CERTIFICATE OF ANALYSIS

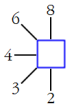
PRODUCT NAME:	GLYKO® 4'-β-MANNOSYL CHITOBIOSE CORE (MNN)
PRODUCT CODE:	GKR-002100
LOT NUMBER:	P04B1602
PACK SIZE:	10 µg (qualitative standard for glycan identification)
PURITY:	≥90% of glycan by UPLC®
FORM:	Dry solid
STORAGE:	Store at -20°C before and after reconstitution
EXPIRATION:	March 2020 (extended from prior exp. date based on re-assay), may be used for 1 year after reconstitution
RE-ASSAY DATE:	March 2015

STRUCTURE[1,2,3] :

Structure Key:

Monosaccharide symbol:
- Glucose
- Galactose
- Mannose
- Fucose
- Xylose
- N-Acetylglucosamine (GlcNAc)
- N-Acetylgalactosamine (GalNAc)
- N-Acetylneuraminic acid (Neu5Ac or NANA)
- N-Glycolyneuraminic acid (Neu5Gc or NGNA)

Linkage position:



Linkage type:
- β-linkage
- α-linkage
- Unspecified β-linkage
- Unspecified α-linkage

3832 Bay Center Place
Hayward, CA 94545-3619

TOLL FREE (800) 457-9444
PHONE (510) 638-6900
FAX (510) 638-6919

E-MAIL info@prozyme.com
WEB www.prozyme.com

Quality Control:

Sample Preparation: MNN was labeled with 2-aminobenzamide (2-AB) by reductive amination[4] using the Signal™ 2-AB Labeling Kit (product code GKK-404).

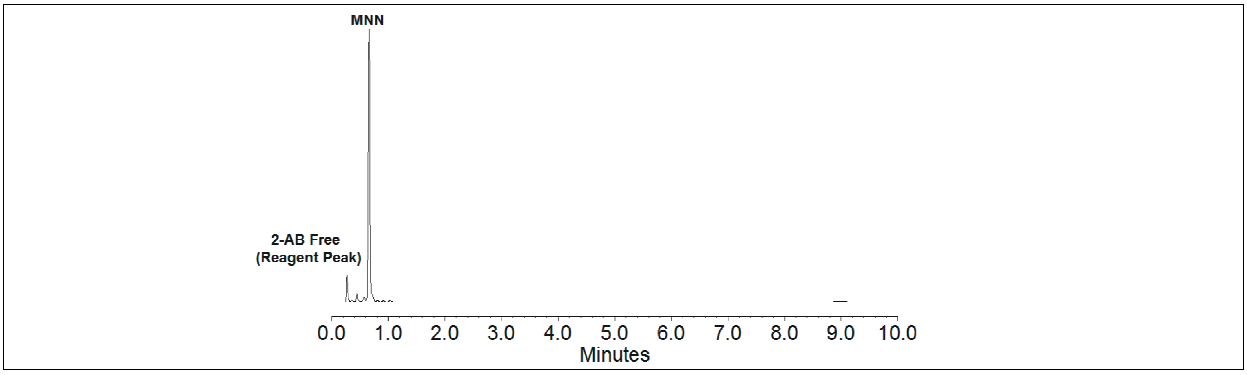


Figure 1 - **UPLC® Results**: 9 - 12 pmol (1 µl, aqueous) of the 2-AB-labeled glycan was injected on a Waters ACQUITY UPLC® H Class System utilizing a 10-minute method under the conditions below:

Time (min)	Flow (ml/min)	% ACN	% Buffer
0	1.0	75	25
8.0	1.0	60	40
8.1	0.5	40	60
8.5	0.5	40	60
8.6	1.0	40	60
8.8	1.0	75	25
10.0	1.0	75	25

Column: Waters ACQUITY UPLC BEH Glycan Column (1.7 µm, 2.1 x 100 mm)
ACN: Acetonitrile
Buffer: 100 m*M* ammonium formate, pH 4.4
Flow rate: As stated in table, in ml/min
Temperature: 60°C
Max Pressure: 15,000 psi
Fluorescence Detection: λ_{ex} = 330 nm
λ_{em} = 420 nm

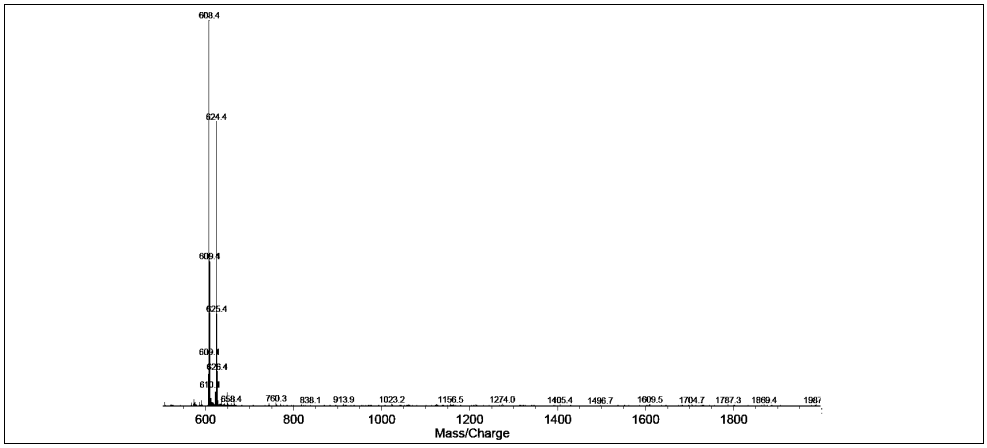


Figure 2 - Mass Spectrum of MNN $[M + Na]^+$

Average Mass[5]: 586.5

Monoisotopic Mass[5]: 586.2222

Structural Analysis: The purity and structural integrity of the glycan was assessed by UPLC[6] (as described above) and MALDI-TOF[7,8] or LC-MS. Agreement was found between the results from mass spectrometry and UPLC.

Applications:

- Qualitative standard for various analytical procedures
- Fluorescent-labeling or formation of a variety of oligosaccharide derivatives
- Substrate for glycosidase and glycosyl transferase assays

Handling & Reconstitution: The labeled oligosaccharide is shipped as a dried solid. Use ultra-pure water or an aqueous buffer to dissolve the glycan.

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 ultra-pure water or aqueous buffer, re-cap and mix thoroughly to redissolve all the oligosaccharide. For maximal recovery, ensure that the cap lining is also rinsed. 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.

Store the reconstituted glycan at -20°C. Allow the vial to equilibrate to ambient temperature before use.

REFERENCES

1. Ceroni A, Maass K, Geyer H, Geyer R, Dell A, Haslam, SM. GlycoWorkbench: a tool for the computer-assisted annotation of mass spectra of glycans. J Proteome Res. 2008 Apr;7(4):150-9.
2. Harvey DJ, Merry AH, Royle L, Campbell MP, Dwek RA, Rudd PM. Proposal for a standard system for drawing structural diagrams of N– and O-linked carbohydrates and related compounds. Proteomics 2009 Aug;9(15):3796-801.
3. Harvey DJ, Merry AH, Royle L, Campbell MP, Rudd PM. Symbol nomenclature for representing glycan structures: Extension to cover different carbohydrate types. Proteomics 2011 Nov;11(22):4291-5.
4. Bigge JC, Patel T, Bruce JA, Goulding PN, Charles SM, Parekh RB. Nonselective and efficient fluorescent labeling of glycans using 2-amino benzamide and anthranilic acid. Anal Biochem 1995 Sep 20;230(2):229-238.
5. Average mass and monoisotopic mass were calculated using the ExPASy GlycanMass calculator:

   http://web.expasy.org/glycanmass/
6. Ahn J, Bones J, Yu YQ, Rudd PM, Gilar M. Separation of 2-aminobenzamide labeled glycans using hydrophilic interaction chromatography columns packed with 1.7 microm sorbent. J Chromatogr B Analyt Technol Biomed Life Sci. 2010 Feb 1;878(3-4):403-8.
7. James DC and Jenkins N. Analysis of N-glycans by matrix-assisted laser desorption/ionization mass spectrometry. In: Jackson P, Gallagher JT, editors. A laboratory guide to glycoconjugate analysis, BioMethods Vol. 9. Basel: Birkhäuser; 1997. p. 91-112.
8. Papac DI, Wong A and Jones AJS. Analysis of acidic oligosaccharides by matrix-assisted laser desorption/ionization time of flight mass spectrometry. Anal Chem 1996 Sep 15;68(18):3215-3223.

Digitally signed by Shiva Pourkaveh
Date: 2015.05.11 09:31:24 -07'00'

Authorized Signature