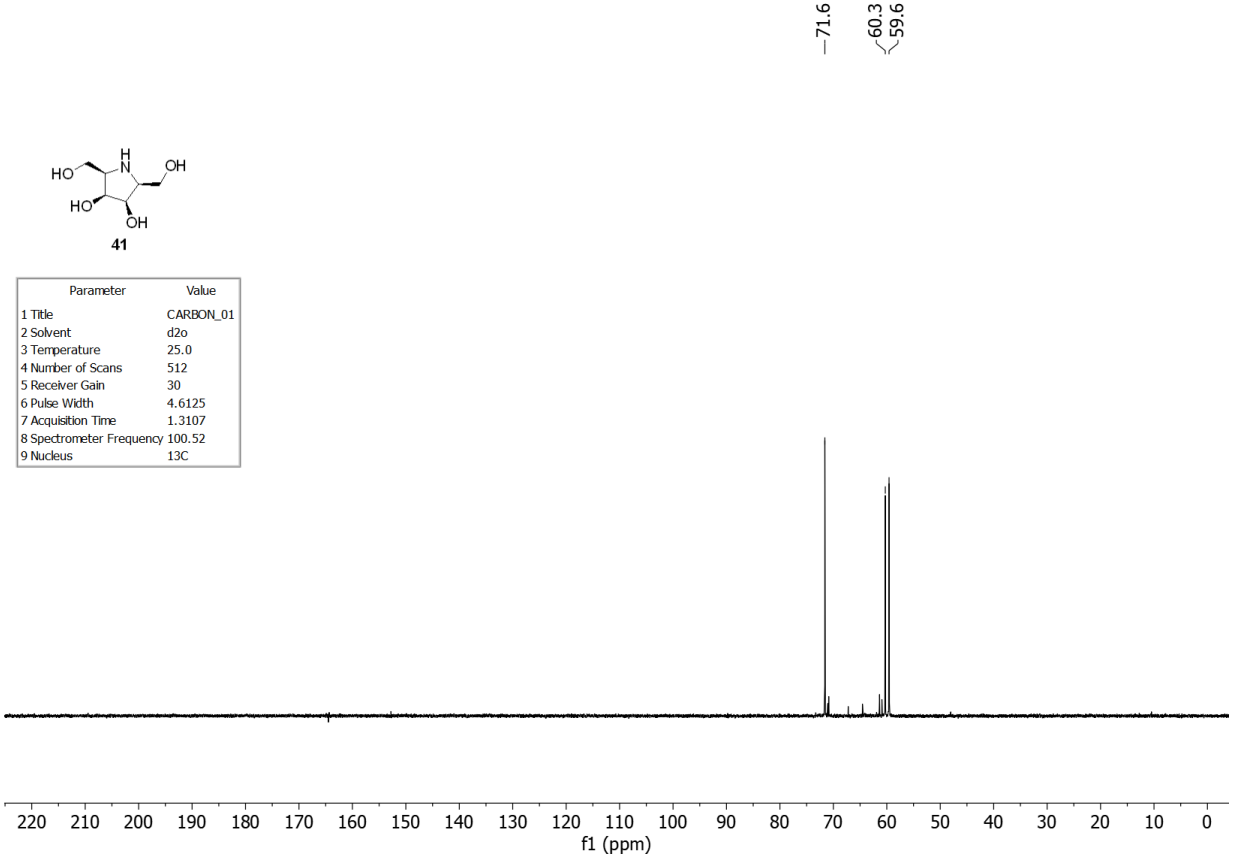
40

Parameter	Value
1 Title	AGF-N_21557.10.fid
2 Solvent	D2O
3 Temperature	297.8
4 Number of Scans	237
5 Receiver Gain	1440.0
6 Pulse Width	15.2500
7 Acquisition Time	0.5505
8 Spectrometer Frequency	125.80
9 Nucleus	13C



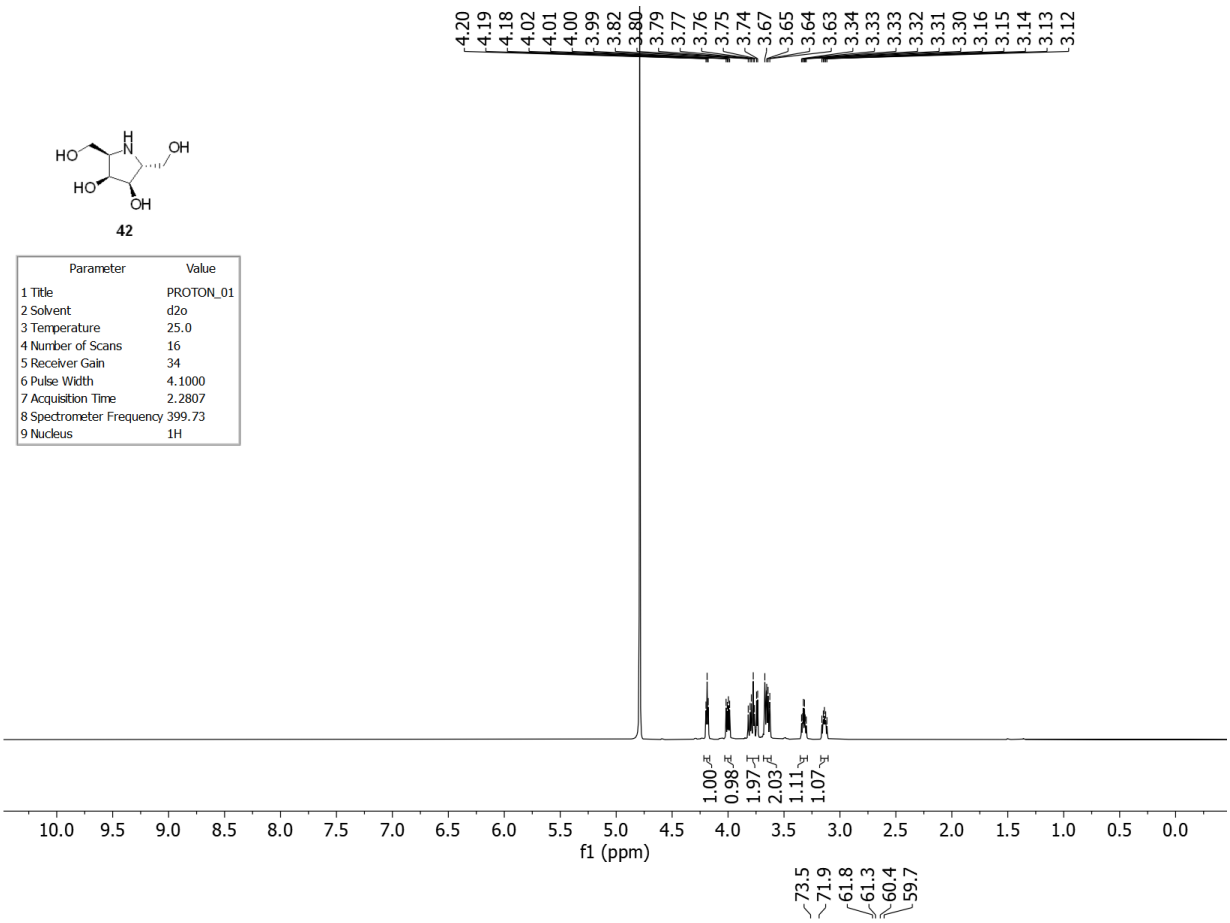
41

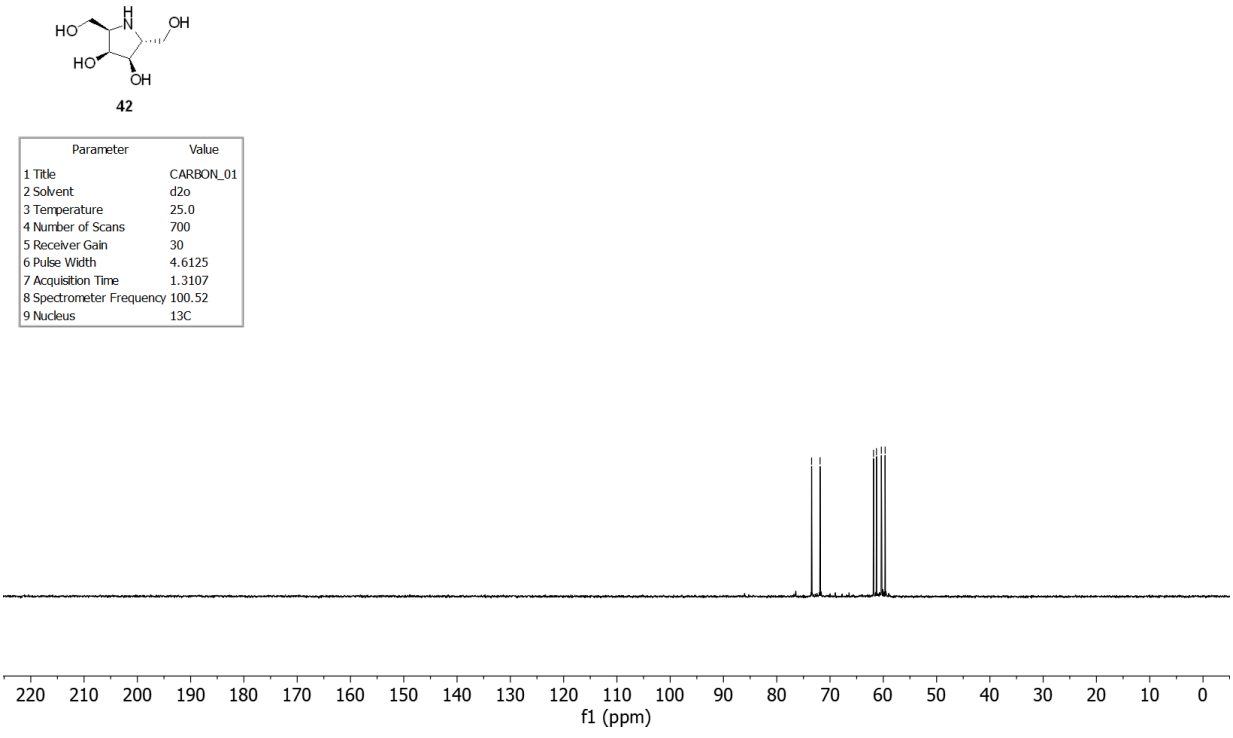
Parameter	Value
1 Title	PROTON_01
2 Solvent	d2o
3 Temperature	25.0
4 Number of Scans	16
5 Receiver Gain	34
6 Pulse Width	4.1000
7 Acquisition Time	2.2807
8 Spectrometer Frequency	399.73
9 Nucleus	1H

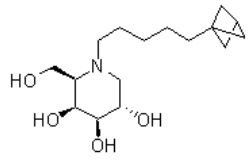


41

Parameter	Value
1 Title	CARBON_01
2 Solvent	d2o
3 Temperature	25.0
4 Number of Scans	512
5 Receiver Gain	30
6 Pulse Width	4.6125
7 Acquisition Time	1.3107
8 Spectrometer Frequency	100.52
9 Nucleus	13C

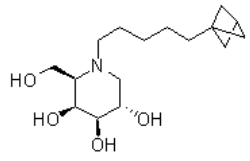

4.20
4.19
4.18
4.02
4.01
4.00
3.99
3.82
3.80
3.79
3.77
3.76
3.75
3.74
3.67
3.65
3.64
3.63
3.34
3.33
3.33
3.32
3.31
3.30
3.16
3.15
3.14
3.13
3.12
HO
OH
HO
OH
H
N
42
Parameter Value
1 Title PROTON_01
2 Solvent d2o
3 Temperature 25.0
4 Number of Scans 16
5 Receiver Gain 34
6 Pulse Width 4.1000
7 Acquisition Time 2.2807
8 Spectrometer Frequency 399.73
9 Nucleus 1H
1.00
0.98
1.97
2.03
1.11
1.07
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


73.5
71.9
61.8
61.3
60.4
59.7
HO
OH
HO
OH
H
N
42
Parameter Value
1 Title CARBON_01
2 Solvent d2o
3 Temperature 25.0
4 Number of Scans 700
5 Receiver Gain 30
6 Pulse Width 4.6125
7 Acquisition Time 1.3107
8 Spectrometer Frequency 100.52
9 Nucleus 13C
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



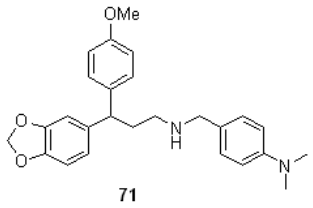
53

	Parameter	Value
1	Title	MVT1082 sve 7892
2	Solvent	MeOD
3	Temperature	297.9
4	Number of Scans	16
5	Receiver Gain	81
6	Relaxation Delay	2.0000
7	Pulse Width	8.3000
8	Acquisition Time	1.6384
9	Spectrometer Frequency	500.26
10	Nucleus	1H



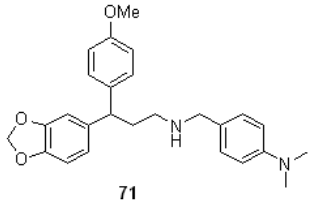
53

	Parameter	Value
1	Title	MVT1082 sve 7892
2	Solvent	MeOD
3	Temperature	298.0
4	Number of Scans	2471
5	Receiver Gain	2050
6	Relaxation Delay	1.5000
7	Pulse Width	15.2500
8	Acquisition Time	0.5505
9	Spectrometer Frequency	125.79
10	Nucleus	13C



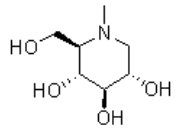
71

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	40
6	Relaxation Delay	2.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



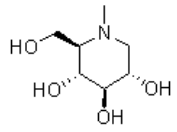
71

	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



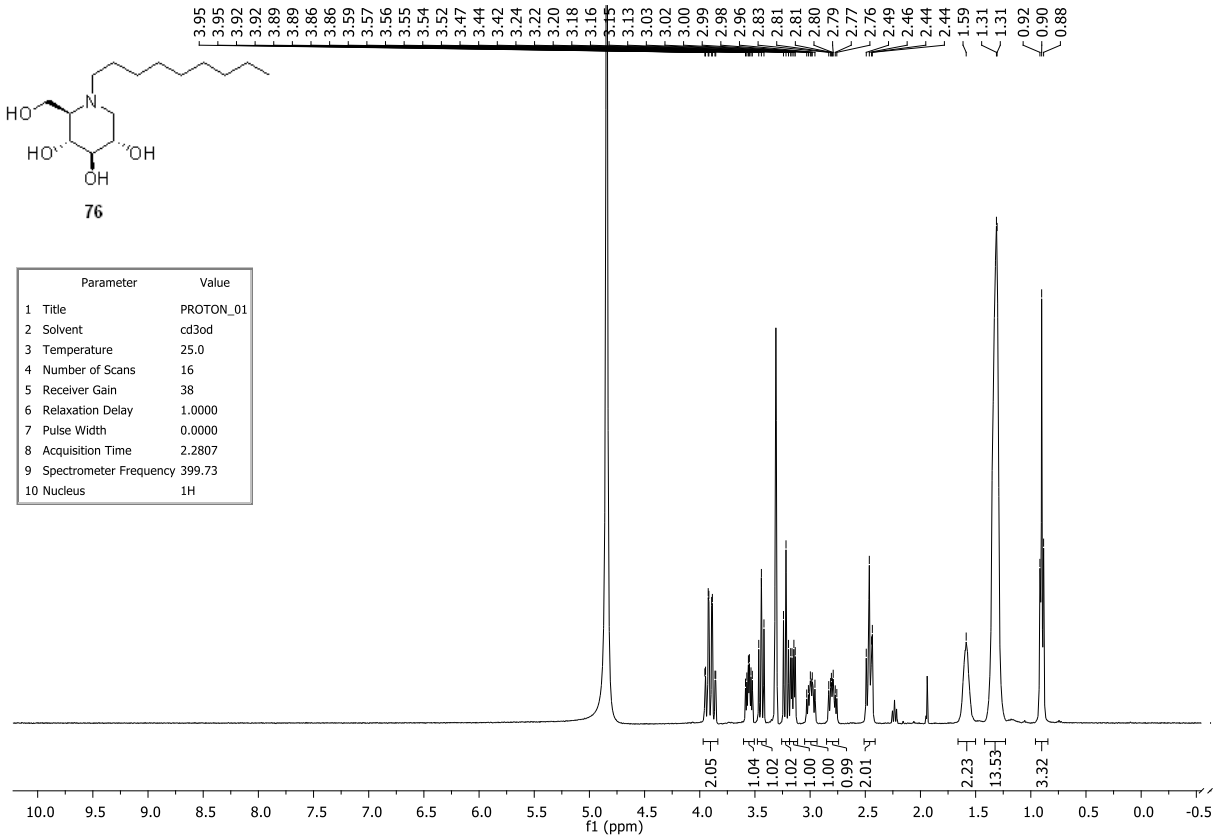
75

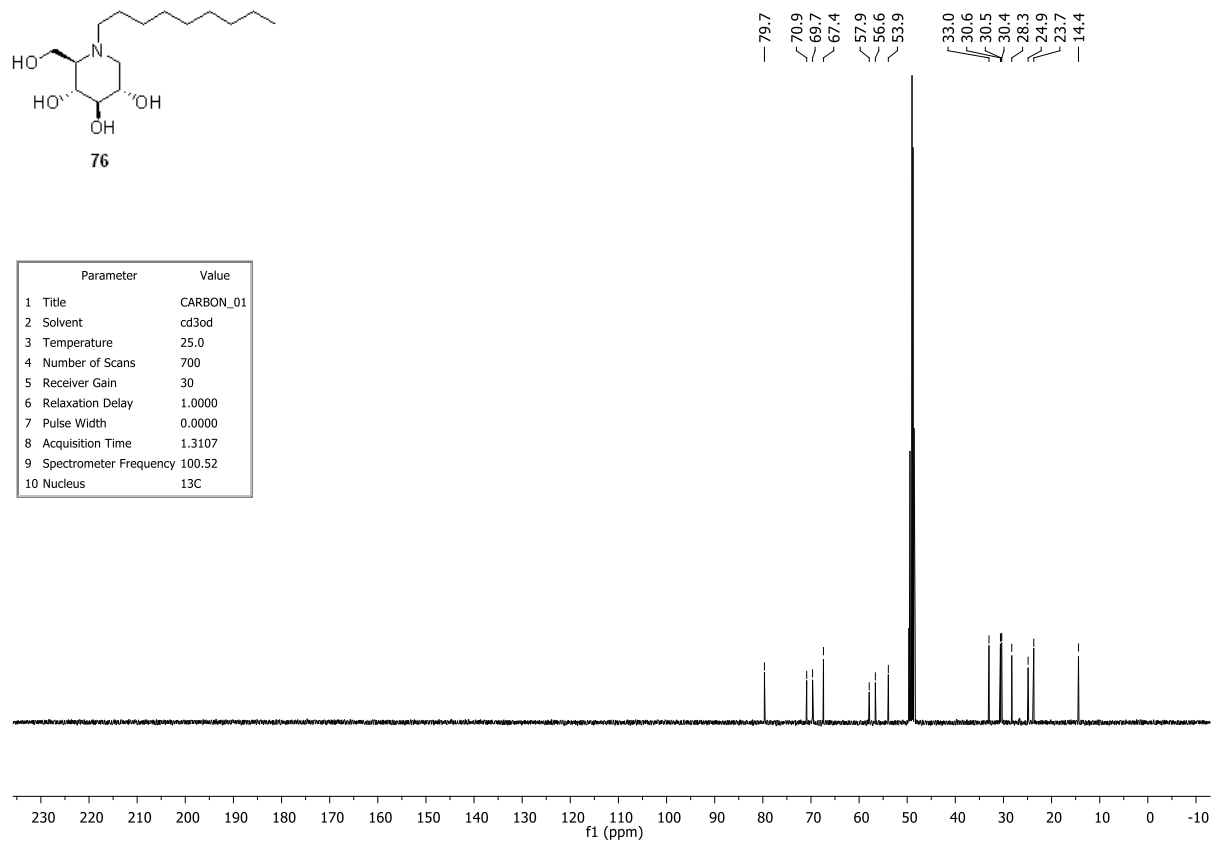
	Parameter	Value
1	Title	PROTON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	40
6	Relaxation Delay	2.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.5559
9	Spectrometer Frequency	399.73
10	Nucleus	1H

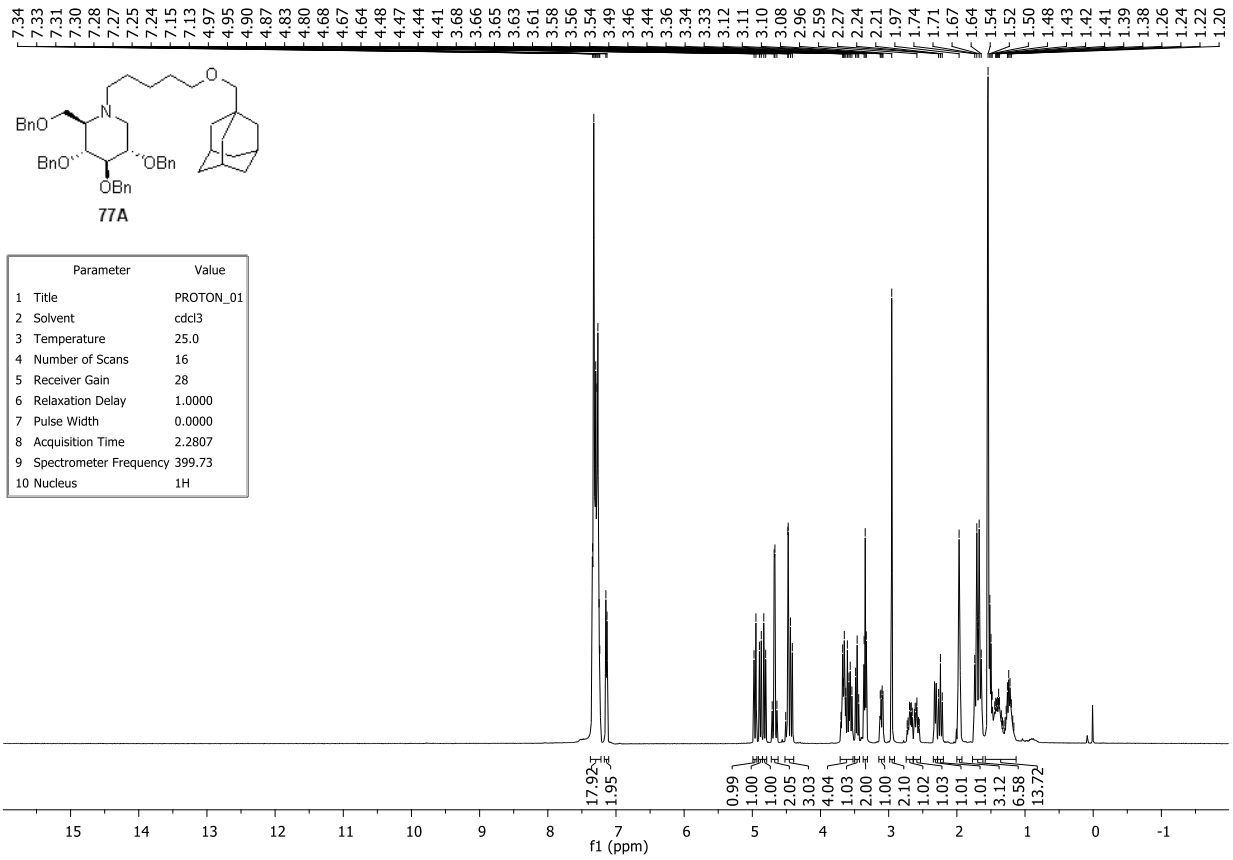


75

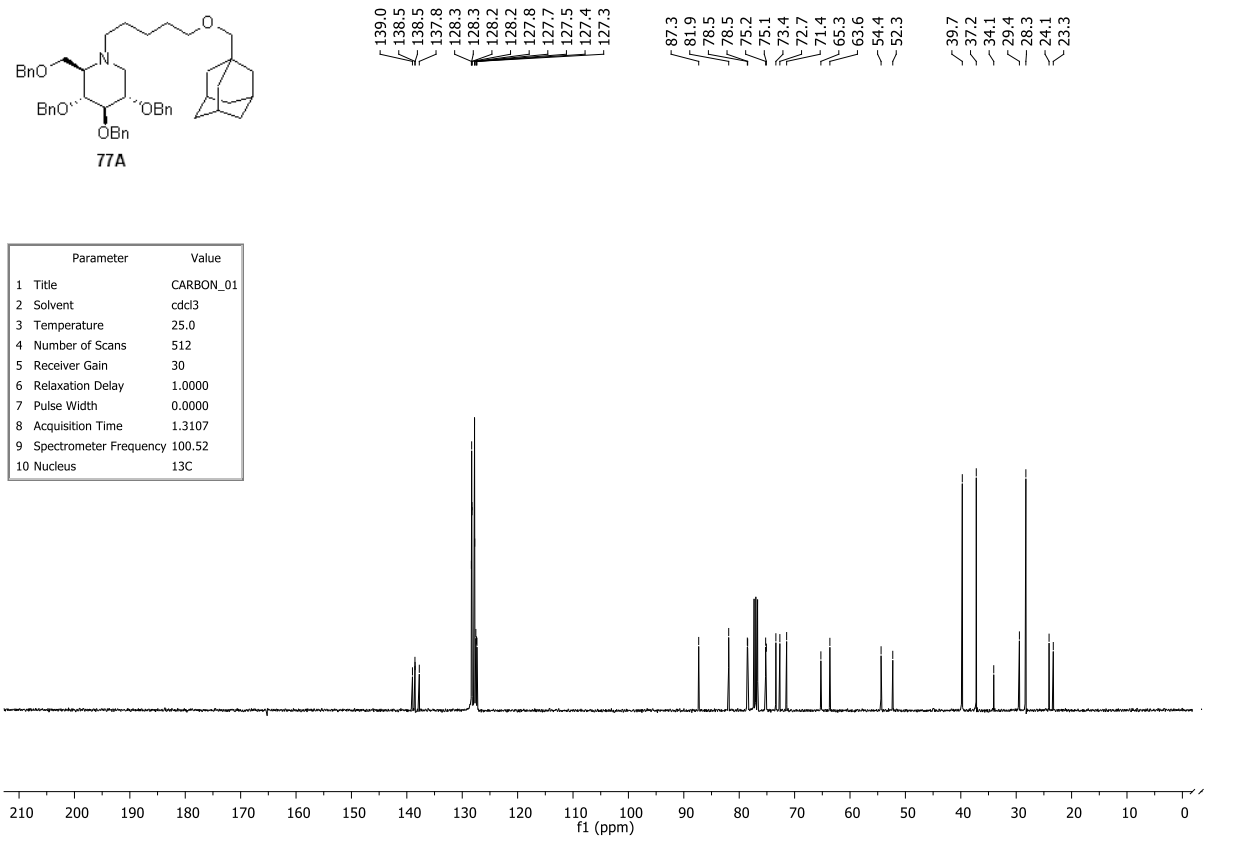
	Parameter	Value
1	Title	CARBON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	700
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C


3.95 3.95 3.92 3.92 3.89 3.89 3.86 3.86 3.59 3.57 3.56 3.55 3.54 3.52 3.47 3.44 3.42 3.24 3.22 3.20 3.18 3.16 3.15 3.13 3.03 3.02 3.00 2.99 2.98 2.96 2.83 2.81 2.81 2.80 2.79 2.77 2.76 2.49 2.46 2.44 2.44 1.59 1.31 1.31 0.92 0.90 0.88
HO
HO
OH
OH
N
76
Parameter Value
1 Title PROTON_01
2 Solvent cd3od
3 Temperature 25.0
4 Number of Scans 16
5 Receiver Gain 38
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 2.2807
9 Spectrometer Frequency 399.73
10 Nucleus 1H
2.05 1.04 1.02 1.02 1.00 1.00 0.99 2.01 2.23 13.53 3.32
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

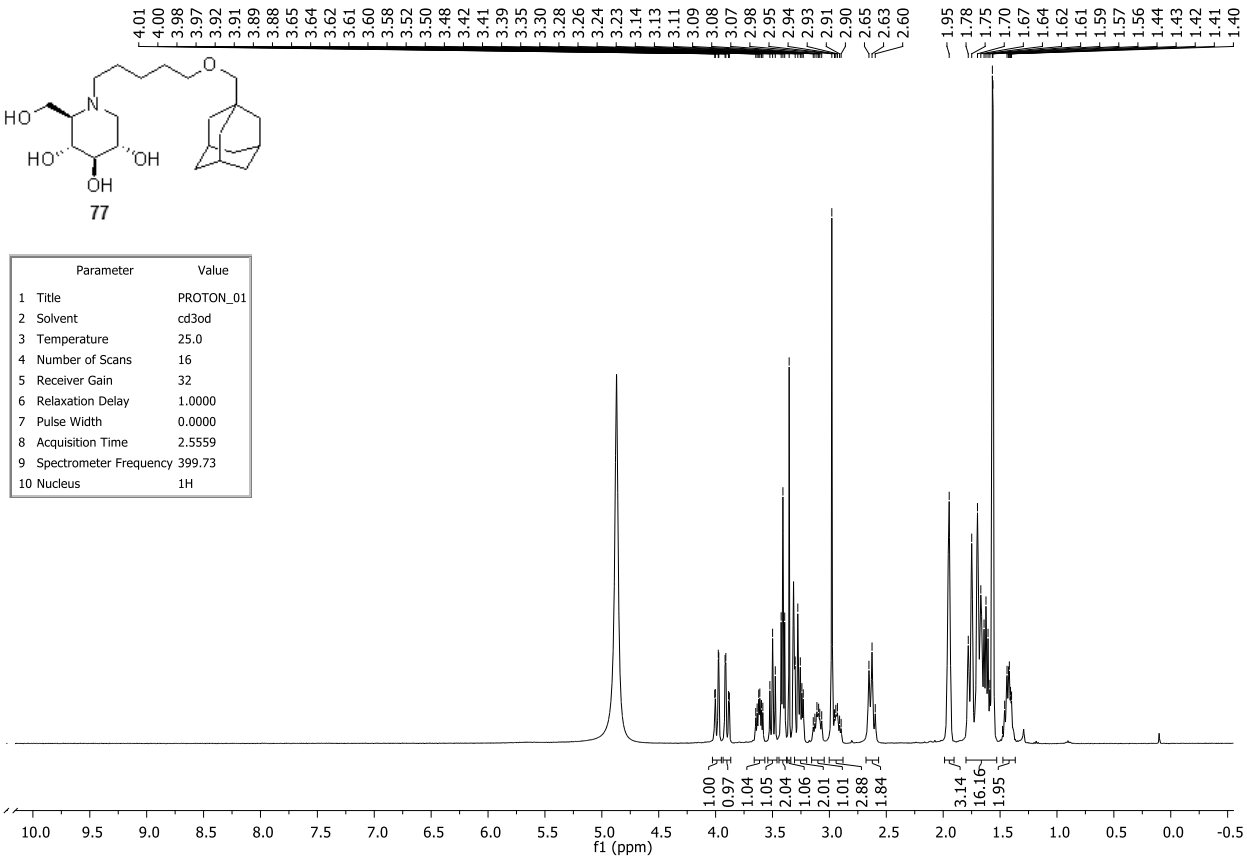

79.7 70.9 69.7 67.4 57.9 56.6 53.9 33.0 30.6 30.5 30.4 28.3 24.9 23.7 14.4
HO
HO
OH
OH
N
76
Parameter Value
1 Title CARBON_01
2 Solvent cd3od
3 Temperature 25.0
4 Number of Scans 700
5 Receiver Gain 30
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 1.3107
9 Spectrometer Frequency 100.52
10 Nucleus 13C
230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



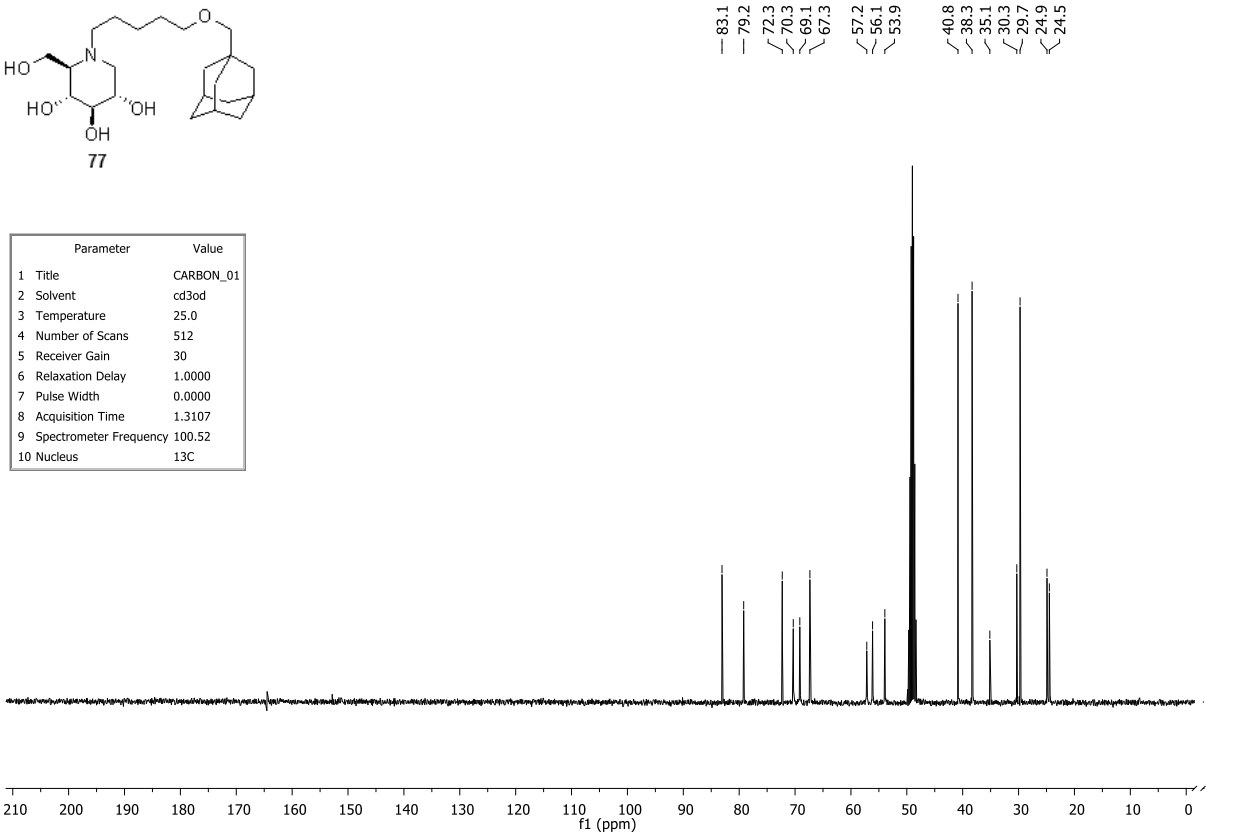
	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	28
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



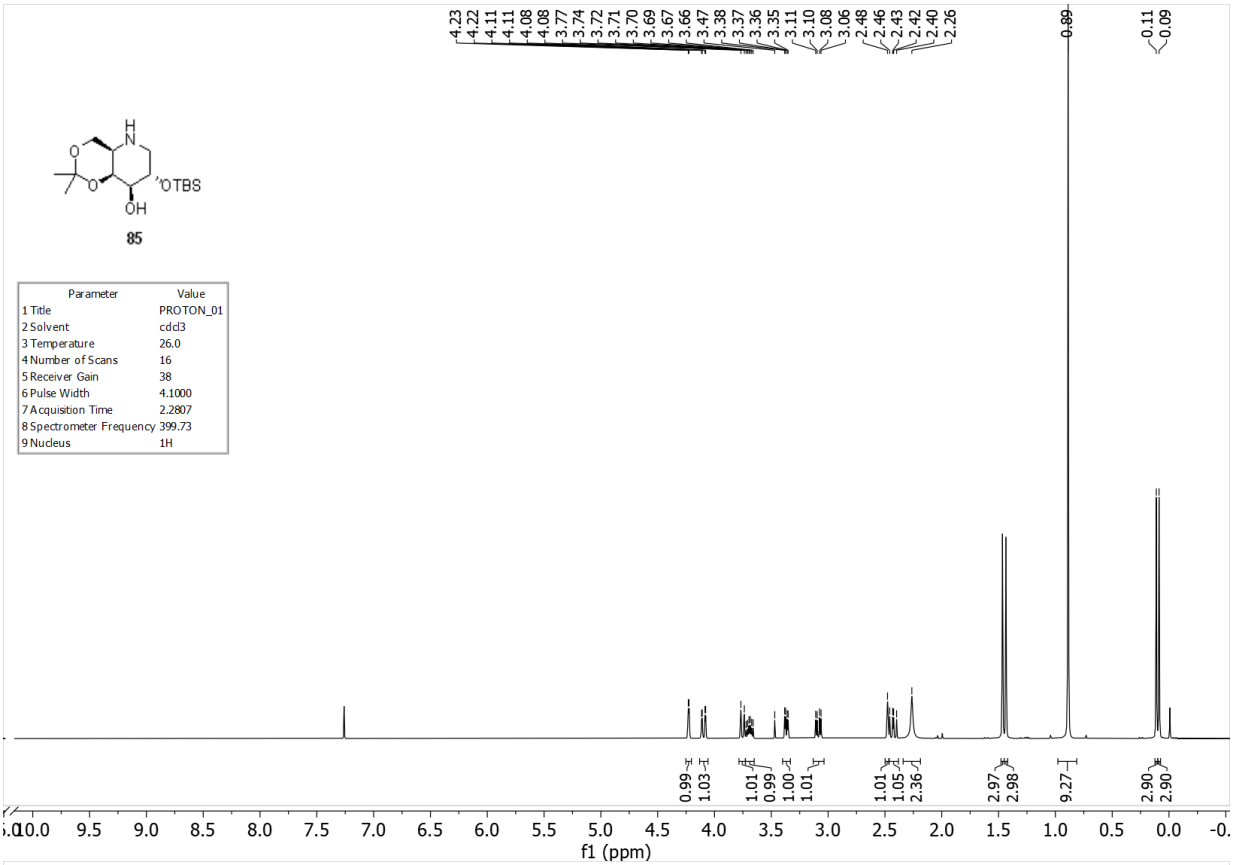
	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C

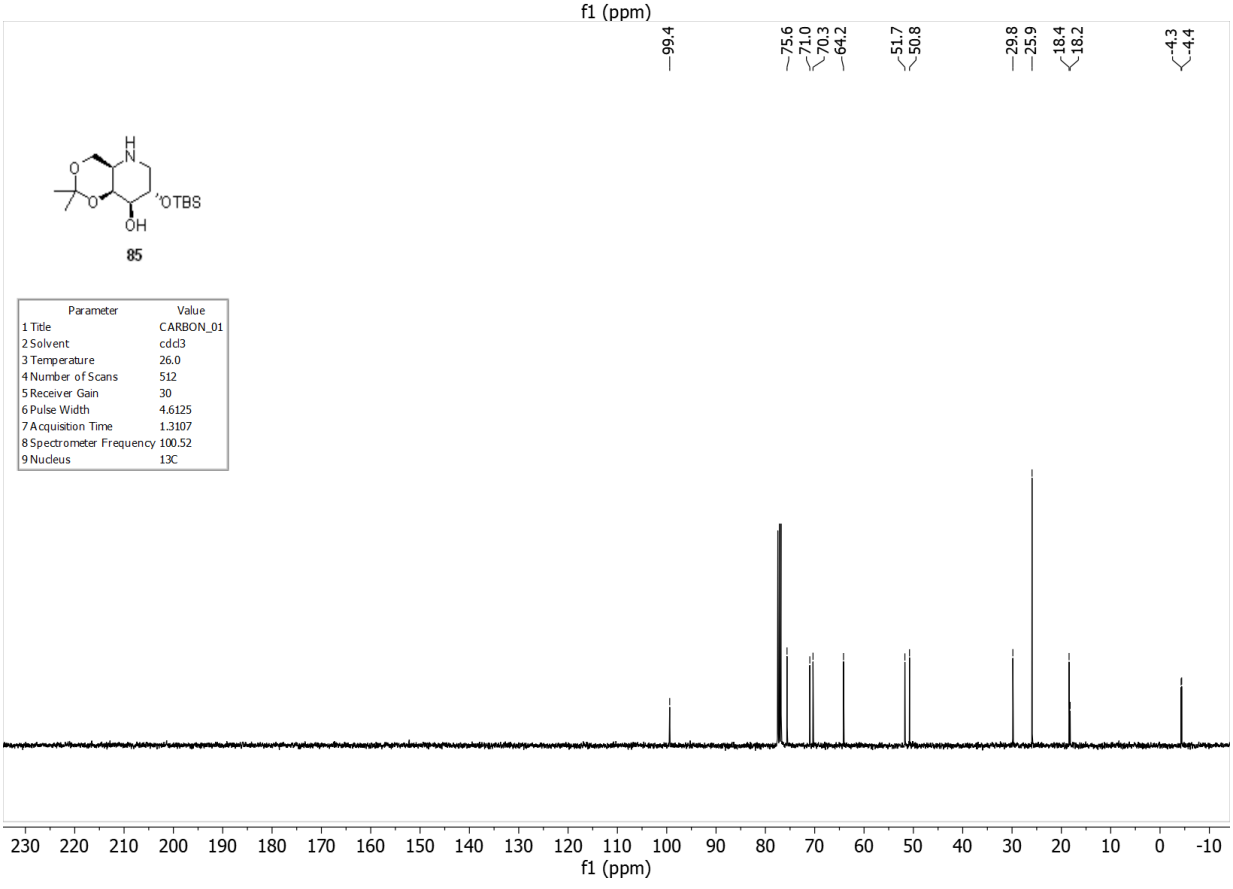


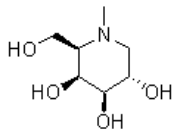
	Parameter	Value
1	Title	PROTON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	32
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.5559
9	Spectrometer Frequency	399.73
10	Nucleus	1H



	Parameter	Value
1	Title	CARBON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C

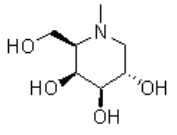

4.23
4.22
4.11
4.11
4.08
4.08
3.77
3.74
3.72
3.71
3.70
3.69
3.67
3.66
3.47
3.38
3.37
3.36
3.35
3.11
3.10
3.08
3.06
2.48
2.46
2.43
2.42
2.40
2.26
0.89
0.11
0.09
H
N
O
O
OTBS
OH
85
Parameter Value
1 Title PROTON_01
2 Solvent cdcl3
3 Temperature 26.0
4 Number of Scans 16
5 Receiver Gain 38
6 Pulse Width 4.1000
7 Acquisition Time 2.2807
8 Spectrometer Frequency 399.73
9 Nucleus 1H
0.99
1.03
1.01
0.99
1.00
1.01
1.01
1.05
2.36
2.97
2.98
9.27
2.90
2.90
f1 (ppm)


99.4
75.6
71.0
70.3
64.2
51.7
50.8
29.8
25.9
18.4
18.2
-4.3
-4.4
H
N
O
O
OTBS
OH
85
Parameter Value
1 Title CARBON_01
2 Solvent cdcl3
3 Temperature 26.0
4 Number of Scans 512
5 Receiver Gain 30
6 Pulse Width 4.6125
7 Acquisition Time 1.3107
8 Spectrometer Frequency 100.52
9 Nucleus 13C
f1 (ppm)



87

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	40
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.5559
9	Spectrometer Frequency	399.73
10	Nucleus	1H



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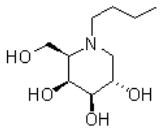
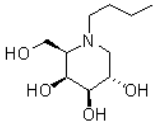
	Parameter	Value
1	Title	CARBON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	700
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



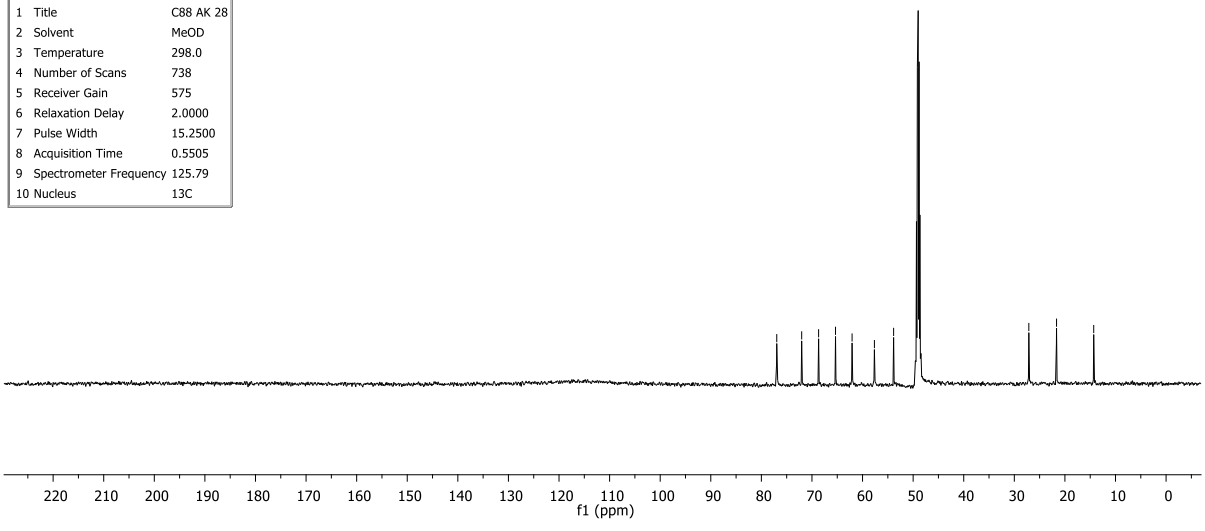
88

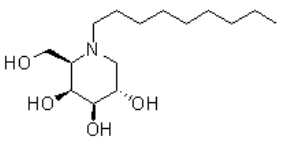
	Parameter	Value
1	Title	C88 AK 28
2	Solvent	MeOD
3	Temperature	298.0
4	Number of Scans	8
5	Receiver Gain	72
6	Relaxation Delay	1.0000
7	Pulse Width	8.3000
8	Acquisition Time	1.6384
9	Spectrometer Frequency	500.26
10	Nucleus	1H



88

	Parameter	Value
1	Title	C88 AK 28
2	Solvent	MeOD
3	Temperature	298.0
4	Number of Scans	738
5	Receiver Gain	575
6	Relaxation Delay	2.0000
7	Pulse Width	15.2500
8	Acquisition Time	0.5505
9	Spectrometer Frequency	125.79
10	Nucleus	13C





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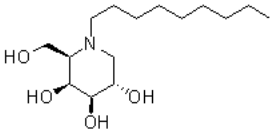
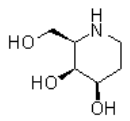
	Parameter	Value
1	Title	PROTON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	38
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



89

	Parameter	Value
1	Title	CARBON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	700
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



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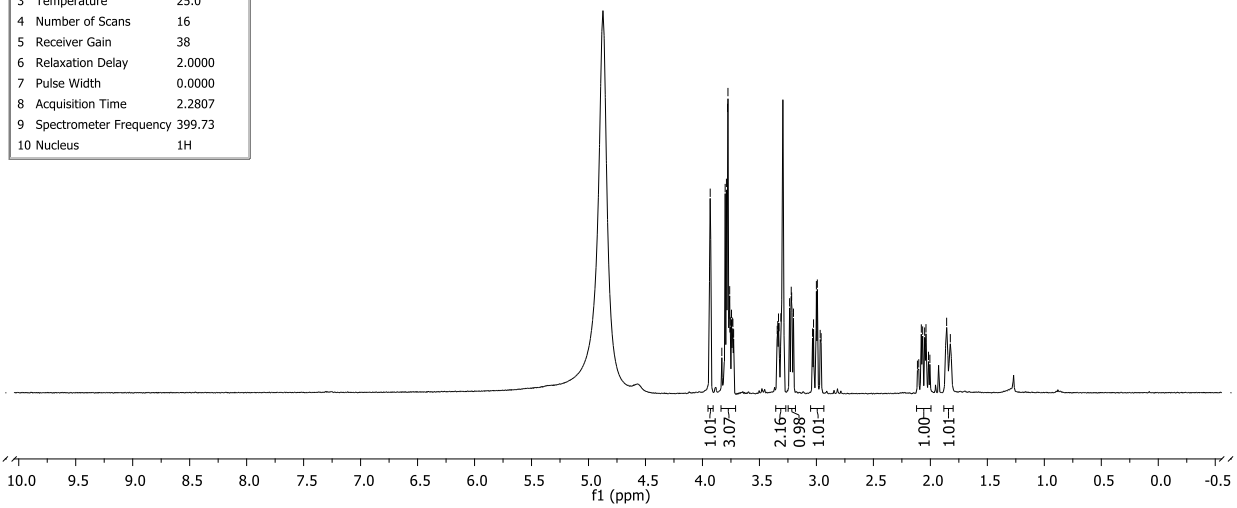
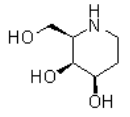
3.93 3.83 3.80 3.79 3.78 3.78 3.77 3.76 3.76 3.75 3.74 3.73 3.73 3.24 3.22 3.22 3.00 2.99 2.11 2.10 2.08 2.07 2.05 2.05 2.04 2.02 2.00 1.86 1.82

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	38
6	Relaxation Delay	2.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H





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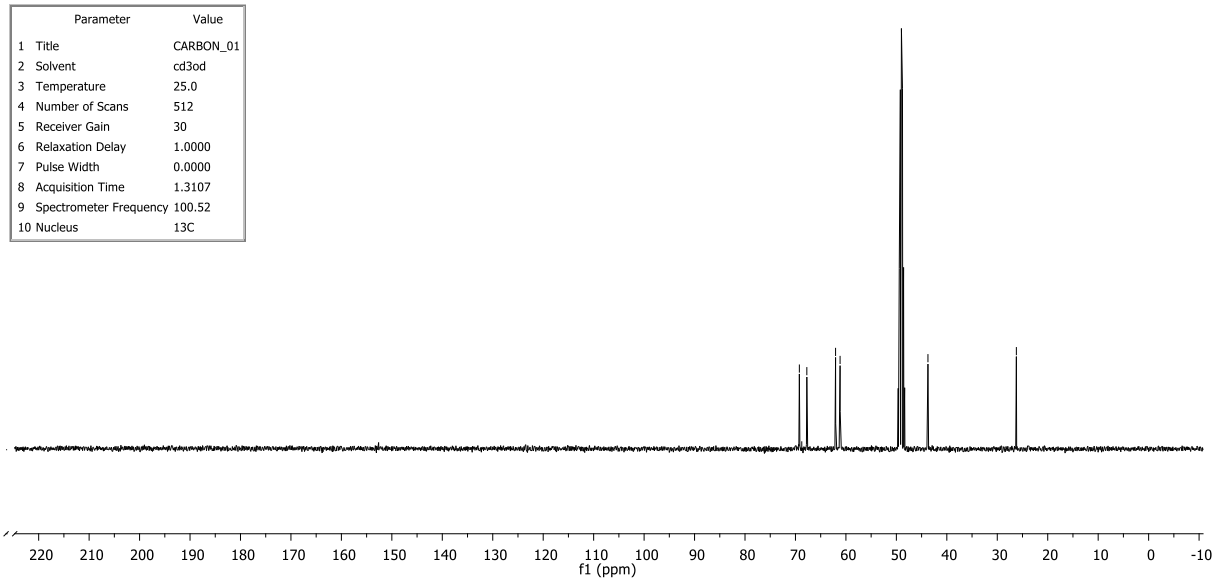
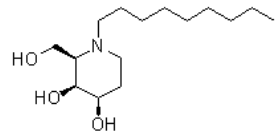
69.2 68.7 67.7 62.1 61.2 43.7 26.2

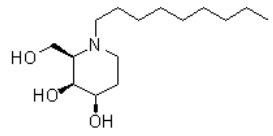
	Parameter	Value
1	Title	CARBON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C





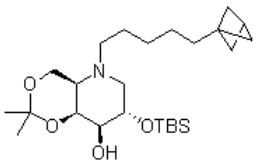
94

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	38
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



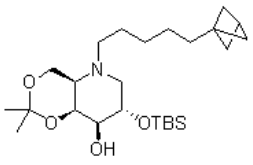
94

	Parameter	Value
1	Title	CARBON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	700
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



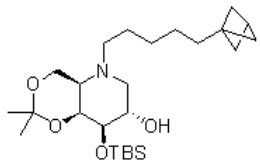
95

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.5559
9	Spectrometer Frequency	399.73
10	Nucleus	1H



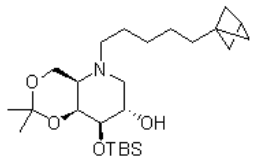
95

	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	256
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



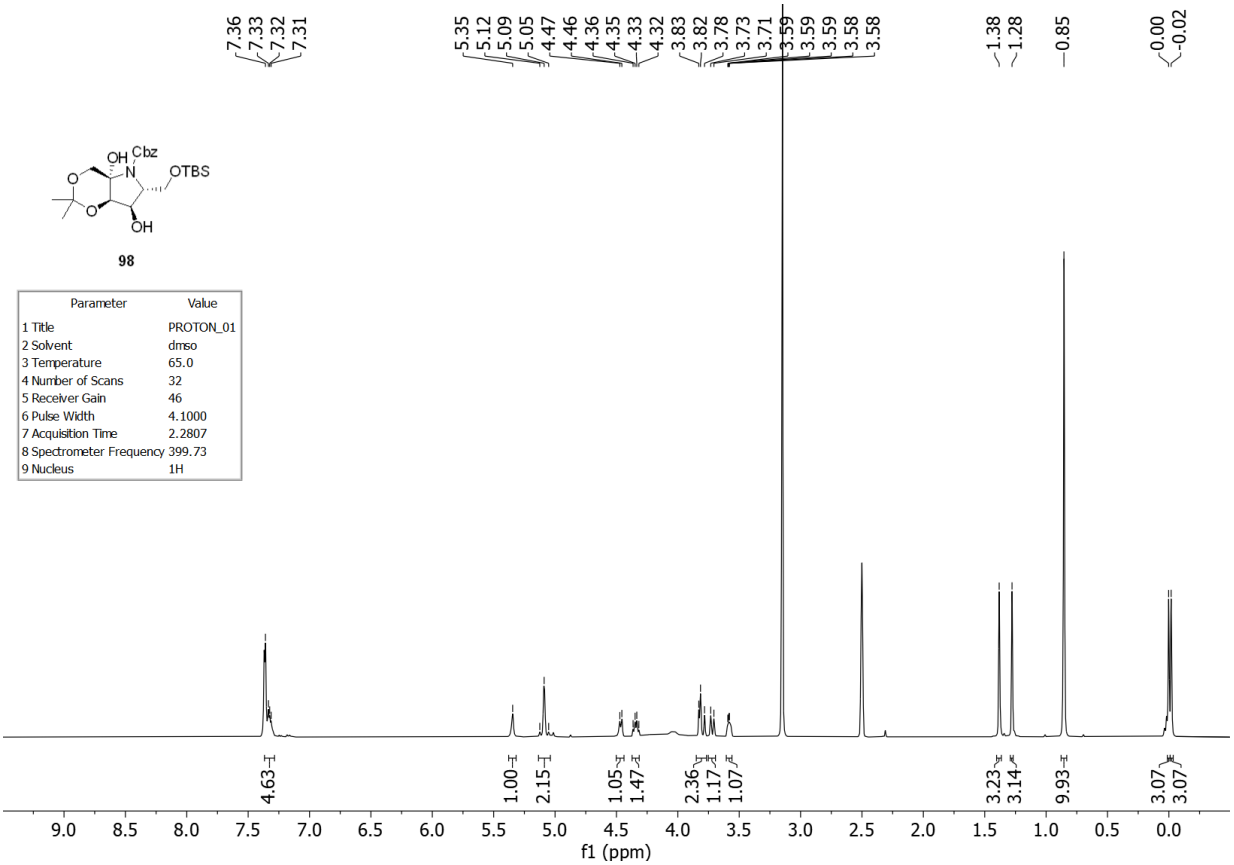
96

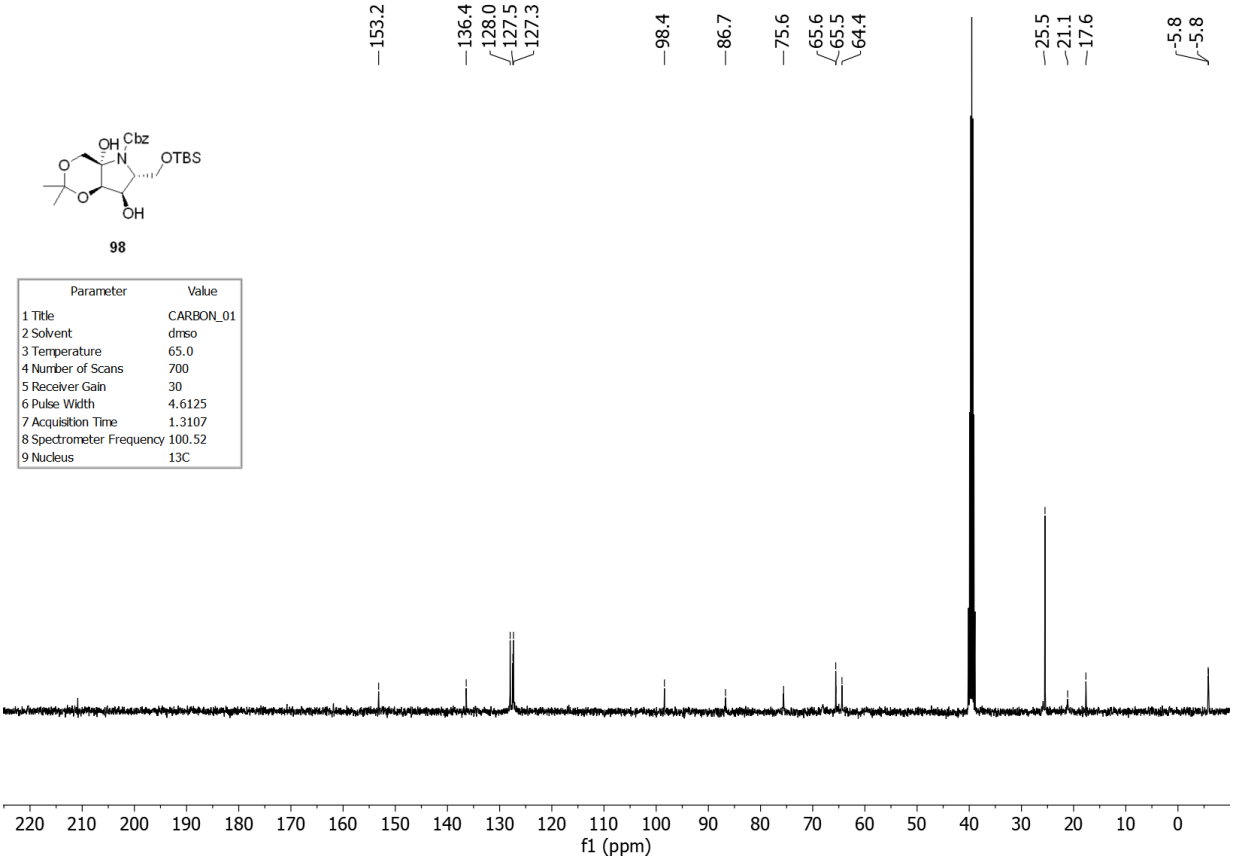
	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	34
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.5559
9	Spectrometer Frequency	399.73
10	Nucleus	1H

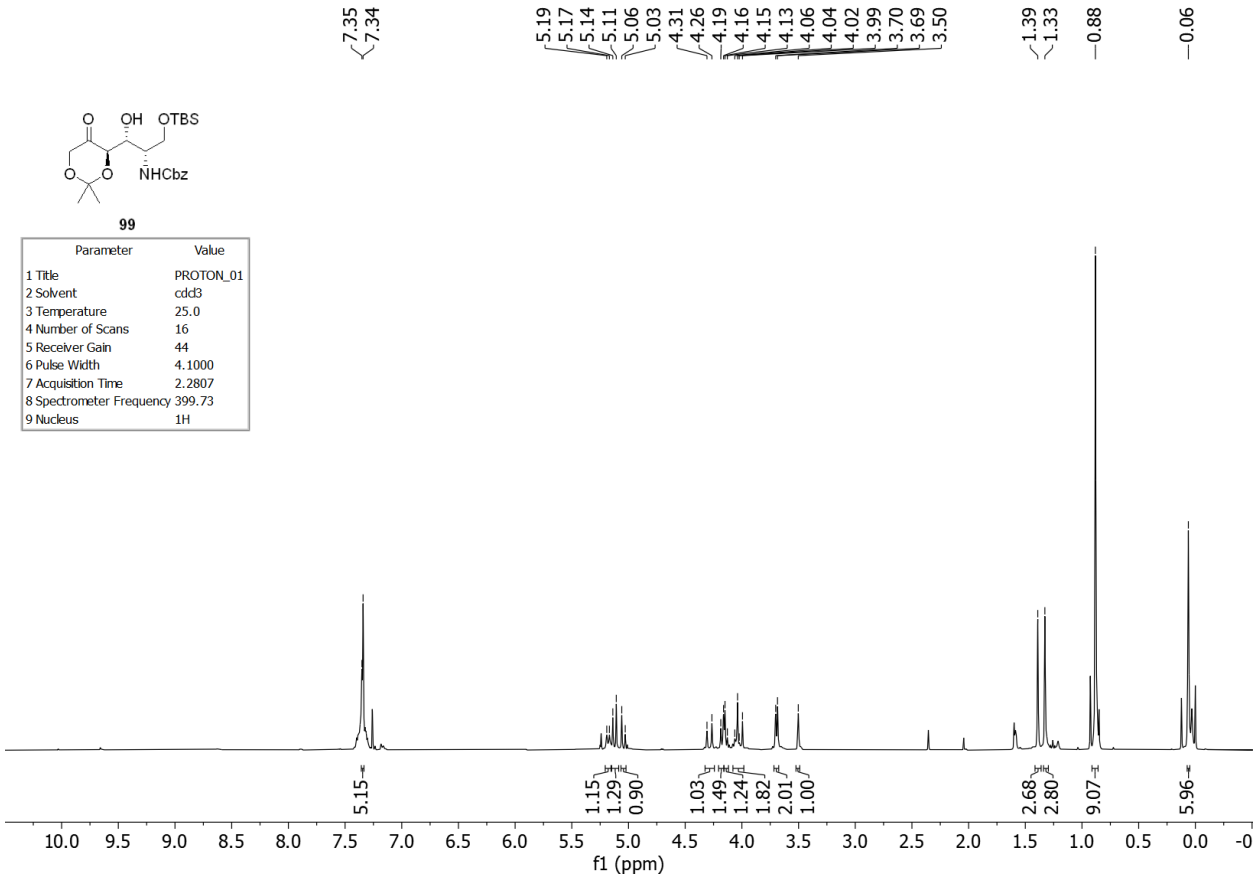


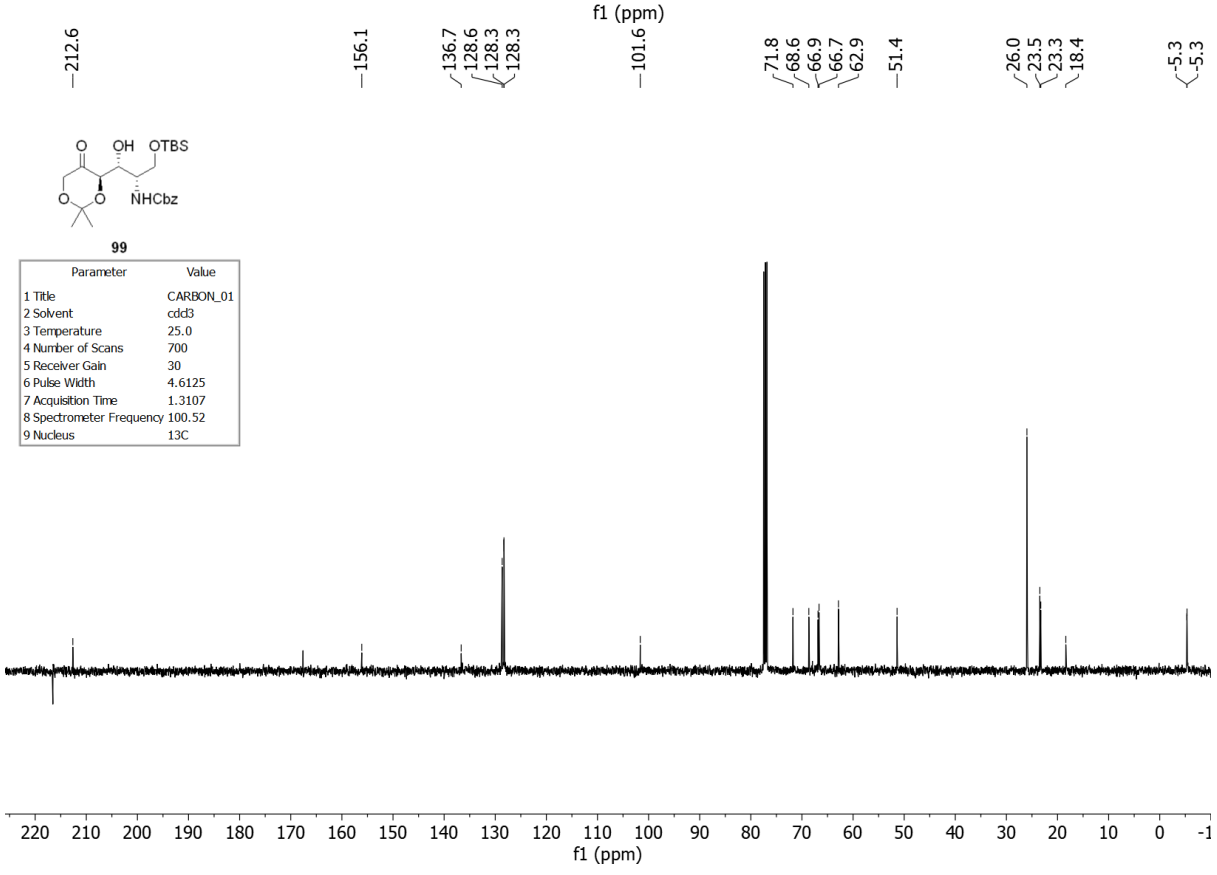
96

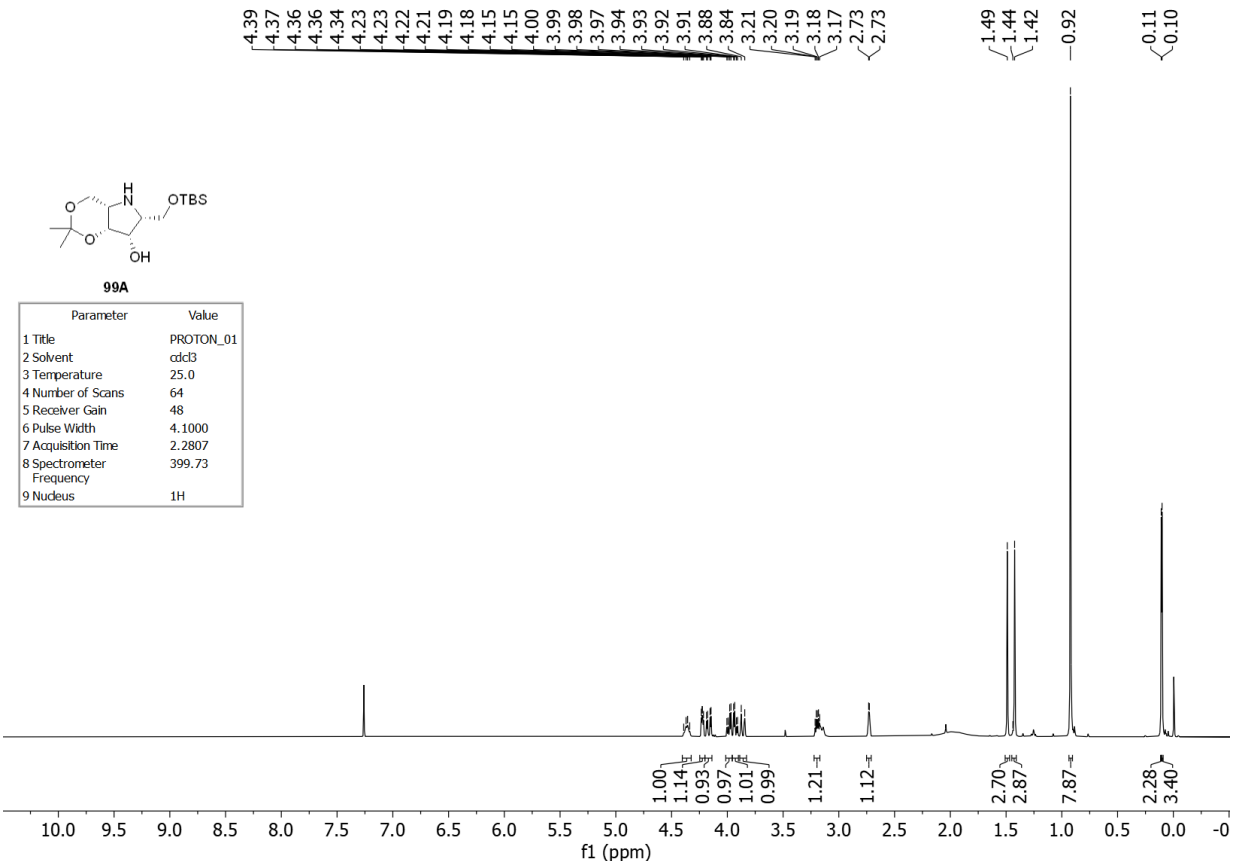
	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	256
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C

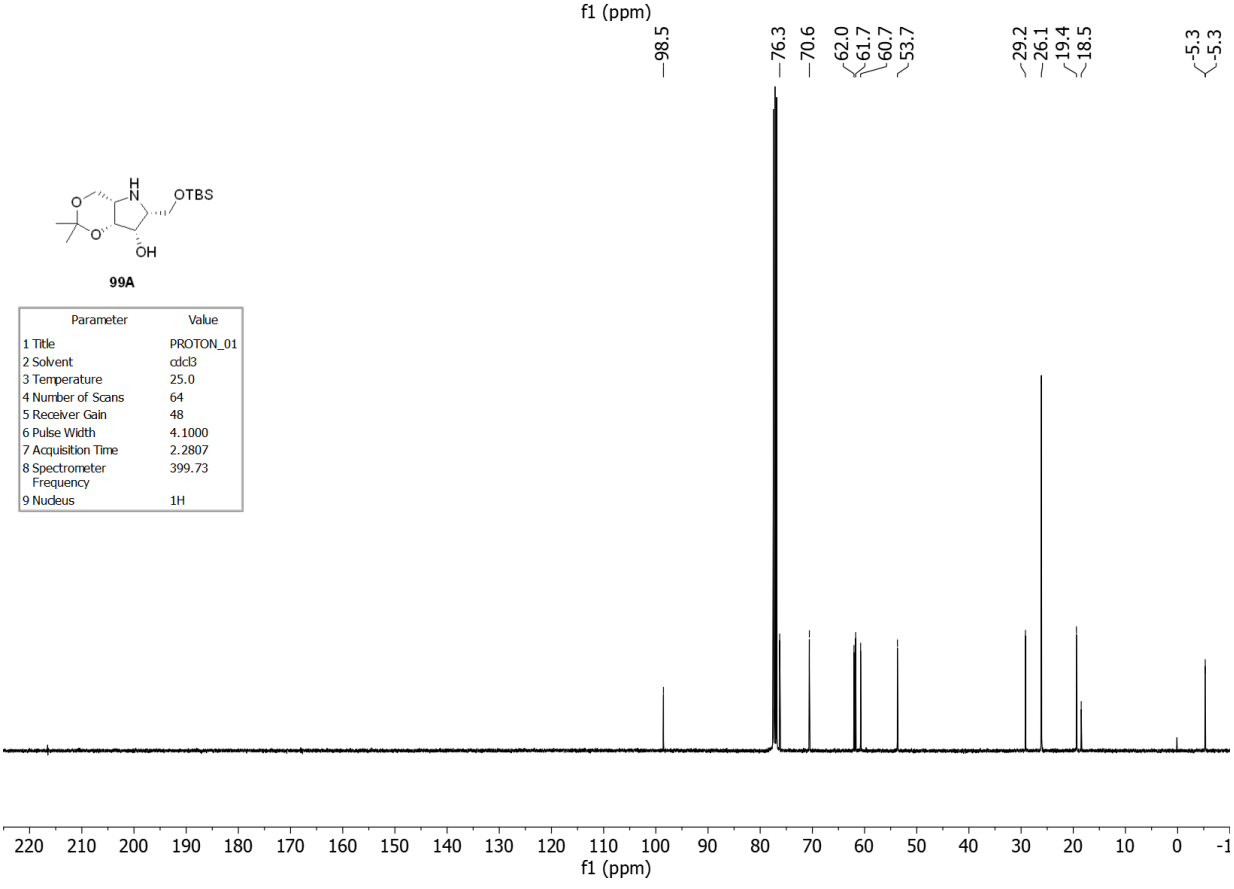

7.36
7.33
7.32
7.31
5.35
5.12
5.09
5.05
4.47
4.46
4.36
4.35
4.33
4.32
3.83
3.82
3.78
3.73
3.71
3.59
3.59
3.59
3.58
3.58
1.38
1.28
0.85
0.00
-0.02
OH
Cbz
N
OTBS
O
O
OH
98
Parameter Value
1 Title PROTON_01
2 Solvent dmso
3 Temperature 65.0
4 Number of Scans 32
5 Receiver Gain 46
6 Pulse Width 4.1000
7 Acquisition Time 2.2807
8 Spectrometer Frequency 399.73
9 Nucleus 1H
4.63
1.00
2.15
1.05
1.47
2.36
1.17
1.07
3.23
3.14
9.93
3.07
3.07
f1 (ppm)

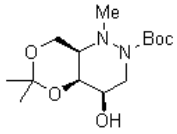

153.2
136.4
128.0
127.5
127.3
98.4
86.7
75.6
65.6
65.5
64.4
25.5
21.1
17.6
-5.8
-5.8
OH
Cbz
N
OTBS
O
O
OH
98
Parameter Value
1 Title CARBON_01
2 Solvent dmso
3 Temperature 65.0
4 Number of Scans 700
5 Receiver Gain 30
6 Pulse Width 4.6125
7 Acquisition Time 1.3107
8 Spectrometer Frequency 100.52
9 Nucleus 13C
f1 (ppm)


7.35
7.34
5.19
5.17
5.14
5.11
5.06
5.03
4.31
4.26
4.19
4.16
4.15
4.13
4.06
4.04
4.02
3.99
3.70
3.69
3.50
1.39
1.33
0.88
0.06
O
OH
OTBS
O
O
NHCbz
99
Parameter Value
1 Title PROTON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 16
5 Receiver Gain 44
6 Pulse Width 4.1000
7 Acquisition Time 2.2807
8 Spectrometer Frequency 399.73
9 Nucleus 1H
5.15
1.15
1.29
0.90
1.03
1.49
1.24
1.82
2.01
1.00
2.68
2.80
9.07
5.96
f1 (ppm)


212.6
156.1
136.7
128.6
128.3
128.3
101.6
71.8
68.6
66.9
66.7
62.9
51.4
26.0
23.5
23.3
18.4
-5.3
-5.3
O
OH
OTBS
O
O
NHCbz
99
Parameter Value
1 Title CARBON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 700
5 Receiver Gain 30
6 Pulse Width 4.6125
7 Acquisition Time 1.3107
8 Spectrometer Frequency 100.52
9 Nucleus 13C
f1 (ppm)

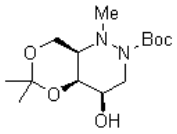

4.39
4.37
4.36
4.36
4.34
4.23
4.23
4.22
4.21
4.19
4.18
4.15
4.15
4.00
3.99
3.98
3.97
3.94
3.93
3.92
3.91
3.88
3.84
3.21
3.20
3.19
3.18
3.17
2.73
2.73
1.49
1.44
1.42
0.92
0.11
0.10
OTBS
OH
99A
Parameter Value
1 Title PROTON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 64
5 Receiver Gain 48
6 Pulse Width 4.1000
7 Acquisition Time 2.2807
8 Spectrometer Frequency 399.73
9 Nucleus 1H
1.00
1.14
0.93
0.97
1.01
0.99
1.21
1.12
2.70
2.87
7.87
2.28
3.40
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0
f1 (ppm)


98.5
76.3
70.6
62.0
61.7
60.7
53.7
29.2
26.1
19.4
18.5
-5.3
-5.3
OTBS
OH
99A
Parameter Value
1 Title PROTON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 64
5 Receiver Gain 48
6 Pulse Width 4.1000
7 Acquisition Time 2.2807
8 Spectrometer Frequency 399.73
9 Nucleus 1H
220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -1
f1 (ppm)



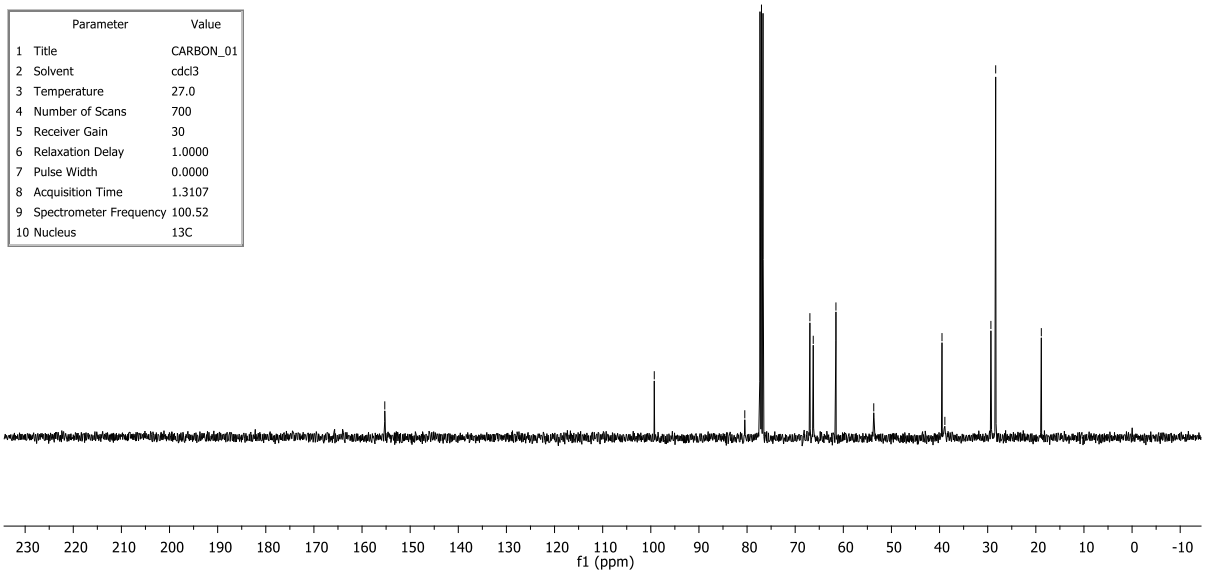
103

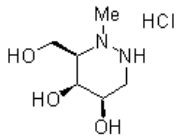
	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	27.0
4	Number of Scans	16
5	Receiver Gain	42
6	Relaxation Delay	2.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.5559
9	Spectrometer Frequency	399.73
10	Nucleus	1H



103

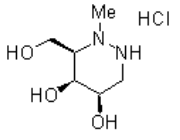
	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	27.0
4	Number of Scans	700
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C





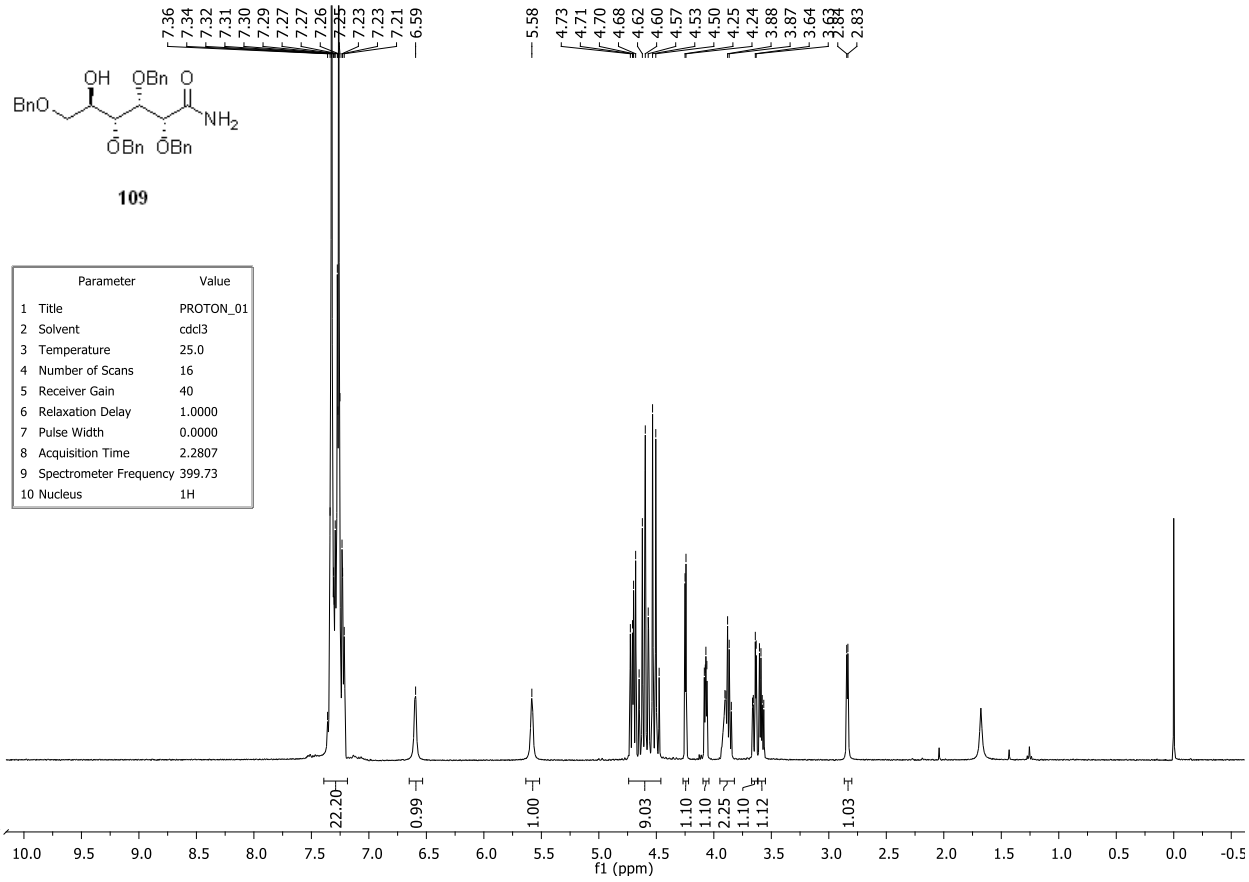
104

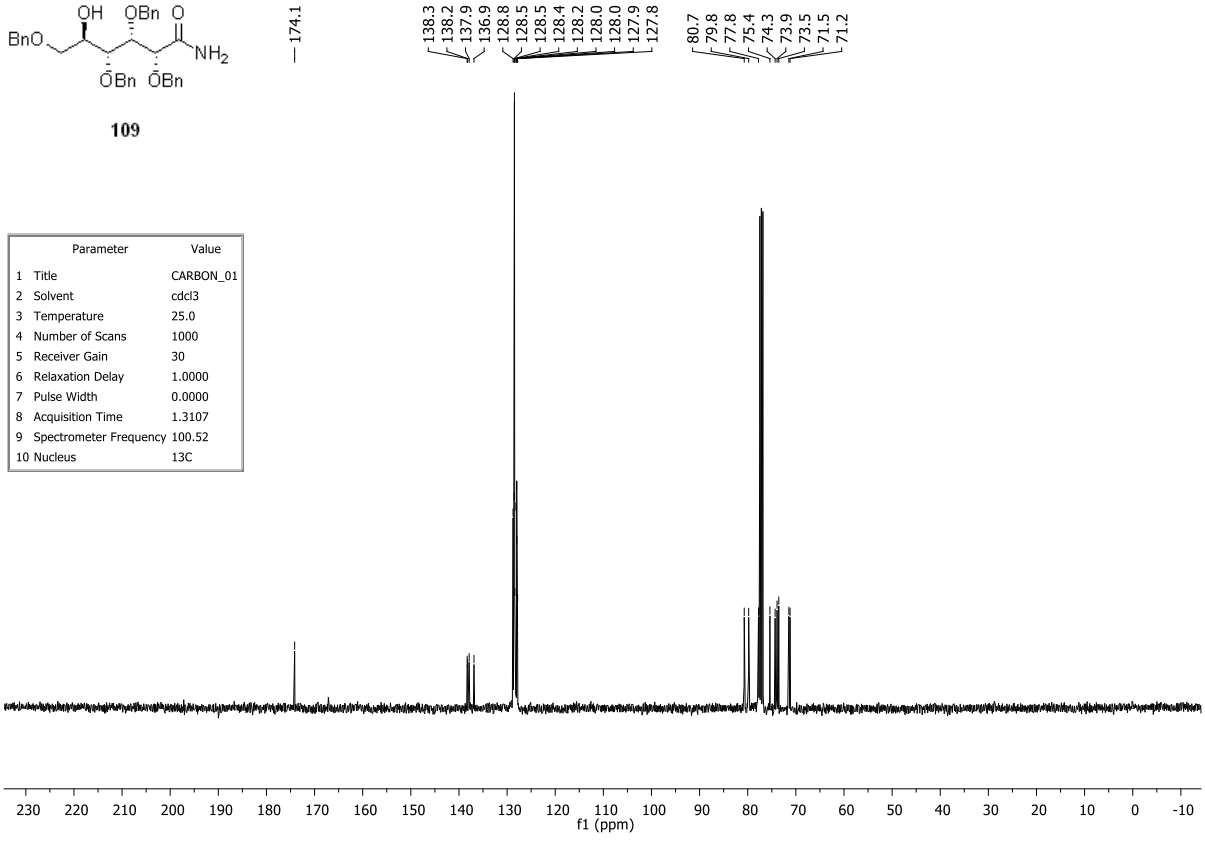
	Parameter	Value
1	Title	PROTON_01
2	Solvent	d2o
3	Temperature	27.0
4	Number of Scans	64
5	Receiver Gain	42
6	Relaxation Delay	2.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H

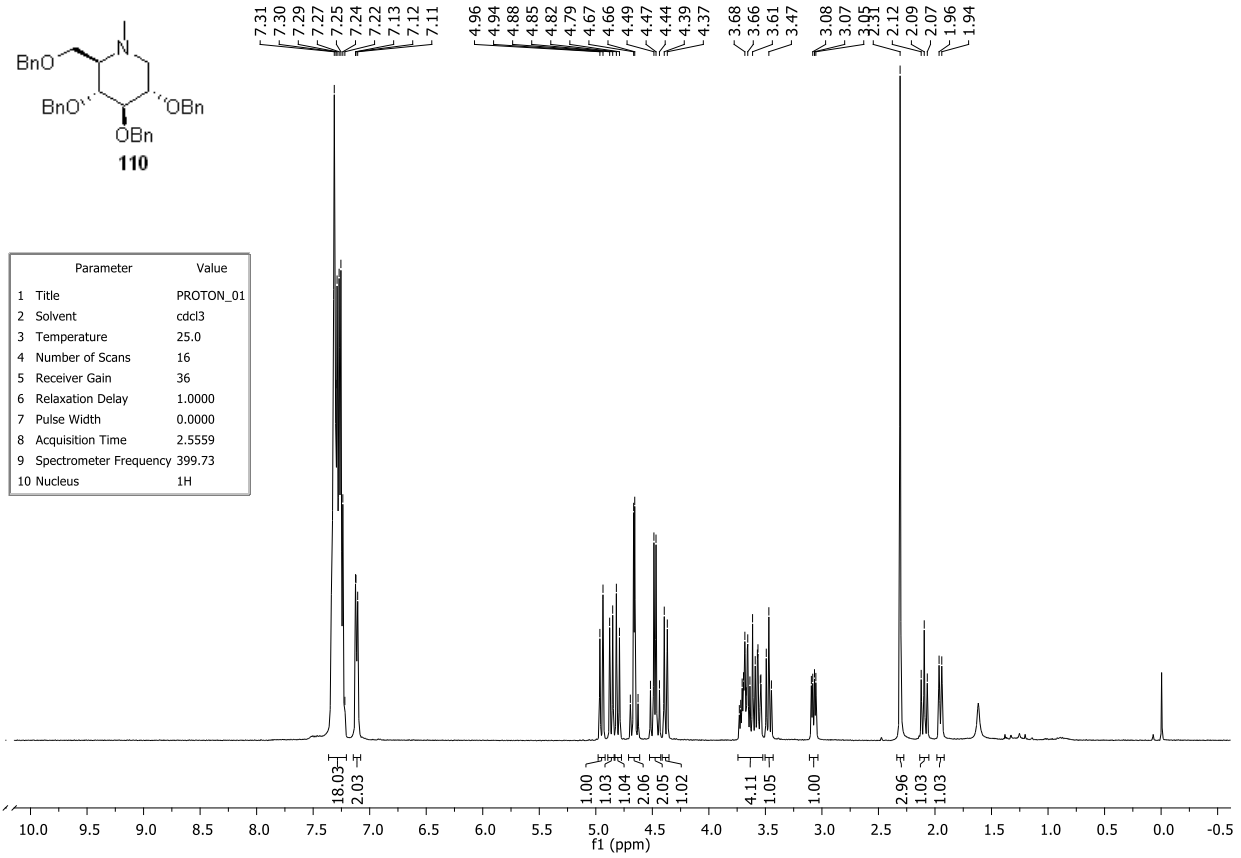


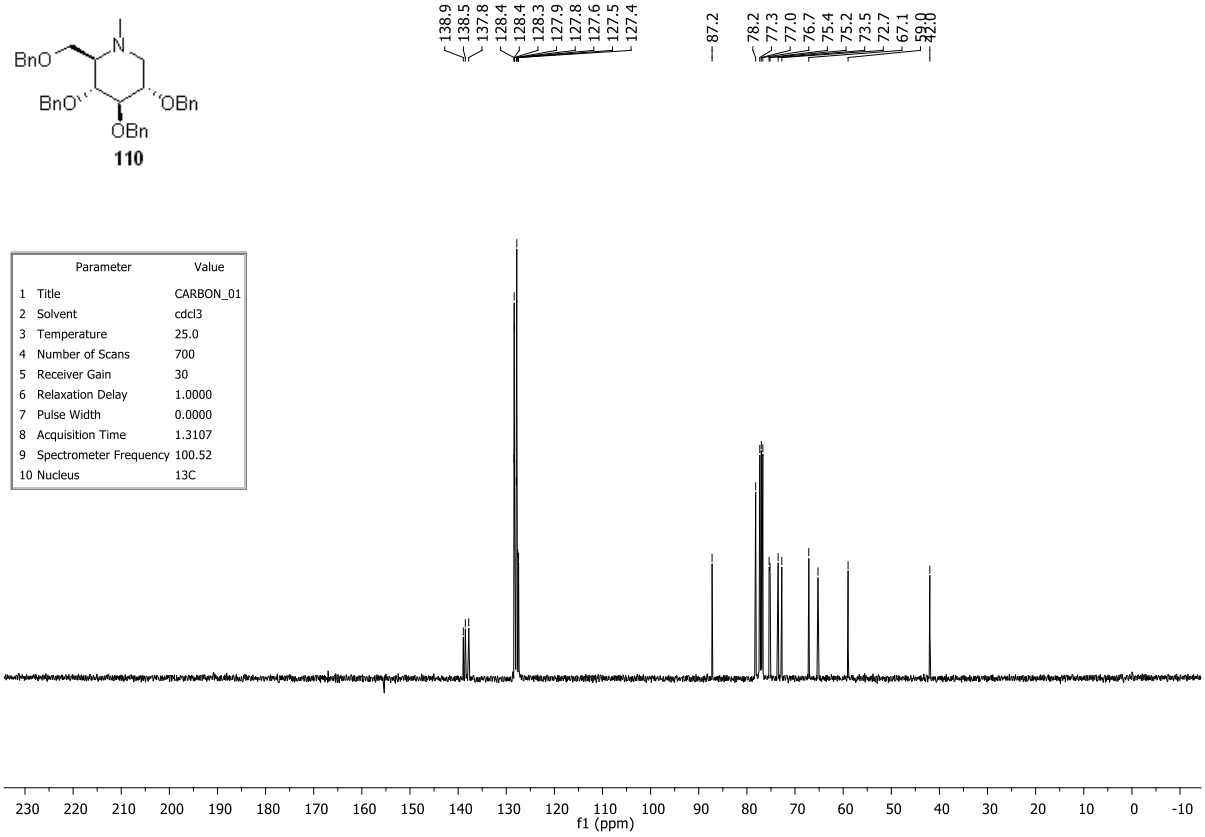
104

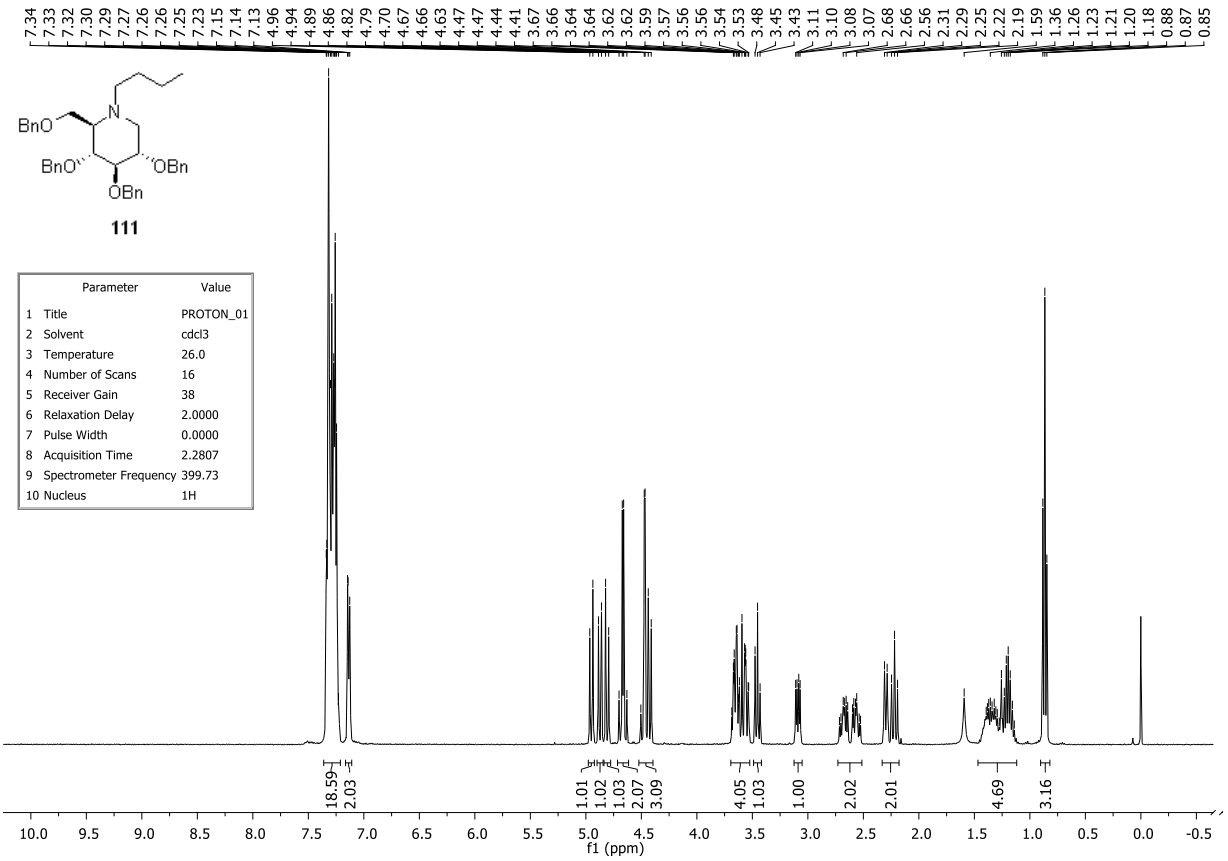
	Parameter	Value
1	Title	CARBON_01
2	Solvent	d2o
3	Temperature	27.0
4	Number of Scans	700
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C

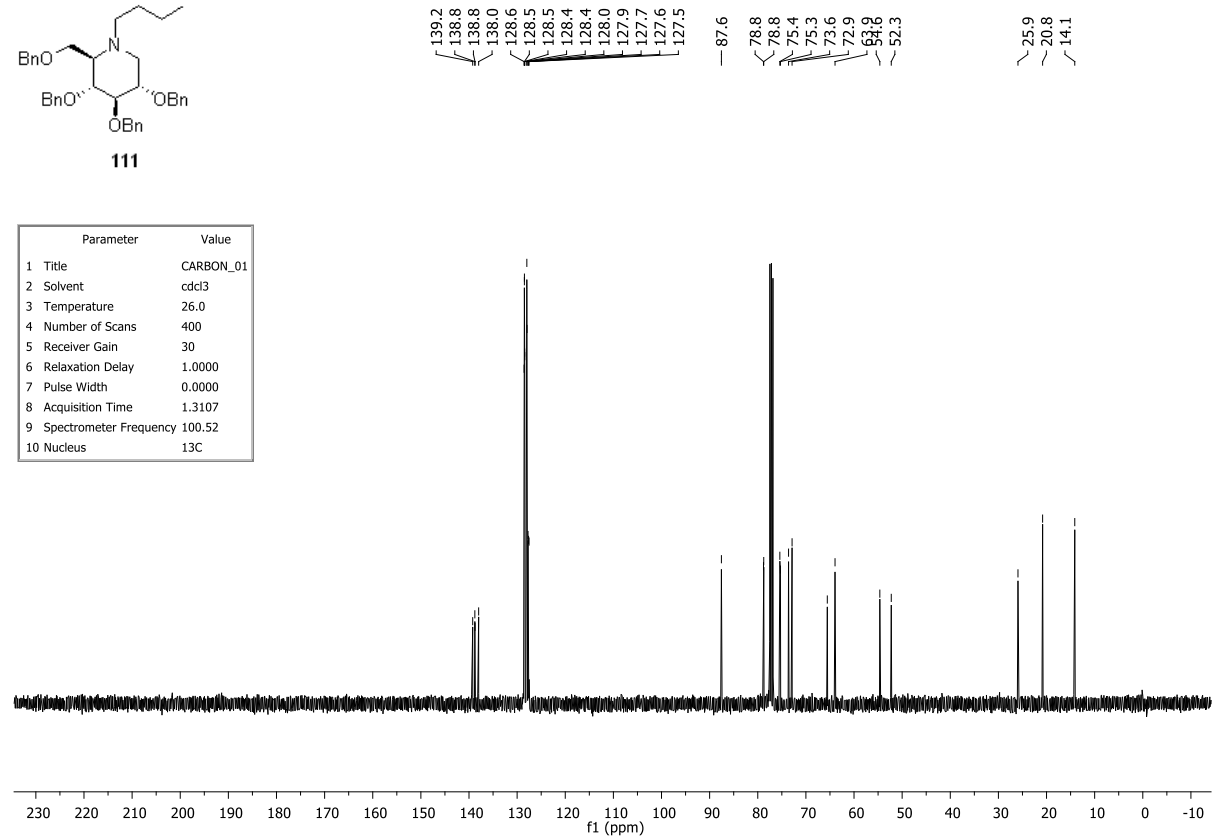

OH OBn O
BnO
NH2
OBn OBn
109
Parameter Value
1 Title PROTON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 16
5 Receiver Gain 40
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 2.2807
9 Spectrometer Frequency 399.73
10 Nucleus 1H
7.36 7.34 7.32 7.31 7.30 7.29 7.27 7.27 7.26 7.25 7.23 7.23 7.21 6.59
5.58 4.73 4.71 4.70 4.68 4.62 4.60 4.57 4.53 4.50 4.25 4.24 3.88 3.87 3.64 2.83
22.20 0.99 1.00 9.03 1.10 1.10 2.25 1.10 1.12 1.03
f1 (ppm)

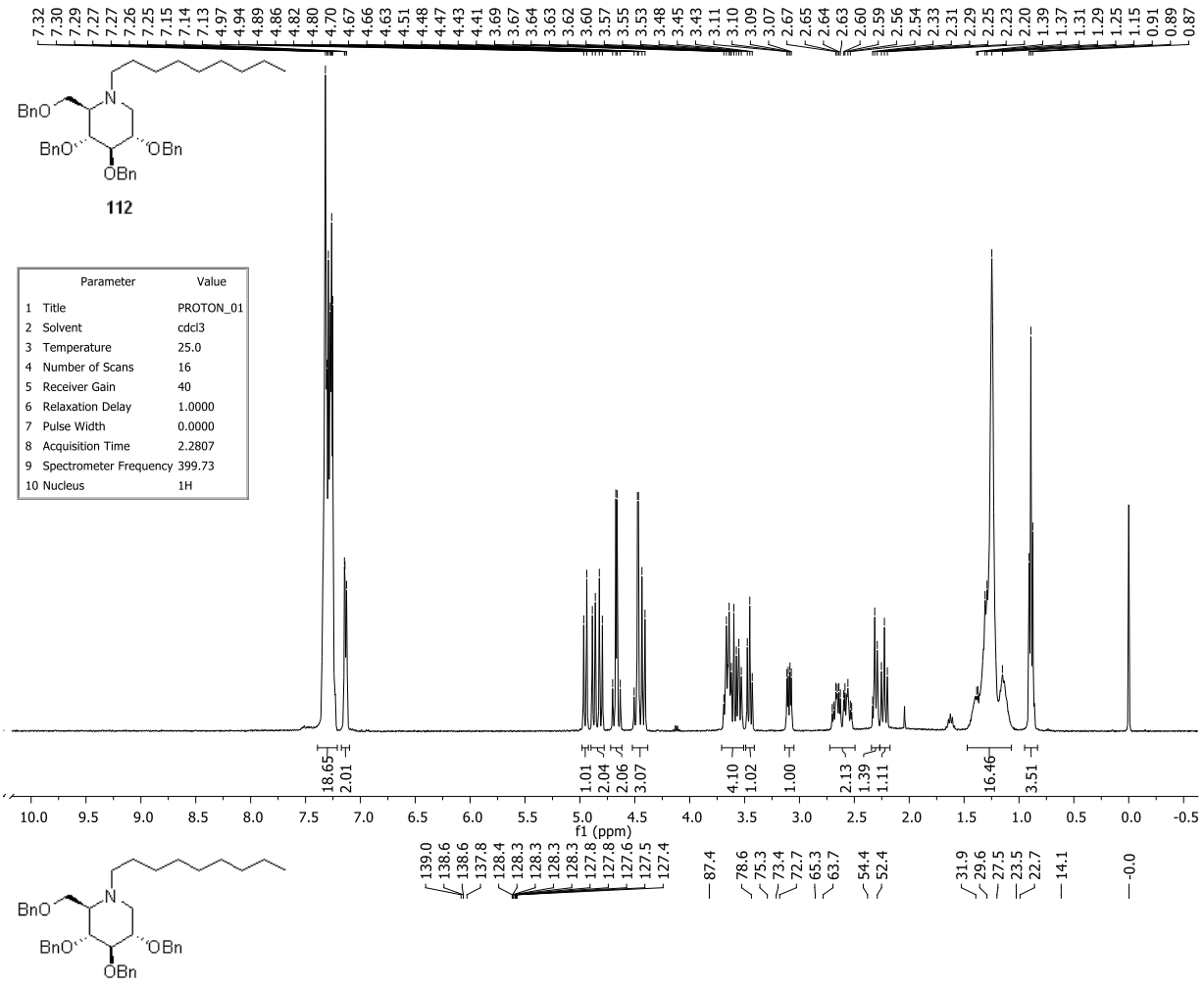

OH OBn O
BnO
NH2
OBn OBn
109
Parameter Value
1 Title CARBON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 1000
5 Receiver Gain 30
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 1.3107
9 Spectrometer Frequency 100.52
10 Nucleus 13C
174.1
138.3 138.2 137.9 136.9 128.8 128.5 128.5 128.4 128.2 128.0 128.0 128.0 127.9 127.8
80.7 79.8 77.8 75.4 74.3 73.9 73.5 71.5 71.2
f1 (ppm)


BnO
BnO
OBn
OBn
110
Parameter Value
1 Title PROTON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 16
5 Receiver Gain 36
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 2.5559
9 Spectrometer Frequency 399.73
10 Nucleus 1H
7.31 7.30 7.29 7.27 7.25 7.24 7.22 7.13 7.12 7.11
4.96 4.94 4.88 4.85 4.82 4.79 4.67 4.66 4.49 4.47 4.44 4.39 4.37
3.68 3.66 3.61 3.47
3.08 3.07 3.05 2.12 2.09 2.07 1.96 1.94
18.03 2.03 1.00 1.03 1.04 2.06 2.05 1.02 4.11 1.05 1.00 2.96 1.03 1.03
f1 (ppm)

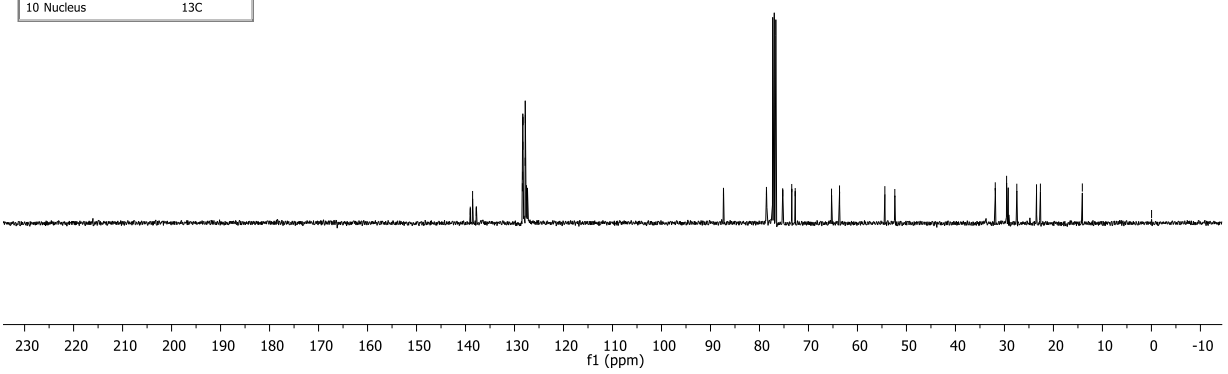

BnO
BnO
OBn
OBn
110
Parameter Value
1 Title CARBON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 700
5 Receiver Gain 30
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 1.3107
9 Spectrometer Frequency 100.52
10 Nucleus 13C
138.9 138.5 137.8 128.4 128.4 128.3 127.9 127.8 127.6 127.5 127.4
87.2
78.2 77.3 77.0 76.7 75.4 75.2 73.5 72.7 67.1 59.0 42.0
f1 (ppm)

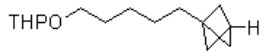

BnO
BnO
OBn
OBn
111
Parameter Value
1 Title PROTON_01
2 Solvent cdcl3
3 Temperature 26.0
4 Number of Scans 16
5 Receiver Gain 38
6 Relaxation Delay 2.0000
7 Pulse Width 0.0000
8 Acquisition Time 2.2807
9 Spectrometer Frequency 399.73
10 Nucleus 1H
f1 (ppm)


BnO
BnO
OBn
OBn
111
Parameter Value
1 Title CARBON_01
2 Solvent cdcl3
3 Temperature 26.0
4 Number of Scans 400
5 Receiver Gain 30
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 1.3107
9 Spectrometer Frequency 100.52
10 Nucleus 13C
f1 (ppm)



Parameter Value
1 Title CARBON_01
2 Solvent cdcl3
3 Temperature 25.0
4 Number of Scans 700
5 Receiver Gain 30
6 Relaxation Delay 1.0000
7 Pulse Width 0.0000
8 Acquisition Time 1.3107
9 Spectrometer Frequency 100.52
10 Nucleus 13C





114

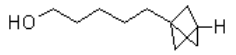
	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	26
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H

114

	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	256
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C

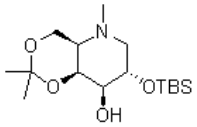
115

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	28
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



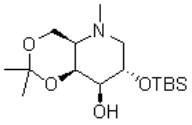
115

	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



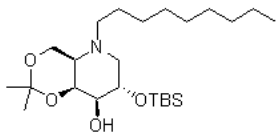
116

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	34
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



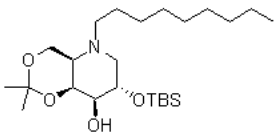
116

	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



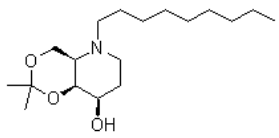
118

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	32
6	Relaxation Delay	2.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H



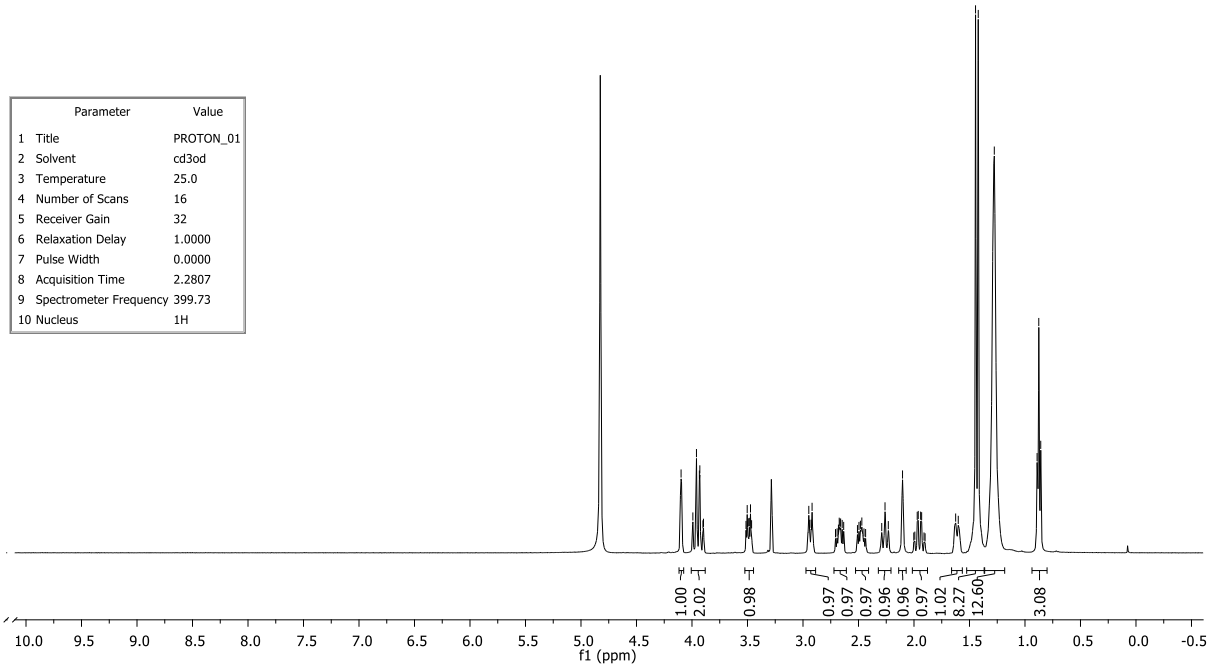
118

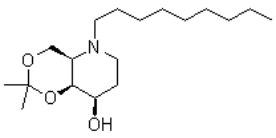
	Parameter	Value
1	Title	CARBON_01
2	Solvent	cdcl3
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C



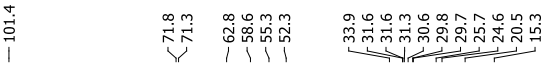
119

	Parameter	Value
1	Title	PROTON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	16
5	Receiver Gain	32
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	2.2807
9	Spectrometer Frequency	399.73
10	Nucleus	1H





119



	Parameter	Value
1	Title	CARBON_01
2	Solvent	cd3od
3	Temperature	25.0
4	Number of Scans	512
5	Receiver Gain	30
6	Relaxation Delay	1.0000
7	Pulse Width	0.0000
8	Acquisition Time	1.3107
9	Spectrometer Frequency	100.52
10	Nucleus	13C