Electronic Supplementary Material (ESI) for Chemical Communications


# Supporting Informations

## Thiol-ene click chemistry for the synthesis of highly effective glycosyl sulfonamide carbonic anhydrase inhibitors

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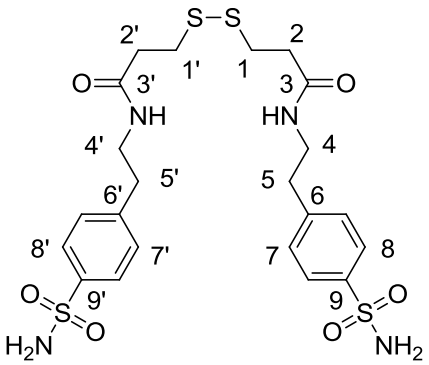
**Experimental Section:**

**General.** All reagents and solvents were of commercial quality and used without further purification, unless otherwise specified. All reactions were carried out under an inert nitrogen atmosphere. TLC analyses were performed on silica gel 60 F254 plates (Merck Art.1.05554). Spots were visualized under 254nm UV illumination, or by ninhydrin solution spraying. Melting points were determined on a Büchi Melting Point 510 and are uncorrected. $^{1}H$ and $^{13}C$ NMR spectra were recorded on Bruker DRX-400 spectrometer using DMSO-d6 as solvent and tetramethylsilane as internal standard. For 1H NMR spectra, chemical shifts are expressed in $\delta$ (ppm) downfield from tetramethylsilane, and coupling constants (J) are expressed in Hertz. Electron Ionization mass spectra were recorded in positive or negative mode on a Water MicroMass ZQ.

***bis* [*N*-(4-sulfamoylphenethyl)]-3, 3'-dithiodipropanamide (1):**

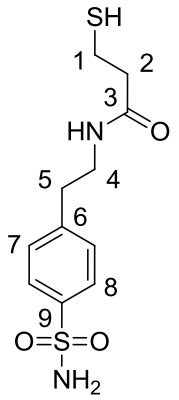



1.5g of dithiopropionic acid (7.13 mmol, 1 equiv) were refluxed for 3 hours with 6.5 mL of thionyl chloride (90 mmol, 12.5 equiv.). Then 20 mL of THF were added, and the solution was cooled at 0°C. A solution of 4-(2-aminoethyl)benzene sulfonamide (3.14 g, 15.7 mmol, 2.2 equiv.) and 4-

DMAP (45 mg, 0.35 mmol) in 50 mL of anhydrous pyridine was then added. The mixture was stirred overnight at room temperature then concentrated under vacuum. The final product is precipitated from the crude mixture with 20mL of methanol and then filtered.

Yield: 42%; R*f*: 0.03 (methylene chloride - methanol, 4-1, v-v); mp: 143-145 °C; MS ESI+: *m/z* 575.08 ($M+H^+$), 597.12 ($M+Na^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ ppm: 2.44 (t, $J_{2et2'-1et1'}$= 7.2 Hz, 4H, $H_2$ et $H_{2'}$), 2.77 (t, $J_{5et\,5'-4et4'}$= 7.2 Hz, 4H, $H_5$ et $H_{5'}$),2.86 (t, $J_{1et1'-2et2'}$= 7.1 Hz, 4H, $H_1$ et $H_{1'}$),3.34 – 3.25 (m, 4H, $H_4$ et $H_{4'}$),7.29 (s, 4H, $NH_2$),7.39 (d, $J_{7et7'-8et8'}$= 7.1Hz, 4H, $H_7$ et $H_{7'}$),7.74 (d, $J_{8et8'-7et7'}$= 7.8 Hz, 4H,$H_8$ et $H_{8'}$),8.06 (t, $J_{NH-4et4'}$= 5.2 Hz, 2H, NHC(O)); $^{13}$C RMN (101 MHz, DMSO) δ ppm: 33.76 ($C_1$ et $C_{1'}$), 34.74 ($C_5$ et $C_{5'}$), 34.86 ($C_2$ et $C_{2'}$), 39.82 ($C_4$ et $C_{4'}$), 125.62 ($C_7$ et $C_{7'}$), 129.09 ($C_8$ et $C_{8'}$), 141.99 ($C_6$ et $C_{6'}$), 143.65 ($C_9$ et $C_{9'}$), 170.00 ($C_3$ et $C_{3'}$).

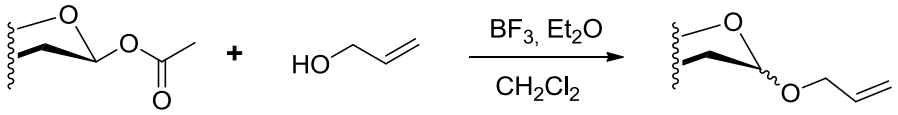
**3-mercapto-*N*-(4-sulfamoylphenethyl)propanamide (2):**




0.5g of compound **1** (0.87 mmol, 1equiv.) and 135 mg of dithiothreitol (0.87 mmol, 1 equiv.) were solubilized in 50 mL of anhydrous DMF. The mixture was stirred at room temperature overnight and then another equivalent of dithiothreitol was added. After 24hours under stirring, the mixture is concentrated under vacuum and the residue was purified on silica gel (methylene choride – methanol 9.5-0.5, v-v).

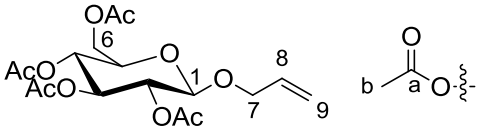
Yield: 70 %; R*f*: 0.10 (methylene chloride - methanol, 9-1, v-v); Mp: 171-173°C; MS ESI+: *m/z* 289.21 ($M+H^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ(ppm) : 2.34 (t, $J_{2-1}$ = 7.3Hz, 2H, $H_2$), 2.63 (t, $J_{1-2}$= 7.3Hz, 2H, $H_1$), 2.79 (t, $J_{5-4}$= 7.2Hz, 2H, $H_5$), 3.35 – 3.24 (m, 2H, $H_4$), 7.27 (s, 2H, $NH_2$), 7.39 (d, $J_{7-8}$= 7.1Hz, 2H, $H_7$), 7.72 (d, $J_{8-7}$= 7.8 Hz, 2H, $H_8$), 8.05 (t, $J_{NH-4}$= 4.8 Hz, 1H, NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ(ppm): 19.89($C_1$), 33.75($C_5$), 34.76($C_2$), 39.84($C_4$), 125.61($C_7$), 129.09($C_8$), 141.98($C_6$), 143.66($C_9$), 170.18($C_3$).

**General procedure for synthesis of 1-O-allyl peracetylated sugars:**



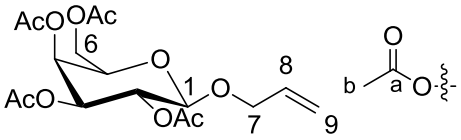

To a solution of peracetylated sugar (2mmol) in 20 mL of methylene chloride was added, under argon atmosphere, 0.545 mL of allylic alcohol (8 mmol, 4 equiv.). The mixture was then cooled at 0°C and 0.35 mL of $BF_3$, $Et_2O$ (3mmol, 1.5 equiv.) was added. The reaction mixture was stirred at room temperature for 20 hours, then neutralized with 15 mL of water, and extracted three times with 20 mL of ethyl acetate. The organic layer was washed with 15 mL of a 5% aqueous solution of NaHCO3, then dried over anhydrous sodium sulfate and concentrated under vacuum. The residue was purified on silica gel chromatography (eluent: ethyl acetate/ petroleum ether 1-3).

**2,3,4,6-tetra-*O*-acetyl-1-*O*-allyl-β-D-glucopyranose (3a):**



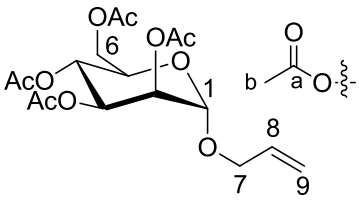
Yield: 42%**;** R*f*: 0.13 (AcOEt/ EP, 1/3, v/v)**;** MS ESI+: *m/z* 411.53 ($M+Na^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ ppm: 1.93, 1.98, 2.00, 2.02 (4s, 12H, $H_b$), 4.10 – 3.93 (m, 3H, $H_7$ et $H_{6a}$), 4.18 (dd, $J_{6b-6a}$= 12.0Hz, $J_{6b-5}$=4.7Hz, 1H, $H_{6b}$), 4.22 (m, 1H, $H_5$), 4.85 – 4.72 (m, 2H, $H_2$ et $H_3$) , 4.90 (t, $J_{4-5}$=$J_{4-3}$= 9.6Hz, 1H, $H_4$), 5.27 (t, *J* = 8.4, 1H, $H_1$), 5.23 (dd, $J_{9a-8}$= 17.5Hz, $J_{9a-9b}$=1.6Hz, 1H, $H_{9a}$), 5.16 (dd, $J_{9b-8}$= 10.5Hz, $J_{9b-9a}$=1.6Hz, 1H, $H_{9b}$), 5.94 – 5.78 (m, 1H, $H_8$); $^{13}$C NMR (101 MHz, DMSO): δ ppm 20.3, 20.41, 20.53 ($4C_b$), 61.71($C_6$), 68.21($C_4$), 69.25 ($C_7$), 70.57, 70.97, 72.05 (C2, C3, C5), 98.79 ($C_1$), 116.68 ($C_9$), 134.12 ($C_8$), 169.10, 169.34, 169.66, 170.10 ($4C_a$).

**2,3,4,6-tetra-*O*-acetyl-1-*O*-allyl-β-D-galactopyranose (3b):**



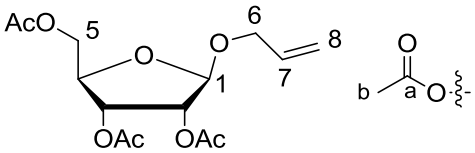
Yield: 45% ; R*f*: 0.12 (AcOEt/ EP, 1/3, v/v); MS ESI+: *m/z* 411.53 ($M+Na^+$); $^1$H NMR (400 MHz, DMSO, 298 K) δ ppm: 1.91, 2.00, 2.01, 2.11(4s, 12H, $H_b$), 4.10 – 3.99 (m, 3H, $H_6$, $H_5$), 4.26 – 4.15 (m, 2H, $H_7$), 4.72 (d, $J_{1-2}$=8.0Hz, 1H, H1), 4.96 (dd, $J_{2-3}$ = 10.4Hz, $J_{2-1}$ = 8.0Hz, 1H, $H_2$), 5.22 – 5.12 (m, 3H, $H_3$, $H_9$), 5.25 (t, $J_{4-3}$=$J_{4-5}$= 3.0Hz, 1H, $H_4$), 5.85 (ddt, $J_{8-9a}$= 17.2Hz, $J_{8-9a}$=10.4Hz, $J_{8-7}$=5.2Hz, 1H, $H_8$); $^{13}$C NMR (101 MHz, DMSO) δ ppm:20.38, 20.43, 20.54, 20.55 ($4C_b$), 61.29 ($C_6$), 67.36($C_4$), 68.72 ($C_2$), 69.16 ($C_7$), 69.89 ($C_5$), 70.23 (C3), 99.24 ($C_1$), 116.61 ($C_9$), 134.20 ($C_8$), 169.23, 169.57, 169.96, 170.02 ($4C_a$).

**2, 3, 4, 6-tetra-*O*-acetyl-1-*O*-allyl-α-D-mannopyranose (3c):**



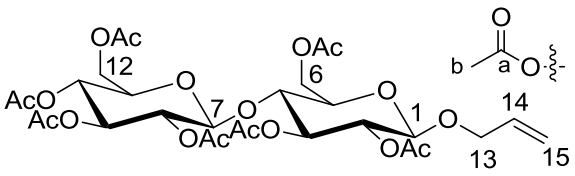

Yield: 39%; R*f*: 0.15 (AcOEt/ EP, 1/3, v/v); MS ESI+: *m/z* 411.53 ($M+Na^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.94, 2.02, 2.02, 2.11 (4s, 12H, $H_b$), 3.94 (ddd, $J_{5-4}$=9.9Hz, $J_{5-6a}$= 4.6Hz, $J_{5-6b}$= 2.4Hz, 1H, $H_5$), 4.03 (dd, $J_{6a-6b}$= 12.8Hz, $J_{6a-5}$= 6.0Hz, 1H, $H_{6a}$), 4.05 (dd, $J_{7a-7b}$= 9.8Hz, $J_{7a-8}$= 2.3Hz, 1H, $H_{7a}$), 4.14 (dd, $J_{7b-7a}$= 9.5Hz, $J_{7b-8}$= 2.5, 1H, $H_{7b}$), 4.16 (dd, $J_{6b-6a}$= 12.8Hz, $J_{6b-5}$= 6.0Hz, 1H, $H_{6b}$), 4.90 (s, 1H, $H_1$), 5.16 – 5.07 (m, 3H, $H_2$, $H_3$, $H_4$), 5.22 (dd, $J_{9a-8}$= 10.4Hz, $J_{9a-9b}$=1.7Hz, 1H, $H_{9a}$), 5.30 (dd, $J_{9b-8}$= 17.2Hz, $J_{9b-9a}$=1.7Hz, 1H, $H_{9b}$), 6.02 – 5.88 (m, 1H, $H_8$) ; $^{13}$C RMN (101 MHz, DMSO) δ ppm: 20.45, 20.46, 20.53, 20.63 ($4C_b$), 61.98 ($C_6$), 65.39($C_4$), 67.89 ($C_7$), 67.99 ($C_5$), 68.69($C_2$), 68.74($C_3$), 95.91($C_1$), 117.89($C_9$), 133.80 ($C_8$), 169.55, 169.73 (2C), 170.11 ($4C_a$).

**2, 3, 5-tri-*O*-acetyl-1-*O*-allyl-β-D-ribofuranose (3d):**



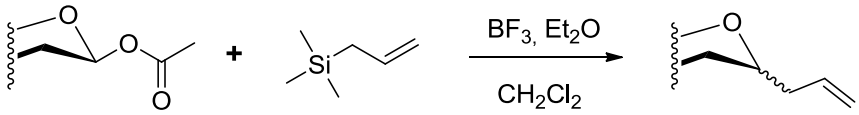

Yield: 45%; R*f*: 0.22 (AcOEt/ EP, 1/3, v/v); MS ESI+: *m/z* 339.24 ($M+Na^+$); $^1$H NMR (400 MHz, DMSO) δ ppm : 2.02, 2.02, 2.08 (3s, 9H, $H_b$), 3.97 (dd, $J_{6a-6b}$= 13.1Hz, $J_{6a-7}$=5.7Hz, 1H, $H_{6a}$), 4.02 (dd, $J_{5a-5b}$= 11.7Hz, $J_{5a-4}$=5.2Hz, 1H, $H_{5a}$), 4.13 (dd, $J_{6b-6a}$= 13.1Hz, $J_{6b-7}$=5.2Hz, 1H, $H_{6b}$), 4.27 – 4.22 (m, 1H, $H_4$), 4.30 (dd, $J_{5b-5a}$= 11.7Hz, $J_{5b-4}$=3.8Hz, 1H, $H_{5b}$), 5.06 (d, $J_{1-2}$= 0.7Hz, 1H, $H_1$), 5.11 (dd, $J_{2-1}$ = 5.0Hz, $J_{2-3}$=1.0Hz, 1H, $H_2$), 5.21 – 5.14 (m, 2H, $H_3$ et $H_{8a}$), 5.26 (dd, $J_{8b-7}$= 17.2Hz, $J_{8b-8a}$=1.8Hz, 1H, $H_{8b}$ ), 5.94 – 5.82 (m, 1H, $H_7$); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 20.32, 20.37, 20.59 ($3C_b$), 63.59 ($C_5$), 67.80 $C_6$), 70.97 ($C_3$), 73.97 ($C_2$), 78.00 ($C_4$), 103.75 ($C_1$), 117.04 ($C_8$), 134.12 ($C_7$), 169.45, 169.61, 170.09 ($3C_a$).

**2, 3, 6, 8, 9, 10, 12-hepta-*O*-acetyl-1-*O*-allyl-β-D-cellobiose (3e):**



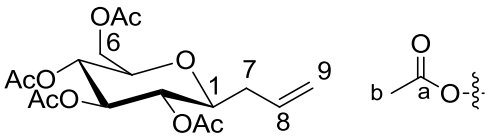
Yield: 35%; R*f*: 0.32 (methylene chloride 1% methanol); MS ESI+: *m/z* 699.44 ($M+Na^+$); $^1H$ NMR (400 MHz, DMSO) δ ppm: 5.89 - 5.78 (m, 1H, $H_{14}$), 5.33 – 5.02 (m, 3H, $H_3$, $H_9$, $H_{10}$), 5.20 - 5.18 (m, 1H, $H_{15b}$), 5.14 (dd, $J_{15a-14}$= 10.2Hz, $J_{15a-15b}$= 1.6Hz, 1H, $H_{15a}$), 4.89 (dd, $J_{2-3}$ = 10.3Hz, $J_{2-1}$ = 8.1Hz, 1H, $H_2$), 4.88 (dd, $J_{8-9}$ = 9.9Hz, $J_{8-7}$ =5.9Hz, 1H, $H_8$), 4.71 (d, $J_{1-2}$= 8.4Hz, 1H, $H_1$), 4.62 (d, $J_{7-8}$= 8.0Hz, 1H, $H_7$), 4.34 - 4.22 (m, 2H, $H_{12}$), 4.08 – 3.99 (m, 2H, $H_6$), 3.99 - 3.85 (m, 3H, $H_4$, $H_5$, $H_{11}$), 2.08, 2.01, 2.00, 1.99, 1.97, 1.96 (6s, 21H, $H_b$); $^{13}C$ NMR (101 MHz, DMSO) δ ppm: 20.24 (2C), 20.26, 20.30, 20.35, 20.45, 20.68 ($7C_b$), 61.46 ($C_6$), 61.53 ($C_{12}$), 67.62, 68.88, 69.50, 70.24, 70.42, 71.21, 72.18($C_9$), 75.58 ($C_4$), 99.35 ($C_1$), 99.67 ($C_7$), 116.64($C_{15}$), 135.31($C_{14}$), 169.20, 169.10, 169.05, 169.62, 169.65, 170.04, 170.30 ($7C_a$).

**General procedure for synthesis of 1-C-allyl peracetylated sugars:**




0.985 ml of allyltrimethylsilane (6.2 mmol, 3.1 equiv) and 2 mmol of peracetylated sugar were mixed in 15 mL of anhydrous acetonitrile. The solution was cooled at 0°C and 1.13mL of $BF_3.Et_2O$ (9.8 mmol, 4.9 equiv.) were added under argon atmosphere. The mixture was stirred 48 hours at room temperature, then neutralized with 20 mL of water, and extracted four times with 20 mL of ethyl acetate. The organic layer was washed with 15 mL of a 5% aqueous solution of NaHCO3, dried over anhydrous sodium sulfate, and then concentrated under vacuum. The residue was purified on silica gel (eluent: AcOEt – Petroleum ether, 1-3, v-v).

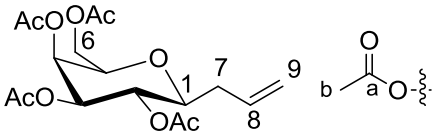
**2, 3, 4, 6-tetra-*O*-acetyl-1-*C*-allyl-β-D-glucopyranose (<u>4a</u>):**



Yield: 69%; R*f*: 0.15 (AcOEt/ EP, 1/3, v/v); MS ESI+: *m/z* 395.28 ($M+Na^+$) $^1H$ NMR (400 MHz, DMSO) δ ppm: 1.98, 1.99, 2.00, 2.02 (4s, 12H, $H_b$), 2.24 (ddd, $J_{7a-7b}$= 14.9Hz, $J_{7a-1}$= 5.9Hz, $J_{7a-8}$= 4.5Hz, 1H, $H_{7a}$),

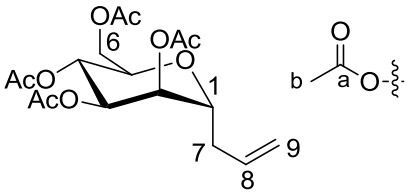
2.62 (ddd, $J_{7b-7a}$= 15.0Hz, $J_{7b-1}$= 11.0Hz, $J_{7b-8}$= 7.6Hz, 1H, $H_{7b}$), 4.02 – 3.90 (m, 2H, $H_5$, $H_{6a}$), 4.19 – 4.08 (m, 2H, $H_1$, $H_{6b}$), 4.84 (t, $J_{2-1}$=$J_{2-3}$= 8.9Hz, 1H, $H_2$), 4.89 (dd, $J_{4-3}$= 9.3Hz, $J_{4-5}$= 5.6Hz, 1H, $H_4$), 5.05 (dd, *J* = 10.3, $J_{9b-9a}$=1.9, 1H, $H_{9a}$), 5.17 (dd, $J_{9b-8}$17.6Hz, $J_{9b-9b}$=1.9Hz, 1H, $H_{9b}$), 5.27 (t, $J_{3-2}$=$J_{3-4}$= 8.9Hz, 1H, $H_3$), 5.80 – 5.62 (m, 1H, $H_8$); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 20.45, 20.49, 20.52, 20.55 (4$C_b$), 29.98($C_7$), 61.83 ($C_6$), 68.42 ($C_3$, $C_5$), 69.47 ($C_2$), 69.81($C_4$), 71.05($C_1$), 117.47($C_9$), 134.05($C_8$), 169.41, 169.57, 169.63, 170.08 (4$C_a$).

**2, 3, 4, 6-tetra-*O*-acetyl-1-*C*-allyl-β-D-galactopyranose (<u>4b</u>):**



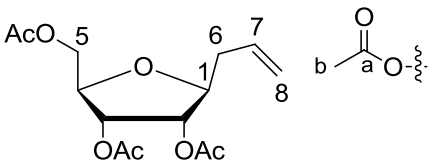

Yield: 85%; R*f*: 0.14 (AcOEt/ EP, 1/3, v/v)**;** MSESI+: *m/z* 395.26 (M+Na$^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ ppm: 1.93, 1.94 , 1.97, 2.02(4s, 12H, $H_b$), 2.25 – 2.14 (m, 1H, $H_{7a}$), 2.47 – 2.30 (m, 1H, $H_{7b}$), 4.04 – 3.95 (m, 2H, $H_5$, $H_{6a}$), 4.11 (dd, *J* = 12.7, 9.1, 1H, $H_{6b}$), 4.20 (dt, $J_{1-2}$=9.7Hz, $J_{1-7}$=4.7Hz, 1H, $H_1$), 5.00 – 4.89 (m, 1H, $H_2$), 5.04 (dd, $J_{9a-8}$= 16.9Hz, $J_{9a-9b}$= 1.4Hz, 1H, $H_{9a}$), 5.12 (dd, $J_{9b-8}$= 9.3Hz, $J_{9b-9a}$= 3.1, 1H, $H_{9b}$), 5.17 (dd, $J_{3-2}$=9.3Hz, $J_{3-4}$=4.8, 1H, $H_3$), 5.32 (t, $J_{4-3}$=$J_{4-5}$= 2.6Hz, 1H, $H_4$), 5.73 – 5.56 (m, 1H, $H_8$). $^{13}$C NMR (101 MHz, $CDCl_3$, 298 K): δ ppm: 20.65, 20.71, 20.77 (4$C_b$), 30.90 ($C_7$), 61.49($C_6$), 67.64 ($C_5$), 67.93 ($C_2$), 68.28 ($C_4$), 68.25 ($C_3$), 71.45($C_1$), 117.63($C_9$), 133.43($C_8$), 169.81, 169.92, 170.10, 170.53 (4$C_a$).

**2, 3, 4, 6-tetra-*O*-acetyl-1-*C*-allyl-α-D-mannopyranose (<u>4c</u>):**



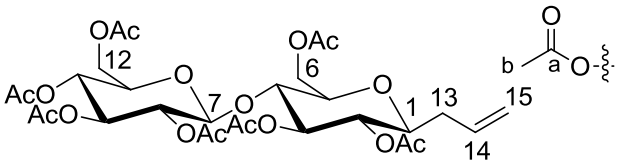

Yield: 71%; R*f*: 0.15 (AcOEt/ EP, 1/3, v/v); MS ESI+: *m/z* 395.28 (M+Na$^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ ppm: 2.00, 2.03, 2.06, 2.09 (4s, 12H, $H_b$), 2.38 (dt, $J_{7a-7b}$=13.3 Hz, $J_{7a-8}$= $J_{7a-1}$6.4 Hz, 1H, $H_{7a}$), 2.50 (td, $J_{7b-7a}$=14.9 Hz, $J_{7b-8}$= $J_{7b-1}$=7.7 Hz, 1H, $H_{7b}$), 3.90 – 3.83 (m, 1H, $H_5$), 4.01 (ddd, $J_{1-2}$= 9.1 Hz, $J_{1-7b}$=6.0 Hz, $J_{1-7a}$=3.1 Hz, 1H, $H_1$), 4.08 (dd, $_{6a-6b}$= 12.0 Hz, $J_{6a-5}$=2.8 Hz, 1H, $H_{6a}$), 4.29 (dd, $J_{6b-6a}$= 12.1 Hz, $J_{6b-5}$=6.3 Hz, 1H, $H_{6b}$), 5.11 (dd, $J_{9a-8}$= 10.3, $J_{9a-9b}$= 1.1Hz, 1H, $H_{9a}$), 5.19 – 5.15 (m, 3H, $H_2$, $H_4$, $H_{9b}$), 5.24 (dd, $J_{3-4}$= 8.9 Hz, $J_{3-2}$= 3.3 Hz, 1H, $H_3$), : 5.74 (ddt, $J_{8-9a}$= 17.1 Hz, $J_{8-9a}$=10.2 Hz, $J_{8-7}$=6.9 Hz, 1H, $H_8$); $^{13}$C NMR (101 MHz, $CDCl_3$) δ ppm: 20.88, 20.95 (2C), 21.13 (4$C_b$), 33.75 (C7), 62.58 (C6), 67.18($C_2$), 68.97($C_3$), 70.20($C_5$), 70.82 ($C_4$), 74.34 (C1), 118.53 (C9), 132.72 (C8), 169.87, 170.16, 170.40, 170.88 (4$C_a$).

**2, 3, 5-tri-*O*-acetyl-1-*C*-allyl-β-D-ribofuranose (<u>4d</u>):**



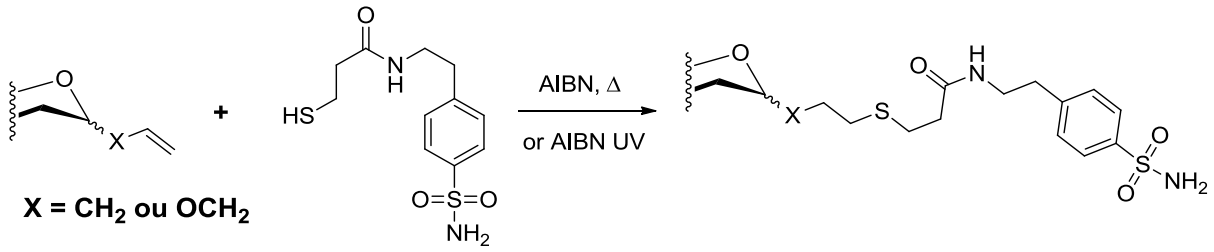

Yield: 75% ; R*f*: 0.25 (AcOEt/ EP, 1/3, v/v) ; MS ESI+: *m/z* 323.19 ($M+Na^+$); $^1H$ NMR (400 MHz, DMSO): δ ppm: 1.98, 2.02, 2.10 (3s, 9H, $H_b$), 2.35 – 2.22 (m, 2H, $H_6$), 4.06 (dd, $J_{5a-5b}$= 10.3Hz, $J_{5a-4}$= 3.7Hz, 1H, $H_{5a}$), 4.11 – 4.08 (m, 1H, $H_4$), 4.17 (dd, $J_{5b-5a}$= 10.1Hz, $J_{5b-4}$= 2.0 Hz, 1H, $H_{5b}$), 4.24 (td, $J_{1-6a}$ = $J_{1-6b}$=7.1Hz, $J_{1-2}$ = 3.2Hz, 1H, $H_1$), 5.02 (dd, $J_{8a-7}$= 10.2Hz, $J_{8a-8b}$= 2.1Hz, 1H, $H_{8a}$), 5.08 (dd, $J_{8b-7}$= 17.2Hz, $J_{8b-8a}$= 2.0Hz, 1H, $H_{8b}$), 5.23 (dd, $J_{3-4}$= 7.3 Hz, $J_{3-2}$= 4.7 Hz, 1H, $H_3$), 5.30 (dd, $J_{2-3}$= 4.7Hz, $J_{2-1}$= 3.3Hz, 1H, $H_2$), 5.70 (ddt, $J_{7-8b}$= 17.1Hz, $J_{7-8a}$= 10.2Hz, $J_{7-6}$= 6.9Hz, 1H, $H_7$) ; $^{13}C$ RMN (101 MHz, DMSO) δ ppm: 20.26, 20.27, 20.53 ($3C_b$), 33.34($C_6$), 63.61 ($C_5$), 71.78 ($C_2$), 72.27 ($C_3$), 76.42 ($C_4$), 77.89 (C1), 117.34 ($C_8$), 133.85 ($C_7$), 169.41, 169.60, 170.16 ($3C_a$).

**2, 3, 6, 8, 9, 10, 12-hepta-*O*-acetyl-1-*C*-allyl-β-D-cellobiose (<u>4e</u>):**



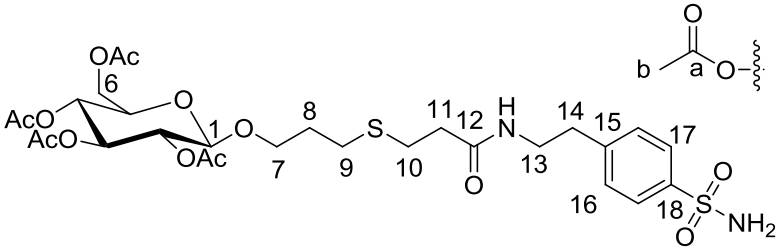

Yield: 60%; R*f*: 0.42 methylene chloride 1% Methanol); MS ESI+: *m/z* 683.54 ($M+Na^+$); $^1H$ NMR (400 MHz, $CDCl_3$) δ ppm: 1.96, 1.99, 2.02, 2.06, 2.08 (5s, 21H, $H_b$), 2.33 – 2.24 (m, 1H, $_{13a}$), 2.50 (ddd, $J_{13b-13a}$=15.3, $J_{13b-14}$=10.5, $J_{13b-1}$=7.4, 1H, $H_{13b}$), 3.63 – 3.58 (m, 1H, $H_4$), 3.65 (ddd, $J_{11-10}$= 10.0Hz, $J_{11-12a}$=4.5Hz, $J_{11-12b}$=2.4Hz, 1H, $H_{11}$), 3.76 (ddd, $J_{5-4}$= 8.6Hz, $J_{5-6b}$= 5.9Hz, $J_{5-6a}$=2.6Hz, 1H, $H_5$), 4.02 (dd, $J_{6a-6b}$=12.4Hz, $J_{6a-5}$= 2.2Hz, 1H, $H_{6a}$), 4.08 (dd, $J_{6b-6a}$ = 11.8Hz, $J_{6b-5}$= 5.9Hz, 1H, $H_{6b}$), 4.16 (dt, $J_{1-13}$ = 10.4Hz, $J_{1-2}$= 5.0Hz, 1H, $H_1$), 4.38 – 4.30 (m, 2H, $H_{12}$), 4.51 (d, $J_{7-8}$= 8.0Hz, 1H, $H_7$), 4.91 (dd, $J_{8-9}$= 9.3Hz, $J_{8-7}$= 8.0Hz, 1H, $H_8$), 4.97 (dd, $J_{2-3}$= 8.8Hz, $J_{2-1}$=5.5Hz, 1H, $H_2$), 5.16 – 5.01 (m, 4H, $H_{15}$, $H_9$, $H_{10}$), 5.32 (dd, $J_{3-2}$=8.7Hz, $J_{3-4}$=7.8Hz, 1H, $H_3$), 5.70 (ddt, $J_{14-15a}$=17.2Hz, $J_{14-13}$=10.2Hz, $J_{14-15b}$=6.8Hz, 1H, $H_{14}$); $^{13}C$ RMN (101 MHz, $CDCl_3$) δ ppm: 20.78(2C), 20.79, 20.89(2C), 20.98, 21.06($7C_b$), 31.10 ($C_{13}$), 61.81($C_6$), 62.44($C_{12}$), 68.00, 69.79, 70.15, 70.24, 71.78, 71.85, 72.19 ($C_9$), 73.18 ($C_4$), 76.91 ($C_1$), 101.26 ($C_7$), 118.02($C_{15}$), 133.26 ($C_{14}$), 169.40, 169.55, 169.93, 170.14, 170.45, 170.61, 170.75 ($7C_a$).

**General procedure: Thiol-ene coupling:**



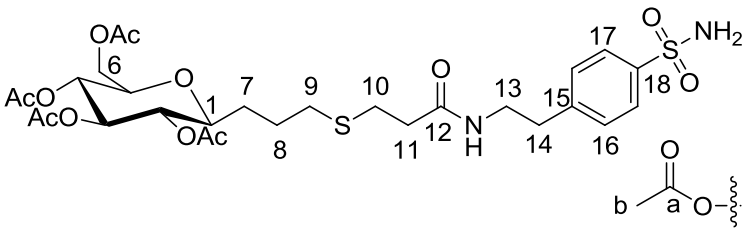

To a solution of 0.1 mmol of 1-O-allyl or 1-C-allyl sugar (1 equiv.) and 288mg of compound 7 (1mmol, 10 equiv.) in 10ml of 1,4-dioxanne were added under argon atmosphere 33mg of AIBN. The mixture was then or refluxed for 20 hours, or irradiated under UV at 254nm for 7 hours. The mixture was then concentrated under vacuum and the residue purified on silica gel (methylene chloride – methanol 9.5 – 0.5, v-v).

***N*-(4-sulfamoylphenethyl)-3-(3-(2, 3, 4, 6-tetra-*O*-acetyl-β-D-glucopyranosyl-1-*O*-) propylthio) propanamide (5a):**



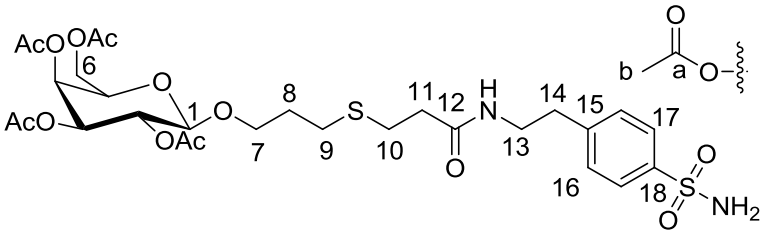
R*f*: 0.54 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 699.32 ($M+Na^+$), 675.24 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ (ppm): 1.78 – 1.68 (m, 2H, $H_8$), 1.93, 2.01, 1.99, 1.98 (4s, 12H, $H_b$), 2.30 (t, $J_{10\text{-}11}$= 7.3Hz, 2H, $H_{10}$), 2.49 (t, $J_{11\text{-}10}$ = 7.2Hz, 2H, $H_{11}$), 2.64 (t, $J_{9\text{-}8}$= 7.3Hz, 2H, $H_9$), 2.78 (t, $J_{14\text{-}13}$= 7.2Hz, 2H, $H_{14}$), 3.33 – 3.23 (m, 2H, $H_{13}$), 3.55 (dt, $J_{7a\text{-}7b}$= 10.2Hz, $J_{7a\text{-}8}$=6.5Hz, 1H, $H_{7a}$), 3.78 (dt, $J_{7b\text{-}7a}$= 10.3Hz, $J_{7b\text{-}8}$=5.8Hz, 1H, $H_{7b}$), 4.04 – 3.94 (m, 2H, $H_{6a}$ et $H_5$), 4.17 (dd, $J_{6b\text{-}6a}$= 12.3Hz, $J_{6b\text{-}5}$=5.2Hz, 1H, $H_{6b}$), 4.84 – 4.70 (m, 2H, $H_1$ et $H_2$), 4.89 (t, $J_{4\text{-}3}$=$J_{4\text{-}5}$= 9.8Hz, 1H, $H_4$ ), 5.27 (t, $J_{3\text{-}2}$=$J_{3\text{-}4}$= 9.4Hz, 1H, $H_3$), 7.30 (s, 2H, $NH_2$), 7.39 (d, $J_{16\text{-}17}$= 7.1Hz, 2H, $H_{16}$), 7.73 (d, $J_{17\text{-}16}$= 7.8Hz, 2H, $H_{17}$), 8.08 (t, $J_{NH\text{-}H13}$= 5.5Hz, 1H, NHC(O)) ; $^{13}$C NMR (101 MHz, DMSO): δ ppm 20.29, 20.39, 20.52 ($4C_b$), 26.99 ($C_{10}$), 27.33 ($C_9$), 28.95 ($C_8$), 34.82($C_{14}$), 35.70 ($C_{11}$), 39.81 (C13), 61.75 (C6), 67.71, 68.21, 70.52, 70.95, 71.98, 99.40 ($C_1$), 125.67 ($2C_{16}$), 129.15 ($2C_{17}$), 142.05 ($C_{14}$), 143.71 ($C_{17}$), 169.05, 169.30, 169.57, 169.85, 170.42 ($4C_a$ et $C_{12}$).

***N*-(4-sulfamoylphénéthyl)-3-(3 –(2, 3, 4, 6-tetra-*O*-acetyl-β-D-glucopyranosyl-1-*C*-) propylthio) propanamide (6a):**



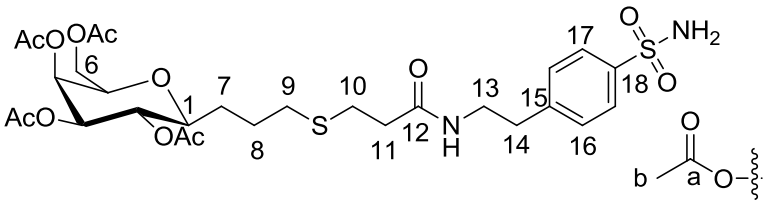
R*f*: 0.56 (methylene chloride - methanol, 9-1, v-v); MS: *m/z* 683.45 ($M+Na^+$), 659.37 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.60 –1.39 (m, 4H, $H_7$, $H_8$), 1.99, 2.00, 2.01, 2.02(4s, 12H, $H_b$), 2.31 (t, $J_{11\text{-}10}$ =7.2Hz, 2H, $H_{11}$), 2.51 (t, $J_{9\text{-}8}$=7.2 Hz, 2H, $H_9$), 2.65 (t, $J_{10\text{-}11}$=7.1 Hz, 2H, $H_{10}$), 2.77 (t, $J_{14\text{-}13}$=7.1 Hz, 2H, $H_{14}$), 3.33 – 3.24 (m, 2H, $H_{13}$), 4.02 – 3.86 (m, 2H, $H_5$, $H_{6a}$), 4.18 – 4.06 (m, 2H, $H_1$, $H_{6b}$), 4.29 (dd, *J*= 10.8, 5.3, 1 H), 5.14–4.81 (m, 2 H, $H_2$, $H_4$), 5.25 (dd, $J_{3\text{-}4}$= 8.9 Hz, $J_{3\text{-}2}$= 4.3 Hz, 1H, $H_3$), 7.30 (s, 2H, $NH_2$), 7.40 (d, $J_{16\text{-}17}$= 7.8Hz, 2H, $H_{16}$), 7.73 (d, $J_{17\text{-}16}$= 8.1Hz, 2H, $H_{17}$), 8.02 (t, $J_{NH\text{-}H13}$=5.6Hz, 1H, NHC(O)).$^{13}$C NMR (101 MHz, DMSO) δ ppm: 20.32, 20.35, 20.44, 20.51 (4$C_b$), 24.88 ($C_8$), 26.26 (C7), 26.81 ($C_{10}$), 30.31 ($C_9$), 34.78 ($C_{14}$), 35.75 ($C_{11}$), 39.85 ($C_{13}$), 61.81 ($C_6$), 68.54 ($C_5$), 68.63($C_3$), 69.79($C_4$), 67.89 ($C_2$), 71.23 ($C_1$), 125.61 ($C_{17}$), 129.08 ($C_{16}$), 142.02 (C18), 143.67 ($C_{15}$), 169.45, 169.60, 169.65, 170.12, 170.52(4$C_a$ et $C_{12}$).

***N*-(4-sulfamoylphénéthyl)-3-(3-(2, 3, 4, 6-tetra-*O*-acetyl-β-D-galactopyranosyl-1-*O*-)propylthio) propanamide (<u>5b</u>):**



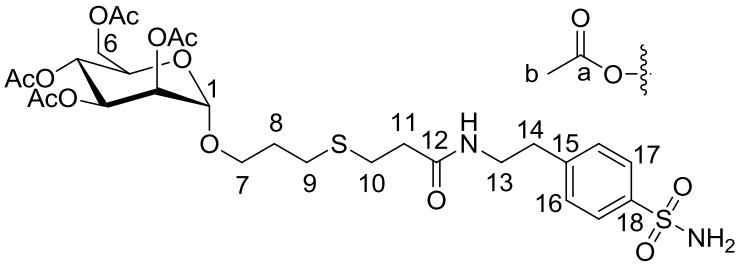
R*f*: 0.55 (methylene chloride - methanol, 9-1, v-v); MS: *m/z* 699.33 ($M+Na^+$), 675.26 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.77 – 1.67 (m, 2H, $H_8$), 1.91, 2.00, 2.02, 2.11(4s, 12H, $H_b$), 2.31 (t, $J_{11\text{-}10}$ = 7.3, 2H, $H_{11}$), 2.52 (t, $J_{9\text{-}8}$= 7.2Hz, 2H, $H_9$), 2.64 (t, $J_{10\text{-}11}$= 7.3Hz, 2H, $H_{10}$), 2.77 (t, $J_{14\text{-}13}$= 7.1Hz, 2H, $H_{14}$), 3.33 – 3.25 (m, 2H, $H_{13}$), 3.55 (dt, $J_{7a\text{-}7b}$= 9.9Hz, $J_{7a\text{-}8}$= 6.4Hz, 1H, $H_{7a}$), 3.78 (dt, $J_{7b\text{-}7a}$= 10.0Hz, $J_{7b\text{-}8}$= 5.8Hz, 1H, $H_{7b}$), 4.04 (dd, $J_{6a\text{-}6b}$= 6.4Hz, $J_{6\text{-}5}$=1.8Hz, 2H, H6), 4.21 – 4.16 (m, 1H, $H_5$), 4.69 (d, $J_{1\text{-}2}$=8.0Hz, 1H, $H_1$), 4.91 (dd, $J_{2\text{-}3}$ = 10.4Hz, $J_{2\text{-}1}$ = 8.0Hz, 1H,$H_2$),5.16 (dd, $J_{3\text{-}2}$=10.4Hz, $J_{3\text{-}4}$=3.6Hz, 1H, $H_3$),5.25 (dd, $J_{4\text{-}3}$=3.5Hz, $J_{4\text{-}5}$=0.7Hz, 1H, $H_4$), 7.30 (s, 2H,$NH_2$), 7.39 (d, $J_{16\text{-}17}$= 8.4Hz, 2H,$H_{16}$), 7.73 (d, $J_{17\text{-}16}$= 8.3Hz, 2H,$H_{17}$), 8.01 (t, $J_{NH\text{-}H13}$= 5.6Hz, 1H,NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 20.36,20.40,20.52 (2C)(4$C_b$),26.98 (C10),27.35 ($C_9$),28.99($C_8$), 34.82($C_{14}$), 35.70 ($C_{11}$), 39.82($C_{13}$), 61.30 ($C_6$), 67.32 ($C_4$), 67.65 ($C_7$), 68.70 ($C_2$), 69.81($C_5$), 70.18 ($C_3$), 99.96 ($C_1$), 125.66 ($C_{17}$), 129.15 ($C_{16}$), 142.04 ($C_{18}$), 143.72 ($C_{15}$), 169.19, 169.55, 169.92, 169.98, 170.43 (4$C_a$ et $C_{12}$).

***N*-(4-sulfamoylphenethyl)-3-(3-(2, 3, 4, 6-tetra-*O*-acetyl-β-D-galactopyranosyl-1-*C*-)propylthio) propanamide (6b) :**



R*f*: 0.58 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 683.44 ($M+Na^+$), 659.33 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm : 1.60 – 1.40 (m, 4H, $H_7$, $H_8$), 1.96, 1.99, 2.03, 2.09 (4s, 12H, $H_b$), 2.32 (t, $J_{11\text{-}10}$ = 7.3Hz, 2H, $H_{11}$), 2.52 (t, $J_{9\text{-}8}$= 7.2Hz, 2H, $H_9$), 2.65 (t, $J_{10\text{-}11}$= 7.3Hz, 2H, $H_{10}$), 2.78 (t, $J_{14\text{-}13}$= 7.1Hz, 2H, $H_{14}$), 3.33 – 3.24 (m, 2H, $H_{13}$), 3.99 (dd, $J_{6a\text{-}6b}$= 10.8Hz, $J_{6a\text{-}5}$=4.2Hz, 1H, $H_{6a}$), 4.18 – 4.06 (m, 3H, $H_1$, $H_{6b}$, $H_5$), 5.07 (dd, $J_{2\text{-}3}$= 9.8Hz, $J_{2\text{-}1}$= 5.5Hz, 1H, $H_2$), 5.21 (dd, $J_{3\text{-}2}$= 9.9Hz, $J_{3\text{-}4}$= 3.5Hz, 1H, $H_3$), 5.27 (dd, $J_{4\text{-}3}$= 3.4Hz, $J_{4\text{-}5}$= 1.9Hz, 1H, $H_4$), 7.29 (s, 2H, $NH_2$), 7.39 (d, $J_{16\text{-}17}$= 7.2Hz, 2H, $H_{16}$), 7.73 (d, $J_{17\text{-}16}$= 8.1Hz, 2H, $H_{17}$), 8.07 (t, $J_{NH\text{-}H13}$= 5.5Hz, 1H, NHC(O)) ; $^{13}$C RMN (101 MHz, DMSO) δ ppm: 20.40, 20.46, 20.51, 20.54 ($4C_b$), 24.80 ($C_8$), 26.25(C7), 26.79 ($C_{10}$), 30.45 ($C_9$), 34.82 ($C_{14}$), 35.70($C_{11}$), 39.80 (C13), 61.49 (C6), 67.23 ($C_5$), 67.34($C_3$), 67.81($C_4$), 67.94 ($C_2$), 71.25 ($C_1$), 125.65($C_{17}$), 129.12($C_{16}$), 142.04 (C18), 143.69(C15), 169.46, 169.70, 169.83, 169.92, 170.45 ($4C_a$ et $C_{12}$).

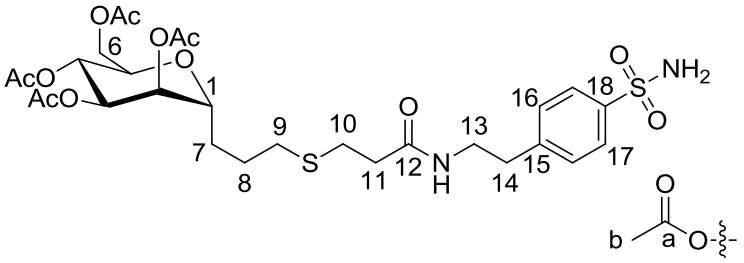
***N*-(4-sulfamoylphenethyl)-3-(3-(2, 3, 4, 6-tetra-*O*-acetyl-α-D-mannopyranosyl-1-*O*-)propylthio) propanamide (5c):**



R*f*: 0.52 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 699.32 ($M+Na^+$), 675.24 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.87 – 1.77 (m, 2H, $H_8$), 1.93, 2.02, 2.02, 2.10 (4s, 12H, $H_b$), 2.32 (t, $J_{11\text{-}10}$ =7.3 Hz, 2H, $H_{11}$), 2.51 (t, $J_{9\text{-}8}$= 7.2 Hz, 2H, $H_9$), 2.67 (t, $J_{10\text{-}11}$= 7.3 Hz, 2H, $H_{10}$), 2.77 (t, $J_{14\text{-}13}$= 7.1 Hz, 2H, $H_{14}$), 3.30 (dt $J_{13\text{-}NH}$= 18.4Hz, $J_{13\text{-}14}$= 5.6Hz, 2H, $H_{13}$), 3.52 (dt, $J_{7a\text{-}7b}$= 9.9 Hz, $J_{7a\text{-}8}$= 6.1 Hz, 1H, $H_{7a}$), 3.71 (dt, $J_{7b\text{-}7a}$= 9.8 Hz, $J_{7b\text{-}8}$= 6.6 Hz, 1H, $H_{7b}$), 3.95 (ddd, $J_{5\text{-}4}$=9.9 Hz, $J_{5\text{-}6a}$=5.2 Hz, $J_{5\text{-}6b}$= 2.4 Hz, 1H, $H_5$), 4.05 (dd, $J_{6a\text{-}6b}$=12.2 Hz, $J_{6a\text{-}5}$=2.4 Hz, 1H, $H_{6a}$), 4.14 (dd, $J_{6b\text{-}6a}$=12.2 Hz, $J_{6b\text{-}5}$=5.3 Hz, 1H, $H_{6b}$), 4.88 (d, $J_{1\text{-}2}$= 1.2 Hz, 1H, $H_1$), 5.14 – 5.05 (m, 3H, $H_2$, $H_3$, $H_4$), 7.30 (s, 2H, $NH_2$), 7.39 (d, $J_{16\text{-}17}$= 8.3 Hz, 2H, $H_{16}$), 7.73 (d, $J_{17\text{-}16}$= 8.3 Hz, 2H, $H_{17}$), 8.01 (t, $J_{NH\text{-}H13}$= 5.6 Hz, 1H NHC(O)) ; $^{13}$C NMR(101 MHz, DMSO) δ ppm: 20.44, 20.46, 20.55, 20.63 ($4C_b$), 26.98($C_{10}$), 27.62 ($C_9$), 28.64 ($C_8$), 34.83 ($C_{14}$), 35.73 ($C_{11}$), 39.83 ($C_{13}$),

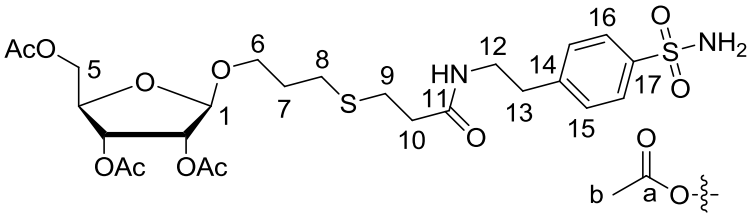
61.97($C_6$), 65.40($C_4$), 66.00($C_7$), 67.94($C_5$), 68.72 ($C_2$), 68.75($C_3$), 96.58($C_1$), 125.67($C_{17}$), 129.15($C_{16}$), 142.04 ($C_{18}$), 143.72($C_{15}$), 169.54, 169.67, 169.69, 170.09, 170.45(4$C_a$ et $C_{12}$).

**_N_-(4-sulfamoylphenethyl)-3-(3-[2, 3, 4, 6-tetra-_O_-acetyl-α-D-mannopyranosyl-1-_C_-]propylthio) propanamide (<u>6c</u>):**




R*f*: 0.56 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 683.45 ($M+Na^+$), (659.37 $M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.61 – 1.45 (m, 4H, $H_7$, $H_8$), 1.96, 2.01, 2.03, 2.07 (4s, 12H, $H_b$), 2.32 (t, $J_{11\text{-}10}$ = 7.2Hz, 2H, $H_{11}$), 2.55 (t, $J_{9\text{-}8}$= 7.3Hz, 2H, $H_9$), 2.66 (t, $J_{10\text{-}11}$= 7.3Hz, 2H, $H_{10}$), 2.79 (t, $J_{14\text{-}13}$= 7.1Hz, 2H, $H_{14}$), 3.34 – 3.25 (m, 2H, $H_{13}$), 3.96 – 3.86 (m, 2H, $H_1$, $H_5$), 4.01 (dd, $J_{6a\text{-}6b}$= 12.0Hz, $J_{6a\text{-}5}$=2.6Hz, 1H, $H_{6a}$), 4.21 (dd, $J_{6b\text{-}6a}$= 12.0Hz, $J_{6b\text{-}5}$=6.5Hz, 1H, $H_{6b}$), 5.08 – 4.96 (m, 2H, $H_2$, $H_4$), 5.21 (dd, $J_{3\text{-}4}$= 14.7Hz, $J_{3\text{-}2}$= 3.8Hz, 1H, $H_3$), 7.30 (s, 2H, $NH_2$), 7.40 (d, $J_{16\text{-}17}$= 8.3Hz, 2H, $H_{16}$), 7.74 (d, $J_{17\text{-}16}$= 8.2Hz, 2H, $H_{17}$), 8.07 (t, $J_{NH\text{-}13}$= 5.6Hz, 1H, NHC(O)). $^{13}$C NMR (101 MHz, DMSO) δ ppm:20.47, 20.54(2C), 20.71(4$C_b$), 24.89 ($C_8$), 26.28($C_7$), 26.81($C_{10}$), 30.29 ($C_9$), 34.76($C_{14}$), 35.73($C_{11}$), 39.86 ($C_{13}$), 62.11($C_6$), 66.57 ($C_2$), 68.51 ($C_3$), 69.52 ($C_5$), 70.40 ($C_4$), 73.75 ($C_1$), 125.68 ($C_{17}$), 129.16 ($C_{16}$), 142.06 ($C_{18}$), 143.69 ($C_{15}$), 169.63, 169.81, 169.87, 170.05, 170.50 (4$C_a$ et $C_{12}$).

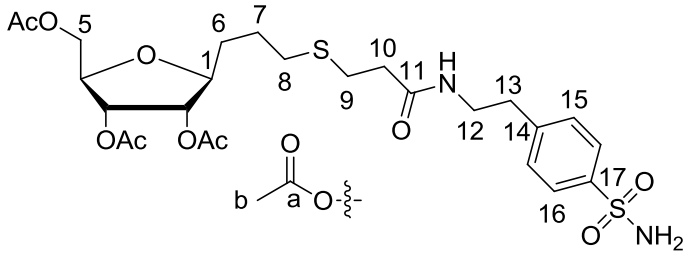
**_N_-(4-sulfamoylphenethyl)-3-(3-(2, 3, 5-tri-_O_-acetyl-β-D-ribofuranosyl-1-_O_-)propylthio) propanamide (<u>5d</u>):**




R*f*: 0.46 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 627.33 ($M+Na^+$), 603.27 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.80 – 1.69 (m, 2H, $H_7$), 2.02, 2.03, 2.07 (3s, 9H, $H_b$), 2.31 (t, $J_{9\text{-}10}$= 7.3 Hz, 2H, $H_9$), 2.52 (t, $J_{10\text{-}9}$ = 7.2 Hz, 2H, $H_{10}$), 2.65 (t, $J_{8\text{-}7}$=7.3 Hz, 2H, $H_8$), 2.77 (t, $J_{13\text{-}12}$=7.2Hz, 2H,$H_{13}$), 3.33 – 3.25 (m, 2H, $H_6$),3.46 (dt, $J_{6a\text{-}6b}$= 9.7Hz, $J_{6a\text{-}7}$=6.3Hz, 1H, $H_{6a}$),3.67 (dt, $J_{6b\text{-}6a}$= 9.8Hz, $J_{6b\text{-}7}$=6.3Hz, 1H, $H_{6b}$),4.03 (dd, $J_{5a\text{-}5b}$= 11.5Hz, $J_{5a\text{-}4}$= 5.4, 1H, $H_{5a}$),4.32 – 4.17 (m, 2H, $H_4$, $H_{5b}$),5.03 (d, $J_{1\text{-}2}$= 0.8Hz, 1H, $H_1$), 5.08 (dd, $J_{2\text{-}3}$= 5.0, $J_{2\text{-}1}$=1.0, 1H, $H_2$),5.16 (dd, $J_{3\text{-}4}$= 6.4Hz, $J_{3\text{-}2}$=5.0Hz, 1H, $H_3$),7.30 (s, 2H,$NH_2$),7.39

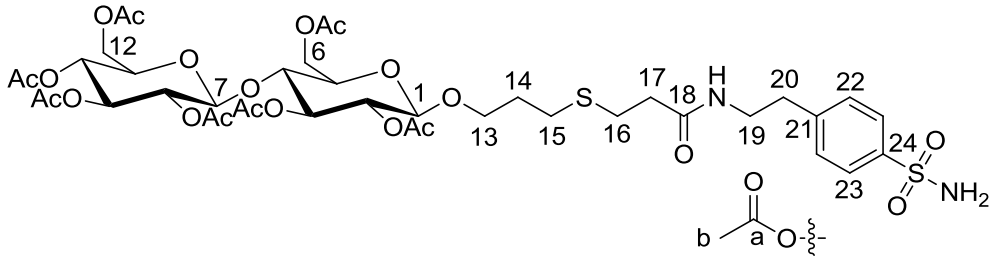
(d, $J_{15\text{-}16}$= 8.3Hz, 2H, $H_{15}$),7.73 (d, $J_{16\text{-}15}$= 8.3Hz, 2H, $H_{16}$),8.01 (t, $J_{NH\text{-}H12}$= 5.6Hz, 1H,NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ ppm:20.34, 20.39, 20.60 ($3C_b$),26.97 ($C_9$), 27.56 ($C_8$), 28.98 ($C_7$), 34.83 ($C_{13}$), 35.72 ($C_{10}$), 39.84 ($C_{12}$), 63.92 ($C_5$), 66.11 ($C_6$), 71.08 ($C_3$), 73.98 ($C_2$), 77.88 ($C_4$), 104.50 ($C_1$), 125.68 ($C_{16}$), 129.16 ($C_{15}$), 142.04 ($C_{17}$), 143.74 ($C_{14}$), 169.47, 169.63, 170.11, 170.46 ($3C_a$ et $C_{11}$).

***N*-(4-sulfamoylphénéthyl)-3-(3-[2, 3, 5-tri-*O*-acetyl-β-D-ribofuranosyl-1-*C*-]propylthio) propanamide (6d) :**




Rf: 0.5 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 611.27 ($M+Na^+$), 587.28 ($M-H^+$); $^1$H RMN (400 MHz, DMSO) δ ppm: 1.50 – 1.36 (m, 1H, $H_{6a}$), 1.60 – 1.49 (m, 3H, $H_{6b}$, $H_7$), 1.99, 2.02, 2.09 (3s, 9H, $H_b$), 2.30 (t, $J_{10\text{-}9}$ = 7.3Hz, 2H, $H_{10}$), 2.49 (t, $J_{8\text{-}7}$= 7.2Hz, 2H, $H_8$), 2.63 (t, $J_{9\text{-}10}$= 7.3Hz, 2H, $H_9$), 2.77 (t, $J_{13\text{-}12}$= 7.1Hz, 2H, $H_{13}$), 3.31 – 3.23 (m, 2H, $H_{12}$), 4.04 (dd, $J_{5a\text{-}5b}$= 10.3Hz, $J_{5a\text{-}4}$= 3.7Hz, 1H, $H_{5a}$), 4.08 (dd, $J_{4\text{-}3}$=5.7Hz, $J_{4\text{-}5}$=3.7Hz, 1H, $H_4$), 4.22 – 4.13 (m, 2H,$H_1$, $H_{5b}$), 5.20 (dd, $J_{3\text{-}4}$=6.9 Hz, $J_{3\text{-}2}$= 4.8 Hz, 1H,$H_3$), 5.33 (dd, $J_{2\text{-}3}$= 4.7 Hz, $J_{2\text{-}1}$= 3.3 Hz, 1H, $H_2$), 7.29 (s, 2H, $NH_2$), 7.39 (d, $J_{15\text{-}16}$= 8.4Hz, 2H, $H_{15}$), 7.73 (d, $J_{16\text{-}15}$= 8.4Hz, 2H, $H_{16}$), 7.99 (t, $J_{NH\text{-}H12}$= 5.6 Hz, 1H, NHC(O)); $^{13}$C RMN (101 MHz, DMSO) δ ppm: 20.29, 20.34, 20.56 ($3C_b$), 25.23 ($C_7$), 26.90 ($C_6$), 27.71 ($C_9$), 30.70 ($C_8$), 34.80 ($C_{13}$), 35.72 ($C_{10}$), 39.79 ($C_{12}$), 63.63 ($C_5$), 71.99 ($C_2$), 72.48($C_3$), 76.32($C_4$), 78.29($C_1$), 125.64 ($C_{16}$), 129.12 ($C_{15}$), 142.03 ($C_{17}$), 143.70 ($C_{14}$), 169.47, 169.73, 170.18, 170.44($3C_a$ et $C_{11}$).

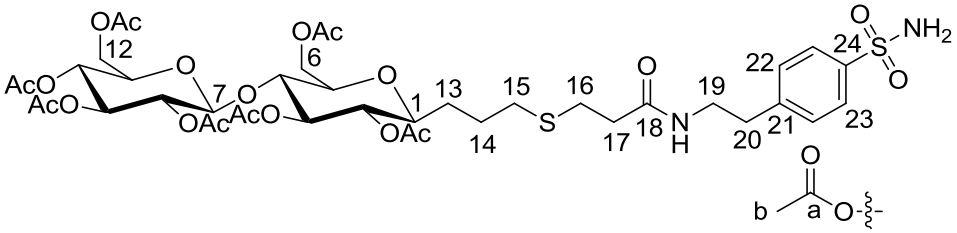
***N*-(4-sulfamoylphenethyl)-3-(3-(2, 3, 6, 8, 9, 10, 12-hepta-*O*-acetyl-β-D-cellobiosyl-1-*O*-)propylthio) propanamide (5e):**




R*f*: 0.48 (methylene chloride - methanol, 9-1, v-v); MS: *m/z* 988.19 ($M+Na^+$), 963.92 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.74 – 1.67 (m, 2H, $H_{14}$), 1.91, 1.94, 1.96, 1.97, 1.98, 2.00, 2.08 (7s, 21H, $H_b$), 2.32 (t, $J_{17\text{-}16}$ =7.3Hz, 2H, $H_{17}$), 2.49 (t, $J_{15\text{-}14}$= 7.2Hz, 2H, $H_{15}$), 2.63 (t, $J_{16\text{-}17}$= 7.4Hz, 2H, $H_{16}$), 2.77 (t,

$J_{20\text{-}19}$=7.2Hz, 2H, $H_{20}$), 3.33 – 3.26 (m, 2H, $H_{19}$), 3.58 – 3.48 (m, 2H, $H_{13a}$), 3.77 – 3.70 (m, 2H, $H_4$, $H1_{3b}$), 3.86 – 3.78 (m, 1H, $H_{11}$), 3.94 (dd, $J_{5\text{-}4}$= 12.5, $J_{5\text{-}6}$= 2.1Hz, 1H, $H_5$), 4.09 – 3.98 (m, 2H, $H_6$), 4.24 (dd, $J_{12a\text{-}12b}$= 12.3Hz, $J_{12a\text{-}11}$= 3.9Hz, 1H, $H_{12a}$), 4.30 (dd, $J_{12b\text{-}12a}$= 10.7Hz, $J_{12b\text{-}11}$= 2.4Hz,1H, $H_{12b}$), 4.72– 4.59 (m, $J$ = 5.1, 3H, $H_2$, $H_7$, $H_8$), 4.80 (d, $J_{1\text{-}2}$= 8.0Hz, 1H, $H_1$), 4.87 (t, $J_{10\text{-}11}$= $J_{10\text{-}11}$= 9.7Hz, 1H, $H_{10}$), 5.14 (t, $J_{9\text{-}8}$= $J_{9\text{-}10}$= 9.2Hz, 1H, $H_9$), 5.24 (dd, $J_{3\text{-}4}$= 12.7Hz, $J_{3\text{-}2}$= 6.4Hz, 1H, $H_3$), 7.30 (s, 2H, $NH_2$), 7.39 (d, $J_{22\text{-}23}$=6.3Hz, 2H, $H_{22}$), 7.73 (d, $J_{23\text{-}22}$=7.0Hz, 2H, $H_{23}$), 8.00 (t, $J_{NH\text{-}H19}$=5.8Hz, 1H, NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 20.19, 20.23, 20.28, 20.37, 20.45(2C), 20.68 (7$C_b$), 26.28 ($C_{16}$), 27.01 ($C_{15}$), 27.36 ($C_{14}$), 28.99 ($C_{20}$), 34.83 ($C_{17}$), 39.84 ($C_{19}$), 61.46($C_6$), 62.22($C_{12}$), 67.69, 68.86, 70.42, 71.18, 71.66, 72.19, 73.07($C_9$), 76.56($C_4$), 99.24($C_1$), 99.56($C_7$), 125.68 ($C_{23}$), 129.17 ($C_{22}$), 142.05 ($C_{24}$), 143.74 ($C_{21}$), 169.17, 169.23,169.44, 169.64, 169.89, 170.06, 170.36, 170.45 (7$C_a$ et $C_{18}$).

***N*-(4-sulfamoylphenethyl)-3-(3-[2, 3, 6, 8, 9, 10, 12-hepta-*O*-acetyl-β-D-cellobiosyl-1-*C*-]propylthio) propanamide (6e) :**

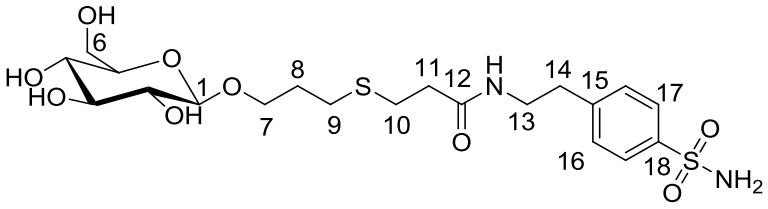



R*f*: 0.52 (methylene chloride - methanol, 9-1, v-v); MS: *m/z* 971.65 ($M+Na^+$), 947.54 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.51 – 1.41 (m, 3H, $H_{13}$, $H_{14a}$), 1.55-1.60 (m, 1H, $H_{14b}$), 1.91, 1.97, 1.98, 1.98, 1.99, 2.01, 2.06 (7s, 21H, $H_b$), 2.32 (t, $J_{17\text{-}16}$ =7.1Hz, 2H, $H_{17}$), 2.52 (t, $J_{15\text{-}14}$= 7.2Hz, 2H, $H_{15}$), 2.64 (t, $J_{16\text{-}17}$= 7.6Hz, 2H, $H_{16}$), 2.77 (t, $J_{20\text{-}19}$=7.0Hz, 2H, $H_{20}$), 3.33 – 3.23 (m, 2H, $H_{19}$), 3.82 – 3.63 (m, 3H, $H_4$, $H_5$, $H_{11}$), 3.93 (dd, $J_{6a\text{-}6b}$=11.6Hz, $J_{6a\text{-}5}$=2.7Hz, 1H, $H_{6a}$), 4.03 (dd, $J_{6b\text{-}6a}$=14.2Hz, $J_{6b\text{-}5}$=7.1Hz, 3H, $H_{6b}$), 4.12 (m, 1H, $H_1$), 4.31– 4.19 (m, 2H, $H_{12}$), 4.37 (d, $J$ = 4.2, 3H, $H_7$), 4.92 – 4.78 (m, 3H, $H_2$, $H_8$, $H_{10}$), 5.18 – 5.11 (m, 1H, $H_9$), 5.25 (t, $J_{3\text{-}2}$= $J_{3\text{-}4}$= 9.6, 1H, $H_3$), 7.30 (s, 2H, $NH_2$), 7.39 (d, $J_{22\text{-}23}$=8.3Hz, 2H, $H_{22}$), 7.73 (d, $J_{23\text{-}22}$=8.3Hz, 2H, $H_{23}$), 8.01 (t, $J_{NH\text{-}H19}$=5.5Hz, 1H, NHC(O)); $^{13}$C NMR (101 MHz, $CDCl_3$) δ ppm: 20.192, 20.29, 20.31, 20.37, 20.41, 20.47, 20.68 (7$C_b$), 26.24 ($C_{14}$), 26.89 ($C_{13}$), 30.49 ($C_{16}$), 34.84 ($C_{20}$), 35.72 ($C_{17}$), 39.83 ($C_{19}$), 61.48 ($C_6$), 62.25 ($C_{12}$), 67.54, 67.77, 68.92, 70.51, 71.02, 71.44, 72.22 ($C_9$), 73.06 ($C_4$), 76.58 ($C_1$), 99.51 ($C_7$), 125.62 ($C_{23}$), 129.11 ($C_{22}$), 141.98 ($_{24}$), 143.72 ($C_{21}$), 169.12, 169.22, 169.44, 169.64, 169.82, 170.05, 170.35, 170.44 (7$C_a$ et $C_{18}$).

**General procedure: cleavage of acetate groups**

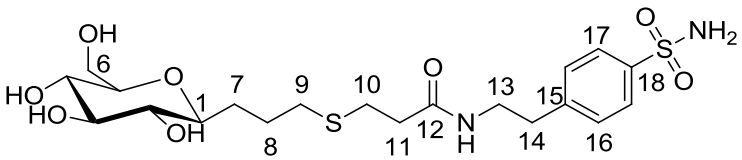
To a solution of glycoconjugate 0.1 mmol in 10 mL of methanol was added sodium methylate (1.2 equiv. / acetate). The mixture was stirred at roome temperature for 4 hours, then neutralized with acidic resin until pH 6-7 and filtered. The solvent was evaporated under vacuum to give the deprotected compound in quantitative yield.

***N*-(4-sulfamoylphenethyl)-3-(3-[β-D-glucopyranosyl-1-*O* -) propylthio) propanamide (7a):**



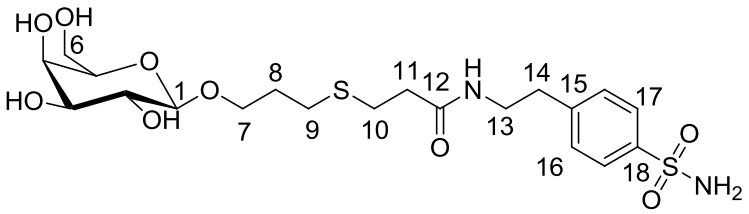
RF: 0.07 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 531.48 ($M+Na^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.81 – 1.69 (m, 2H, $H_8$), 2.32 (t, $J_{10-11}$= 7.3 Hz, 2H, $H_{10}$), 2.56 (t, $J_{11-10}$ = 7.3 Hz, 2H), 2.65 (t, $J_{9-8}$= 7.3 Hz, 2H, $H_9$), 2.78 (t, $J_{14-13}$= 7.1 Hz, 2H, $H_{14}$), 3.32 – 3.21 (m, 2H, $H_{13}$),3.48 – 3.36 (m, 5H, $H_2$, $H_3$, $H_4$, $H_5$ et $H_{6b}$ ),3.50 (dt, $J_{7a-7b}$= 10 Hz, $J_{7a-8}$=6.4 Hz, 1H, $H_{7a}$), 3.71-3.61 (m, 1H, $H_{6b}$), 3.81 (dt, $J_{7b-7a}$ = 9.9 Hz, $J_{7b-8}$=6.3 Hz, 1H $H_{7b}$), 4.10 (d, $J_{1-2}$= 7.8 Hz, 1H, $H_1$), 7.32 (s, 2H, $NH_2$), 7.40 (d, $J_{16-17}$= 8.3 Hz, 2H, $H_{16}$), 7.73 (d, $J_{17-16}$= 8.3 Hz, 2H, $H_{17}$), 8.06 (t, $J_{NH-13}$=5.6 Hz, 1H, NHC(O)); $^{13}$C RMN (101 MHz, DMSO) δ ppm: 27.01($C_{10}$), 27.58($C_9$), 29.45($C_8$), 34.84($C_{14}$), 35.79($C_{11}$), 39.86 ($C_{13}$), 61.05 ($C_6$), 67.26($C_7$), 70.05, 73.47, 76.70, 76.88, 102.95 ($C_1$), 125.69 (2$C_{16}$), 129.17 (2$C_{17}$), 142.05($C_{14}$), 143.75 ($C_{17}$), 170.59 ($C_{12}$).

***N*-(4-sulfamoylphenethyl)-3-(3-(β-D-glucopyranosyl-1-*C* -) propylthio) propanamide (8a):**



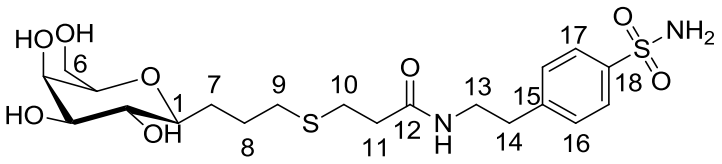
R*f*: 0.08 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 515.45 ($M+Na^+$), 491.23 ($M-H^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ ppm: 1.52 – 1.41 (m, 1H, $H_{7a}$), 1.70 – 1.57 (m, 3H, $H_{7b}$ et $H_8$), 2.32 (t, $J_{11-10}$ =7.3 Hz, 2H, $H_{11}$), 2.53 (t, $J_{9-8}$=7.3 Hz, 2H, $H_9$), 2.65 (t, $J_{10-11}$=7.3 Hz, 2H, $H_{10}$), 2.78 (t, $J_{14-13}$= 7.2 Hz, 2H, $H_{14}$),3.04 – 2.95 (m, 1H, $H_4$),3.34 – 3.23(m, 2H, $H_{13}$),3.41 – 3.25 (m, 4H, $H_2$, $H_3$, $H_5$, $H_{6a}$),3.60 (ddd, $J_{6b-6a}$= 11.5 Hz, $J_{6b-5}$=5.8 Hz, $J_{6b-OH}$=2.1 Hz, 1H, $H_{6b}$),3.74 – 3.65 (m, 1H, $H_1$),7.29 (s, 2H, $NH_2$),7.40 (d, $J_{16-17}$= 8.4 Hz, 2H, $H_{16}$),7.73 (d, $J_{17-16}$ = 8.4 Hz, 2H, $H_{17}$),8.01 (t, $J_{NH-13}$=5.6 Hz, 1H, NHC(O)) ; $^{13}$C RMN (101 MHz, DMSO) δ ppm:23.30 ($C_8$), 25.28 (C7), 26.98 ($C_{10}$), 31.01 ($C_9$), 34.83 ($C_{14}$), 35.80 ($C_{11}$), 39.84 ($C_{13}$), 61.52 ($C_6$), 70.82, 71.40, 73.47, 73.74, 74.93 ($C_1$), 125.67 ($C_{17}$), 129.15($C_{16}$), 142.03 ($C_{18}$), 143.73($C_{15}$), 170.54($C_{12}$).

***N*-(4-sulfamoylphenethyl)-3-(3-(β-D-galactopyranosyl-1-*O*-) propylthio) propanamide (<u>7b</u>) :**



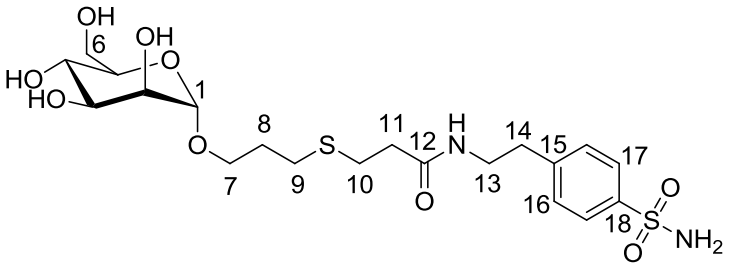
R*f*: 0.05 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 531.47 ($M+Na^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ ppm: 1.80 – 1.70 (m, 2H, $H_8$), 2.32 (t, $J_{11\text{-}10}$ = 7.3 Hz, 2H, $H_{11}$), 2.57 (t, $J_{9\text{-}8}$= 7.3 Hz, 2H, $H_9$),2.65 (t, $J_{10\text{-}11}$ = 7.3 Hz, 2H, $H_{10}$),2.78 (t, $J_{14\text{-}13}$ = 7.1 Hz, 2H, $H_{14}$),3.41 – 3.10 (m, 5H,$H_2$, $H_6$, $H_{13}$),3.56 – 3.42 (m, 3H,$H_3$, $H_4$, $H_5$),3.79 (dt, $J_{7b\text{-}7a}$= 9.9 Hz, $J_{7b\text{-}8}$= 6.3 Hz, 1H, $H_{7b}$),4.06 (d, $J_{1\text{-}2}$= 7.4 Hz, 1H, $H_1$),7.30 (s, 2H, $NH_2$),7.40 (d, $J_{16\text{-}17}$ = 8.4 Hz, 2H, $H_{16}$),7.73 (d, $J_{17\text{-}16}$ = 8.3 Hz, 2H, $H_{17}$),8.02 (t, $J_{NH\text{-}13}$= 5.6 Hz, 1H, NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 27.00 ($C_{10}$), 27.59 ($C_9$), 29.48 ($C_8$), 34.83 ($C_{14}$), 35.78 ($C_{11}$), 39.84 ($C_{13}$), 60.40 ($C_6$), 67.16, 68.12, 70.59, 73.41, 75.16, 103.54 ($C_1$), 125.68 ($C_{17}$), 129.17 ($C_{16}$), 142.04 ($C_{18}$), 143.74($C_{15}$), 170.54 ($C_{12}$).

***N*-(4-sulfamoylphenethyl)-3-(3-(β-D-galactopyranosyl-1-*C*-) propylthio) propanamide (<u>8b</u>):**



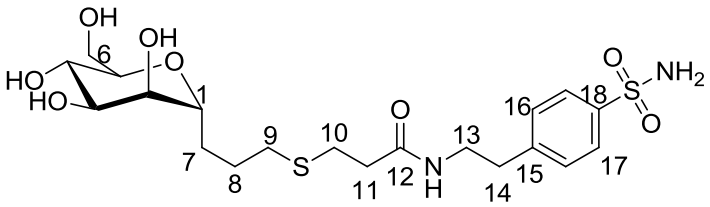
R*f*: 0.07 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 515.42 ($M+Na^+$), 491.22 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.69 – 1.41 (m, 4H, $H_7$et $H_8$),2.32 (t, $J_{11\text{-}10}$ = 7.3Hz, 2H, $H_{11}$),2.49 (t, $J_{9\text{-}8}$ = 7.2Hz, 2H, $H_9$),2.64 (t, $J_{10\text{-}11}$ = 7.3Hz, 2H, $H_{10}$),2.77 (t, $J_{10\text{-}11}$ = 7.2Hz, 2H, $H_{14}$),3.31– 3.25(m, 2H, $H_{13}$),3.53 – 3.40 (m, 3H, $H_4$, $H_6$),3.76 – 3.62 (m, 3H, $H_1$, $H_2$, $H_5$),7.30 (s, 2H, $NH_2$),7.40 (d, $J_{16\text{-}17}$ = 8.3Hz, 2H, $H_{16}$),7.73 (d, $J_{17\text{-}16}$ = 8.3Hz, 2H, $H_{17}$),8.03 (t, *J* = 5.5Hz, 1H, NHC(O)) ; $^{13}$C NMR (101 MHz, DMSO) δ ppm: 23.93 ($C_8$), 25.65 ($C_7$), 27.00 ($C_{10}$), 31.04 ($C_9$), 34.84 ($C_{14}$), 35.81 ($C_{11}$), 39.87 ($C_{13}$), 60.20 ($C_6$), 68.17 (2C), 68.48, 70.37 ($C_1$), 125.69 ($C_{17}$), 129.18 ($C_{16}$), 142.04($C_{18}$), 143.76 ($C_{15}$), 170.59 ($C_{12}$).

***N*-(4-sulfamoylphenethyl)-3-(3-(α-D-mannopyranose-1-*O*-) propylthio) propanamide (<u>7c</u>) :**



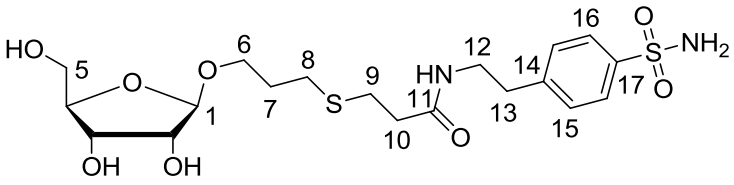
R*f*: 0.07 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 531.52 ($M+Na^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.80 – 1.69 (m, 2H, $H_8$), 2.32 (t, $J_{11-10}$= 7.3 Hz, 2H, $H_{11}$), 2.52 (t, $J_{9-8}$= 7.3 Hz, 2H, $H_9$),2.66 (t, $J_{10-11}$= 7.3 Hz, 2H, $H_{10}$),2.78 (t, $J_{14-13}$= 7.1 Hz, 2H, $H_{14}$),3.31-3.27 (m, 2H, $H_{13}$),3.40 (m, 4H, $H_2H_3$, $H_5$ et $H_{7a}$),3.44 (dd, $J_{6a-6b}$= 9.0 Hz, $J_{6a-5}$= 3.3 Hz, 1H, $H_{6a}$),3.69-3.56 (m, 3H, $H_4$, $H_{6a}$ et $H_{7b}$),4.59 (d, $J_{1-2}$= 1.4 Hz, 1H, $H_1$), 7.30 (s, 2H, $NH_2$),7.40 (d, $J_{16-17}$= 8.3 Hz, 2H, $H_{16}$),7.73 (d, $J_{17-16}$= 8.3 Hz, 2H, $H_{17}$),8.02 (t, $J_{NH-13}$= 5.6 Hz, 1H, 1H NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 27.04($C_{10}$), 27.87 ($C_9$), 29.17 ($C_8$), 34.82 ($C_{14}$), 35.77 ($C_{11}$), 39.83 ($C_{13}$), 61.23 ($C_6$), 64.96, 66.96, 70.34, 71.00, 74.02, 99.84($C_1$), 125.67 ($C_{17}$), 129.16 ($C_{16}$), 142.03($C_{18}$), 143.73 ($C_{15}$), 170.48 ($C_{12}$).

***N*-(4-sulfamoylphenethyl)-3-(3-(α-D-mannopyranosyl-1-*C*-) propylthio) propanamide (8c):**




R*f*: 0.08 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 515.43 ($M+Na^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.68 – 1.43 (m, 4H, $H_7$ et $H_8$), 2.33 (t, $J_{11-10}$ =7.1 Hz, 2H, $H_{11}$), 2.49 (t, $J_{9-8}$=7.2 Hz, 2H, $H_9$), 2.63 (t, $J_{10-11}$=7.1 Hz, 2H, $H_{10}$), 2.76 (t, $J_{14-13}$= 7.2 Hz, 2H, $H_{14}$), 3.35 – 3.22 (m, 2H, $H_{13}$), 3.41 – 3.25 (m, 3H, $H_2$, $H_3$, $H_4$, $H_6$), 3.78 – 3.63 (m, 3H, $H_1$, $H_2$, $H_5$), 7.29 (s, 2H, $NH_2$), 7.39 (d, $J_{16-17}$= 8.3 Hz, 2H, $H_{16}$), 7.73 (d, $J_{17-16}$ = 8.2 Hz, 2H, $H_{17}$), 8.06 (t, $J_{NH-13}$=5.6 Hz, 1H, NHC(O)) ; $^{13}$C RMN (101 MHz, DMSO) δ ppm: 24.71 ($C_8$), 25.21 ($C_7$), 26.82 ($C_{10}$), 30.88 ($C_9$), 34.78 ($C_{14}$), 35.80 ($C_{11}$), 39.84 ($C_{13}$), 61.61 ($C_6$), 65.82, 71.12, 70.47, 73.84, 78.23 ($C_1$), 125.67 ($C_{17}$), 129.15($C_{16}$), 142.05 ($C_{18}$), 143.71 ($C_{15}$), 170.52($C_{12}$).

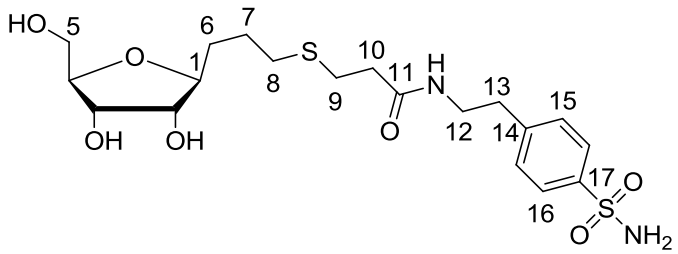
***N*-(4-sulfamoylphenethyl)-3-(3-(β-D-ribofuranosyl-1-*O*-)propylthio) propanamide (7d):**




R*f*: 0.19 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 501.20 ($M+Na^+$), 477.06 ($M-H^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.70 – 1.59 (m, 2H, $H_7$), 2.31 (t, $J_{10-9}$=7.3 Hz, 2H, $H_{10}$), 2.51 (t, $J_{8-7}$= 7.3 Hz, 2H, $H_8$), 2.64 (t, $J_{9-10}$ = 7.3 Hz, 2H, $H_9$), 2.78 (t, $J_{13-12}$ = 7.1 Hz, 2H, $H_{13}$), 3.35 – 3.24 (m, 2H, $H_{12}$), 3.47 – 3.40 (m, 3H, $H_{5a}$ et $H_6$), 3.55 – 3.47 (m, 1H, $H_{5b}$), 3.78 – 3.72 (m, 1H, $H_2$), 3.86 – 3.78 (m, 2H, $H_3$,$H_4$), 4.59 (d, $J_{1-2}$= 8.6 Hz, 1H), 7.30 (s, 2H, $NH_2$), 7.39 (d, $J_{15-16}$ = 8.4 Hz, 2H, $H_{15}$), 7.73 (d, $J_{16-15}$= 8.4 Hz, 2H,

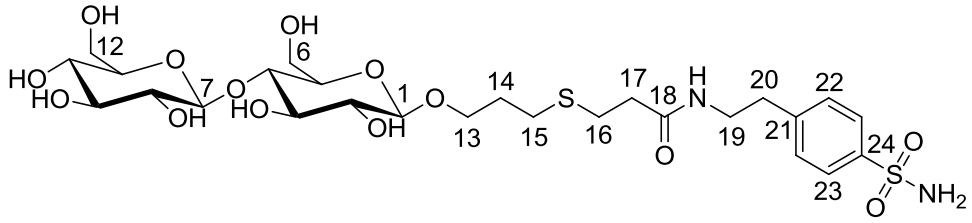
$H_{16}$), 8.00 (t, $J_{NH-12}$ = 5.6 Hz, 1H, NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 27.09($C_9$), 27.68($C_8$), 32.40($C_7$), 34.81($C_{13}$), 35.77($C_{10}$), 39.81($C_{12}$), 59.41($C_5$), 63.18 ($C_6$), 70.95, 74.22, 83.57 ($C_4$), 108.04 ($C_1$), 125.65 ($C_{16}$), 129.16 ($C_{15}$), 142.03 ($C_{17}$), 143.73 ($C_{14}$), 170.49 ($C_{11}$).

***N*-(4-sulfamoylphenethyl)-3-(3-(β-D-ribofuranosyl-1-*C*-)propylthio) propanamide (8d) :**




R*f*: 0.20 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 485.13 (M+Na$^+$), 461.21 (M-H$^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.65 – 1.46 (m, 4H, $H_6$ et $H_7$), 2.31 (t, $J_{10-9}$ = 7.3 Hz, 2H, $H_{10}$), 2.49 (t, $J_{8-7}$ = 7.2 Hz, 2H, $H_8$), 2.64 (t, $J_{9-10}$ = 7.3 Hz, 2H, $H_9$), 2.78 (t, $J_{13-12}$ = 7.2 Hz, 2H, $H_{13}$), 3.33 – 3.23 (m, 2H, $H_{12}$), 3.55 – 3.48 (m, 2H, $H_2$ et $H_3$), 3.62 – 3.55 (m, 1H, $H_1$), 3.81 – 3.74 (m, 2H, $H_5$), 3.90 (td, $J_{4-5}$= 7.5 Hz, $J_{4-3}$ =4.5 Hz, 1H, $H_4$), 7.29 (s, 2H, $NH_2$), 7.40 (d, $J_{15-16}$= 8.4 Hz, 2H, $H_{15}$), 7.73 (d, $J_{16-15}$ = 8.3 Hz, 2H, $H_{16}$), 8.00 (t, $J_{NH-12}$ = 5.6 Hz, 1H, NHC(O)) ; $^{13}$C NMR (101 MHz, DMSO) δ ppm: 25.67 ($C_7$), 27.00 ($C_6$), 28.68 (C9), 31.18 ($C_8$), 34.81 ($C_{13}$), 35.79 ($C_{10}$), 39.81 ($C_{12}$), 61.82 ($C_5$), 71.62 ($C_2$), 72.32, 79.71, 81.48 ($C_1$), 125.65 ($C_{16}$), 129.13 ($C_{15}$), 142.03 ($C_{17}$), 143.72 ($C_{14}$), 170.51 ($C_{11}$).

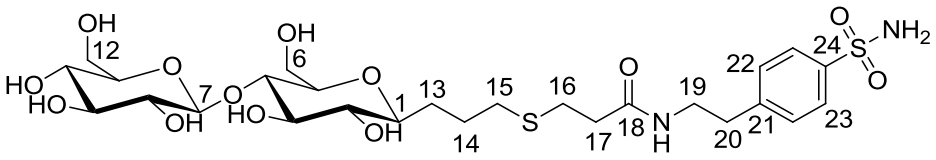
***N*-(4-sulfamoylphenethyl)-3-(3-(β-D-cellobiosyl-1-*O*-) propylthio) propanamide (7e) :**




R*f*: 0.06 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 693.61 (M+Na$^+$), 669.43 (M-H$^+$); $^1$H NMR (400 MHz, DMSO) δ ppm: 1.72 – 1.65 (m, 2H, $H_{14}$), 2.32 (t, $J_{17-16}$ = 7.3 Hz, 2H, $H_{17}$), 2.56 (t, $J_{15-14}$ = 7.2 Hz, 2H, $H_{15}$), 2.65 (t, $J_{16-17}$= 7.3 Hz, 2H, $H_{16}$), 2.78 (t, $J_{20-19}$ = 7.2 Hz, 2H, $H_{20}$), 3.09 – 2.95 (m, 3H, $H_2$, $H_4$ et $H_{10}$), 3.33 – 3.10 (m, 4H, $H_3$, $H_8$ et $H_{19}$), 3.44 – 3.36 (m, 2H, $H_6$), 3.89 – 3.45 (m, 6H, $H_5$, $H_{11}$, $H_{12}$, $H_{13}$), 4.17 (d, $J_{1-2}$= 7.9 Hz, 1H, $H_1$), 4.24 (d, $J_{7-8}$= 8.0 Hz, 1H, $H_7$), 7.30 (s, 2H, $NH_2$), 7.39 (d, $J_{22-23}$= 8.2 Hz, 2H, $H_{22}$), 7.73 (d, $J_{23-22}$ = 8.3 Hz, 2H, $H_{23}$), 8.08 (t, $J_{NH-19}$= 5.6 Hz, 1H, NHC(O)); $^{13}$C NMR (101 MHz, DMSO) δ ppm: 26.31 ($C_{16}$), 27.02 ($C_{15}$), 27.57 ($C_{14}$), 29.39 ($C_{20}$), 34.79 ($C_{17}$), 39.80 ($C_{19}$), 60.42 ($C_6$),

61.05 ($C_{12}$), 67.44, 70.06, 73.18, 73.32, 74.88, 75.00, 76.48, 76.83, 102.61 ($C_1$), 103.23 ($C_7$), 125.71 ($C_{23}$), 129.21 ($C_{22}$), 142.07($C_{24}$), 143.74 ($C_{21}$), 169.92 ($C_{18}$).

***N*-(4-sulfamoylphenethyl)-3-(3-[β-D-cellobiosyl-1-*C*-] propylthio) propanamide (8e) :**




**12B**

R*f*: 0.07 (methylene chloride - methanol, 9-1, v-v); MS ESI+: *m/z* 677.48 ($M+Na^+$), 653.22 ($M-H^+$); $^1$H NMR (400 MHz, $CDCl_3$) δ ppm: 1.53 – 1.40 (m, 1H, $H_{13a}$), 1.71 – 1.55 (m, 3H, $H_{13b}$ et $H_{14}$), 2.32 (t, $J_{17\text{-}16}$ = 7.3 Hz, 2H, $H_{17}$), 2.51 (t, $J_{15\text{-}14}$= 7.2Hz, 2H, $H_{15}$), 2.65 (t, $J_{16\text{-}17}$= 7.3 Hz, 2H, $H_{16}$), 2.78 (t, $J_{20\text{-}19}$ = 7.1Hz, 2H,$H_{20}$),3.09 – 2.94 (m, 2H, $H_4$ et $H_{10}$),3.23 – 3.12 (m, 2H, $H_2$ et $H_8$),3.46 – 3.23 (m, 7H,$H_1$, $H_3$, $H_9$, $H_5$, $H_{11}$ et $H_{19}$),3.61 – 3.52 (m, 1H, $H_{6a}$),3.80 – 3.62 (m, 3H, $H_{6b}$ et $H_{12}$),4.22 (d, $J_{7\text{-}8}$= 7.8 Hz, 1H, $H_7$),7.31 (s, 2H, $NH_2$),7.40 (d, $J_{22\text{-}23}$ = 8.3Hz, 2H, $H_{22}$),7.74 (d, $J_{23\text{-}22}$ = 8.3Hz, 2H, $H_{23}$),8.02 (t, $J_{NH\text{-}19}$ = 5.6Hz, 1H, NHC(O)); $^{13}$C NMR (101 MHz, $CDCl_3$) δ ppm:27.10 ($C_{14}$),27.61 ($C_{13}$),29.41 ($C_{16}$),34.84 ($C_{20}$), 35.79 ($C_{17}$), 39.86 ($C_{19}$), 60.80 ($C_6$),61.08 ($C_{12}$), 65.42, 65.75, 69.96, 70.08, 71.30, 73.33, 74.81, 76.48, 76.79 ($C_1$),103.21($C_7$),125.69 ($C_{23}$),129.18 ($C_{22}$),142.04 ($_{24}$),143.75 ($C_{21}$),170.56 ($C_{18}$).

**CA inhibition**. An Applied Photophysics stopped-flow instrument has been used for assaying the CA catalysed $CO_2$ hydration activity. Phenol red (at a concentration of 0.2 mM) has been used as indicator, working at the absorbance maximum of 557 nm, with 20 mM Hepes (pH 7.5) as buffer, and 20 mM $Na_2SO_4$ (for maintaining constant the ionic strength), following the initial rates of the CA-catalyzed $CO_2$ hydration reaction for a period of 10-100 s.[1] The $CO_2$ concentrations ranged from 1.7 to 17 mM for the determination of the kinetic parameters and inhibition constants. For each inhibitor at least six traces of the initial 5-10% of the reaction have been used for determining the initial velocity. The uncatalyzed rates were determined in the same manner and subtracted from the total observed rates. Stock solutions of inhibitor (0.1 mM) were prepared in distilled-deionized water and dilutions up to 0.01 nM were done thereafter with distilled-deionized water. Inhibitor and enzyme solutions were preincubated together for 15 min at room temperature prior to assay, in order to allow for the formation of the E-I complex. The inhibition constants were obtained by non-linear least-squares methods using PRISM 3, as reported earlier,[2-4] and represent the mean from at least three different determinations. All CA isofoms were recombinant ones obtained in house as reported earlier.[2-4]

**References**

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