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CERTIFICATE OF ANALYSIS

PRODUCT NAME:	GLYKO® APTS-(BIANTENNARY & HIGH MANNOSE PARTITIONED LIBRARY)
PRODUCT CODE:	GKSP-520
LOT NUMBER:	P18K1307
PACK SIZE:	120 pmol of each library (qualitative capillary electrophoresis standard for N-glycan identification) 1 each WS0319 APTS-(Fucosyl Biantennary Library) 1 each WS0320 APTS-(Afucosyl Biantennary Library) 1 each WS0321 APTS-(High Mannose Library)
FORM:	Dry solid
STORAGE:	Store in the dark at -20°C before and after reconstitution
EXPIRATION:	April 2022, may be used for 3 months after reconstitution
STRUCTURE:	The APTS-(Biantennary & High Mannose Partitioned Library) consists of 3 blended libraries of N-linked glycans whose reducing termini are derivatized with the fluorescent dye, APTS (8-Aminopyrene-1,3,6-trisulfonic acid trisodium salt). The libraries were partitioned to minimize overlap of peaks to facilitate glycan peak identification.

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Quality Control:

Capillary Electrophoresis Running Conditions: The APTS labeled glycan library was injected at 0.5 psi for 10 seconds using Ab Sciex Carbohydrate Separation Buffer and N-CHO Capillary with an effective length of 50 cm.

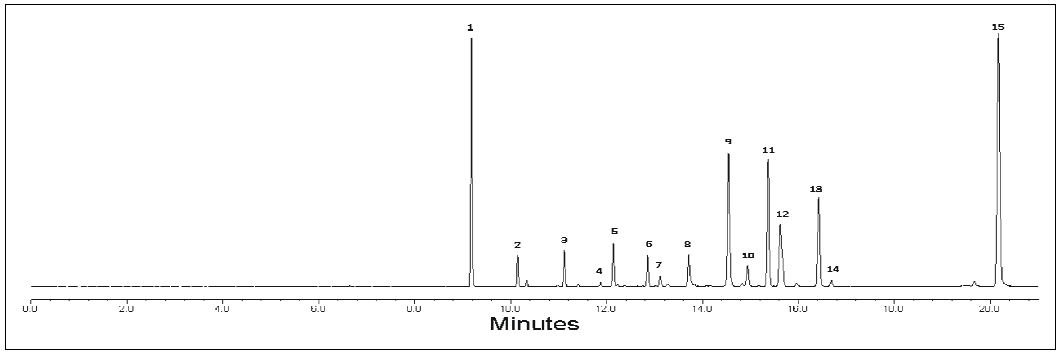

Figure 1. CE Results of WS0319 - See Table 1 for peak ID.

Table 1: Peak Identification of WS0319 APTS-(Fucosyl Biantennary Library)

Peak Number	Glycan Identification[1]
1	GKSP-500 Bracketing Standard, DP2 (maltose)
2	6-α-fucosyl chitobiose [N2F]
3	4'-β-mannosylchitobiose, core-α(1-6)-substituted with fucose [MNNF]
4	Di-α(2-6)-sialylated, galactosylated biantennary [A2 (2-6)]
5	Di-α(2-6)-sialylated, galactosylated biantennary, core-substituted with fucose [A2F (2-6)]
6	Conserved trimannosyl core, substituted with fucose [M3N2F]
7	Mono-α(2-6)-sialylated, mono-galactosylated, biantennary core-substituted with fucose [G1FS1[3]]
8	Mono-α(2-6)-sialylated, galactosylated biantennary, core-substituted with fucose [A1F (2,6)] and Asialo-, agalacto- biantennary [NGA2/G0]
9	Asialo-, agalacto- biantennary, core-substituted with fucose [NGA2F/G0F]
10	Asialo-, agalacto- biantennary, core-substituted with fucose and with bisecting N-Acetylglucosamine [NGA2FB/G0FB]
11	Asialo, mono-galactosylated biantennary, core substituted with fucose [NA2G1F [6]/G1F [6]]
12	Asialo, mono-galactosylated biantennary, core substituted with fucose [NA2G1F [3]/G1F [3]] and Asialo, mono-galactosylated biantennary, core substituted with fucose and with bisecting N-Acetylglucosamine [NA2G1FB [6]/G1FB [6]]
13	Asialo-, galactosylated biantennary, core-substituted with fucose [NA2F/G2F]
14	Asialo-, galactosylated biantennary, core-substituted with fucose and with bisecting N-Acetylglucosamine [NA2FB/G2FB]
15	GKSP-500 Bracketing Standard, DP15 (maltopentadecaose)

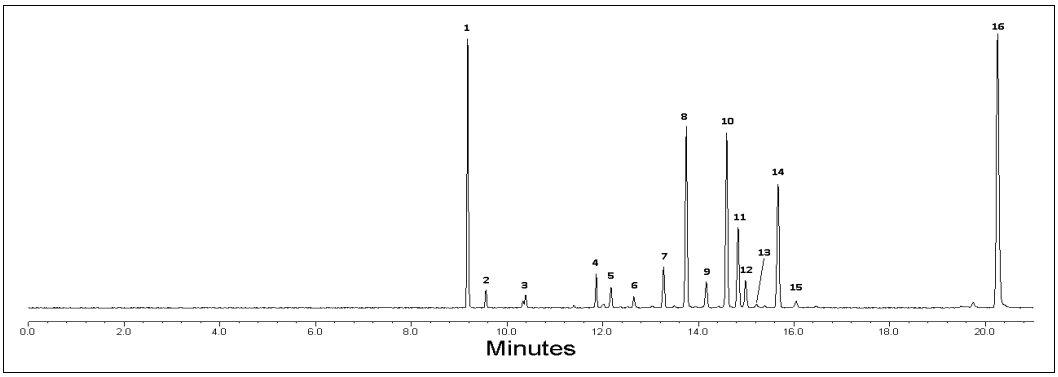

Figure 2. CE Results of WS0320 - See Table 2 for peak ID.

Table 2: Peak Identification of WS0320 APTS-(Afucosyl Biantennary Library)

Peak Number	Glycan Identification[1]
1	GKSP-500 Bracketing Standard, DP2 (maltose)
2	Chitobiose [N2/NN]
3	4'-β-mannosylchitobiose [MNN]
4	Di-α(2-6)-sialylated, galactosylated biantennary [A2 (2,6)]
5	Conserved trimannosyl core [M3N2/Man-3]
6	Mono-α(2-6)-sialylated, mono-galactosylated biantennary [G1S1 [3]]
7	Mono-α(2-6)-sialylated, galactosylated biantennary [A1 (2,6)]
8	Asialo-, agalacto- biantennary [NGA2/G0]
9	Asialo-, agalacto- biantennary with bisecting N-Acetylglucosamine [NGA2B/G0B]
10	Asialo, mono-galactosylated biantennary [NA2G1 [6]/G1[6]]
11	Asialo, mono-galactosylated biantennary [NA2G1 [3]/G1[3]]
12	Asialo, mono-galactosylated biantennary,with bisecting N-Acetylglucosamine [NA2G1B [6]/G1B [6]]
13	Asialo, mono-galactosylated biantennary,with bisecting N-Acetylglucosamine [NA2G1B [3]/G1B [3]]
14	Asialo-, galactosylated biantennary [NA2/G2]
15	Asialo-, galactosylated biantennary with bisecting N-Acetylglucosamine [NA2B/G2B]
16	GKSP-500 Bracketing Standard, DP15 (maltopentadecaose)

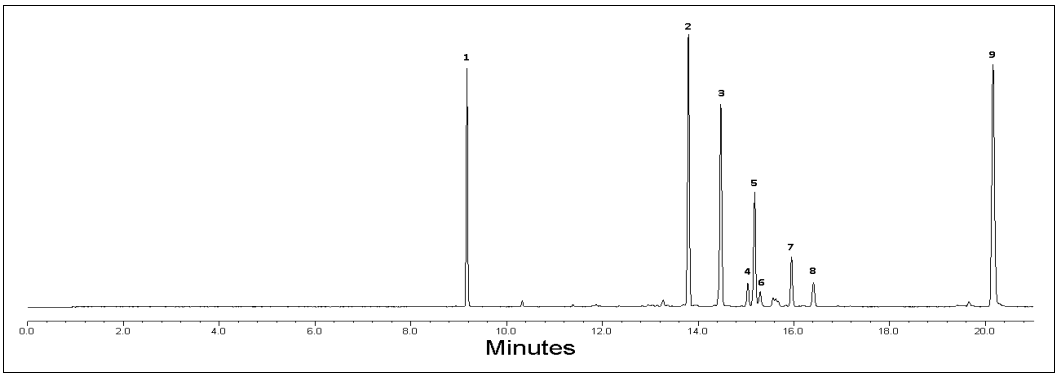

Figure 3. CE Results of WS0321 - See Table 3 for peak ID.

Table 3: Peak Identification of WS0321 APTS-(High Mannose Library)

Peak Number	Glycan Identification[1]
1	GKSP-500 Bracketing Standard, DP2 (maltose)
2	Oligomannose 5 [Man-5]
3	Oligomannose 6 [Man-6]
4	Oligomannose 7 D2 [Man-7 [D2]]
5	Oligomannose 7 D3 [Man-7 [D3]]
6	Oligomannose 7 D1 [Man-7 [D1]]
7	Oligomannose 8 D1D3 [Man-8 [D1D3]]
8	Oligomannose 9 [Man-9]
9	GKSP-500 Bracketing Standard, DP15 (maltopentadecaose)

[1] Peak nomenclature based on the following reference:
Bioinformatics. 2008 May 1;24(9):1214-6. GlycoBase and autoGU: tools for HPLC-based glycan analysis. Campbell MP, Royle L, Radcliffe CM, Dwek RA, Rudd PM.

Structural Analysis: The purity and structural integrity of the glycan libraries were assessed by CE analysis.

Application: As a peak reference standard for capillary electrophoresis.

Handling: The labeled oligosaccharide is shipped as a dried solid. Allow the unopened vial to reach ambient temperature and tap on a solid surface to ensure that most of the material is at the bottom of the vial. Gently remove the cap, add the desired volume of water or buffer, re-cap and mix thoroughly to redissolve all the oligosaccharide. For maximal recovery, ensure that the cap lining is also rinsed and centrifuge the reconstituted vial briefly before use.

Make sure that any glassware, plasticware solvents or reagents used are free of glycosidases and carbohydrate contaminants.

Minimize exposure to elevated temperatures or extremes of pH.

Reconstitution: Use HPLC-grade water or an aqueous buffer to dissolve the glycan to the desired concentration as described in the directions for use below. Store the reconstituted glycan at -20°C. Avoid multiple freeze/thaw cycles.

Directions For Use: Dissolve one vial in 100 µl of HPLC-grade water for injection on the CE to match conditions used for our Quality Control testing.

Digitally signed by Shiva Pourkaveh
Date: 2018.12.06 11:36:21 -08'00'

Authorized Signature