



Sugar Alcohols

Introduction

Sugar alcohols (also called polyols or alditols) are organic compounds, typically derived from sugars, containing one hydroxyl group (–OH) attached to each carbon atom. Sugar alcohols are used widely in the food industry as thickeners and artificial sweeteners [1]. Sugar alcohols are non-cariogenic or, in case of xylitol, even anti-cariogenic, have a low glycemic index and insulin index (useful in obesity and diabetes), are digested more slowly and also have osmotic properties showing water holding properties beneficial to the colon. Due to their laxative effects the approval is restricted and the products with more than 10% added polyols must bear the words "excessive consumption may produce laxative effects" [2].

High Performance Anion Exchange Chromatography in combination with Pulsed Amperometric Detection (HPAEC-PAD) can be used as a tool for the compositional analysis of sugar alcohols. This note shows the proof of principle for the analysis of a mix of sugar alcohols using the ALEXYS Carbohydrate Analyzer.



Fig. 1. ALEXYS Carbohydrate Analyzer. The system is equipped with a Solvent Selection Valve (SSV) and capable of running step gradients for column clean-up. The system can be operated under DataApex™ Clarity™ CDS (version 8.3 and up) or Thermo Scientific™ Chromeleon™ Chromatography Data System (CDS) software (version 7.2 SR 5 and up).

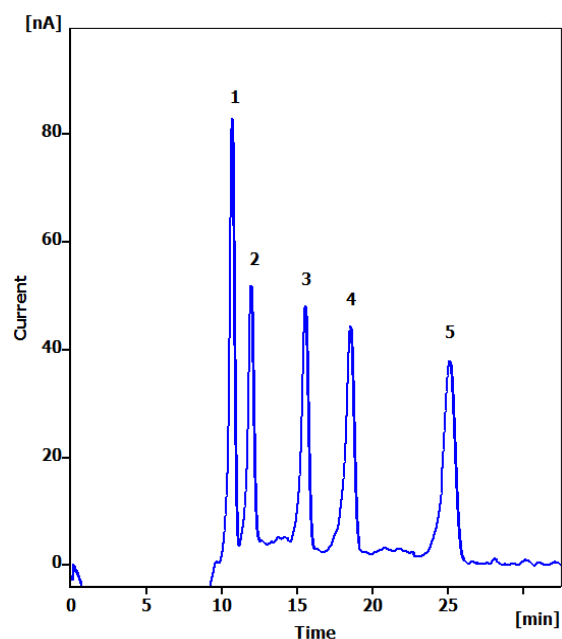


Fig 2. 10 μ L injection of a 10 μ M mix of sugar alcohols; (1) erythritol, (2) xylitol, (3) sorbitol, (4) mannitol and (5) maltitol in water.

Table 1. LC-EC conditions

HPLC	ALEXYS Carbohydrate Analyzer
Columns	CarboPac™ MA1, 250 x 4.0 mm ID + 50 x 4.0 mm ID BorateTrap™ Inline Trap Column, 50 x 4.0 mm ID, 20 μ m All columns: Thermo Scientific™ Dionex™
Mobile phase	A) 500mM NaOH , B) 700mM NaOH mobile phases blanketed with Helium 5.0
Flow rate	0.4 mL/min
Back pressure	about 85 bar
Injection	10 μ L (Partial loop fill)
Temperature	32 °C for separation & detection
Flow cell	SenCell with Au WE, HyREF, AST 2
E-cell	Waveform A
I-cell	about 0.3 μ A
ADF	0.5 Hz
Range	1 μ A/V



Method

The method for the analysis of sugar alcohols is based on isocratic separation (500 mM NaOH) with an anion exchange column followed by post-run column flush (700 mM NaOH) for improved repeatability. Mobile phase eluents were carefully prepared manually using a carbonate-free 50% w/w NaOH solution and sparged with Helium 5.0 prior to use. To eliminate the presence of borate contaminants in the mobile phase, a trap column was installed in the solvent line between pump and autosampler. For detection, a 4-step potential waveform was applied, resulting in an excellent reproducibility and minimal electrode wear [3]; i.e. resulting in less flow cell maintenance and system down time.

An example chromatogram of a 10 µM standard mix of 5 sugar alcohols is shown in figure 2. From figure 2 it is evident that all component peaks show some peak fronting. This behavior is also shown in the different application examples in the column manual [4] of the manufacturer and is considered an as expected performance. When a post-run column flush (700 mM NaOH) is used for improved repeatability, extra stabilization time is needed after the peaks are eluted. A longer equilibration time results in a more stable baseline at the beginning of the next run.

The relative standard deviations (RSD's) for retention time, peak area and height of 10 µL injections of a 10 µM standard mix of 5 sugar alcohols in water are shown in Table 2 to demonstrate the repeatability of the method.

Table 2. Repeatability, 10 µM standard mix (n=6)

Compound	Ret. time (RSD%)	Area (RSD%)	Height (RSD%)
Erythritol	0.07	1.11	0.64
Xylitol	0.07	2.27	1.76
Sorbitol	0.08	2.77	1.58
Mannitol	0.09	2.98	2.15
Maltitol	0.08	3.87	1.93

For research purpose only. The information shown in this communication is solely to demonstrate the applicability of the ALEXYS system and DECADE Elite detector. The actual performance may be affected by factors beyond Antec's control. Specifications mentioned in this application note are subject to change without further notice.

DECADE Elite, ALEXYS, SenCell and HyREF are trademarks of Antec Scientific. Clarity™ and DataApex™ are trademarks of DataApex Ltd. Chromeleon™ is a trademark of Thermo Fisher Scientific. OpenLAB™ and Chemstation™ are trademarks of Agilent Technologies, Inc. All other trademarks are the property of their respective owners.

Ordering information

ALEXYS analyzer	
180.0055W	ALEXYS Carbohydrate Analyzer
116.4321	SenCell 2 mm Au HyREF
Software	
195.0035#	Clarity CDS single instr., incl. LC, AS module

#) optional: Antec ECD drivers for use with Chromeleon CDS , OpenLAB CDS or OpenLAB Chemstation CDS are available.

References

1. Wikipedia, Sugar alcohol, https://en.wikipedia.org/wiki/Sugar_alcohol
2. Eurofins Scientific Media Center, <https://www.eurofins.com/media-centre/newsletters/food-newsletter-nr45-july-2014/sugar-alcohols-content/>
3. R.D. Rocklin, A.P. Clarke, M. Weitzhandler, Improved longterm reproducibility for pulsed amperometric detection of carbohydrates via a new quadruple-potential waveform, Anal. Chem, 70 (1998), 1496 – 1501
4. CarboPac MA1 Column Product Manual, <https://assets.thermofisher.com/TFS-Assets/CMD/manuals/Man-065546-CarboPac-MA1-Column-Man065546-EN.pdf>

Antec Scientific (USA)
 info@AntecScientific.com
 www.AntecScientific.com
 T 888 572 0012

Antec Scientific (worldwide)
 info@AntecScientific.com
 www.AntecScientific.com
 T +31 71 5813333

