Analyst 2017 vol.142 N16, pages 2897-2900

Simple Gd^{3+}-Neu5: N Ac complexation results in NMR chemical shift asymmetries of structurally equivalent complex-type N -glycan branches

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Abstract

© The Royal Society of Chemistry 2017. In the present Communication, we propose a quite simple but previously overlooked approach for conveniently analyzing, assigning, and extracting sialic acid-containing N-glycan structures using high-resolution NMR spectroscopy without pre-installing metal chelators.Paramagnetic metals, such as Gd 3+ , appear to bind to the carboxyl groups of N-acetylneuraminic acid when introduced at room temperature, leading to the measurement of nonequivalent proton and carbon NMR spectral signals among otherwise "identical" glycan branched structures.

http://dx.doi.org/10.1039/c7an00817a

References

[1] Analysis of Glycans, Polysaccharide Functional Properties & Biochemistry of Glycoconjugate Glycans, Carbohydrate-mediated Interactions: Comprehensive Glycoscience, From Chemistry to Systems Biology, ed., J.P.Kamerling, G.-J.Boons, Y.C.Lee, A.Suzuki, N.Taniguchi, and, A.G.J.Voragen, Elsevier, UK, 2007, vol.II & III

[2] P.H.Seeberger D.B.Werz Nature 2007 446 1046 1051

[3] A.G.Morell R.A.Irvine I.Sternlieb I.H.Scheinberg G.Ashwell J.Biol.Chem.1968 243 155 159

[4] S.Elliott T.Lorenzini S.Asher K.Aoki D.Brankow L.Buck L.Busse D.Chang J.Fuller J.Grant N.Hernday M.Hokum S.Hu A.Knudten N.Levin R.Komorowski F.Martin R.Navarro T.Osslund G.Rogers N.Rogers G.Trail J.Egrie Nat.Biotechnol.2003 21 414 421

[5] M.Sato T.Furuike R.Sadamoto N.Fujitani T.Nakahara K.Niikura K.Monde H.Kondo S.I.Nishimura J.Am.Chem.Soc.2004 126 14013 14022

[6] Y.Kaneko F.Nimmerjahn J.V.Ravetch Science 2006 313 670 673

[7] A.Canales A.Mallagaray J.Pérez-Castells I.Boos C.Unverzagt S.André H.J.Gabius F.J.Cañada J.Jiménez-Barbero Angew.Chem., Int.Ed.2013 52 13789 13793

[8] T.Yamaguchi Y.Sakae Y.Zhang S.Yamamoto Y.Okamoto K.Kato Angew.Chem., Int.Ed.2014 53 10941 10944

[9] These structurally pure N -glycans were isolated and derivatized from egg yolk according to the procedure developed by GlyTech, Inc., see, http://www.glytech.jp/jp/

[10] Y.Kajihara Y.Suzuki N.Yamamoto K.Sasaki T.Sakakibara L.R.Juneja Chem.-Eur.J.2004 10 971 985

[11] H.Sato Y.Kajihara Carbohydr.Res.2005 340 469 479

[12] M.P.Williamson Prog.Nucl.Magn.Reson.Spectrosc.2013 73 1 16

[13] F.Delaglio S.Grzesiek G.W.Vuister G.Zhu J.Pfeifer A.Bax J.Biomol.NMR 1995 6 277 293

[14] K.Tanaka Org.Biomol.Chem.2016 14 7610 7621

[15] A.Ogura T.Tahara S.Nozaki K.Morimoto Y.Kizuka S.Kitazume M.Hara S.Kojima H.Onoe A.Kurbangalieva N.Taniguchi Y.Watanabe K.Tanaka Sci.Rep.2016 6 21797

[16] L.Latypova R.Sibgatullina A.Ogura K.Fujiki A.Khabibrakhmanova T.Tahara S.Nozaki S.Urano K.Tsubokura H.Onoe Y.Watanabe A.Kurbangalieva K.Tanaka Adv.Sci.2017 4 1600394