Analysis of Sugars from Biomass Fermentation

Application Note

Biofuels

Author

A. Ewen

Prüf- und Forschungsinstitut

Pirmasens

Germany

Introduction

Biomass fermentation has grown in importance because diverse products such as fuel, lubricants, and chemicals can be derived. One option for this use of biomass is the fermentation of xylose (from hemicelluloses) to xylitol, a sugar substitute. For the HPLC analysis of fermentation liquids, the US NREL Biomass Program method *Determination of Sugars, Byproducts, and Degradation Products in Liquid Fraction Process Samples* can be applied.

This application note shows the analysis of the main hemicellulose-forming carbohydrates in a sample obtained by a hydrothermal digestion of straw. The hemicelluloses are hydrolyzed, and, in addition to other monosaccharides, free xylose can be obtained. While the Agilent Hi-Plex H column is especially suited for the analysis of byproducts and degradation products (Application Note SI-1942), the sugars are best analyzed with an Agilent Hi-Plex Pb column.

Agilent Technologies

Materials and Methods

Conditions

Column	Agilent Hi-Plex Pb, 7.7 × 300 mm, 8 µm (p/n PL1170-6820)
Mobile phase	100% DI H_2O
Gradient	Isocratic
Flow rate	0.5 mL/min
Injection volume	20 µL
Sample concentraion	1 g/L for each component
Temperature	70 °C
Pressure	2.5 MPa (25 bar, 360 psi)
Detector	RI (55 °C)

Results

Figures 1 and 2 highlight the main constituents of hemicellulose and straw after hydrothermal digestion. Clearly, this digestion process yields large quantities of xylose that elute after 29 minutes, as well as glucose and arabinose to a lesser extent.

Conclusion

The sugar composition of straw after hydrothermal digestion is readily determined using water as the mobile phase with an Agilent Hi-Plex Pb column. Analyses with these columns avoid the use, high cost, and disposal implications of toxic acetonitrile when separations are performed on amino silica columns. In addition, Hi-Plex stays active in the presence of sugar molecules. Together with fast dissolution, this benefit results in long lifetimes compared to amino silica columns.

For More Information

These data represent typical results. For more information on our products and services, visit our Web site at www.agilent.com/chem.

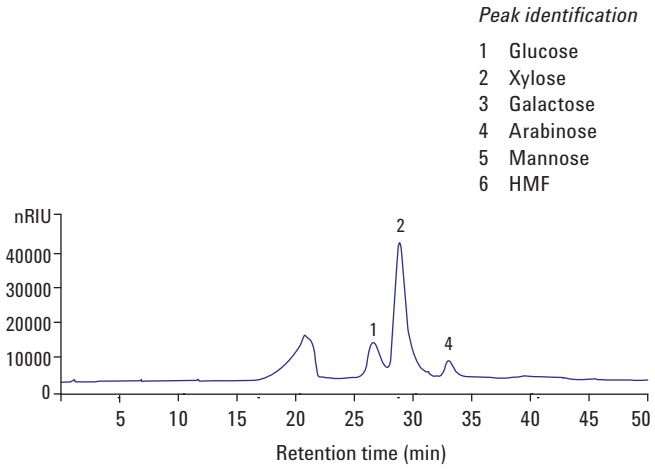

Figure 1. Analysis of a sample of straw after hydrothermal digestion using an Agilent Hi-Plex Pb column.

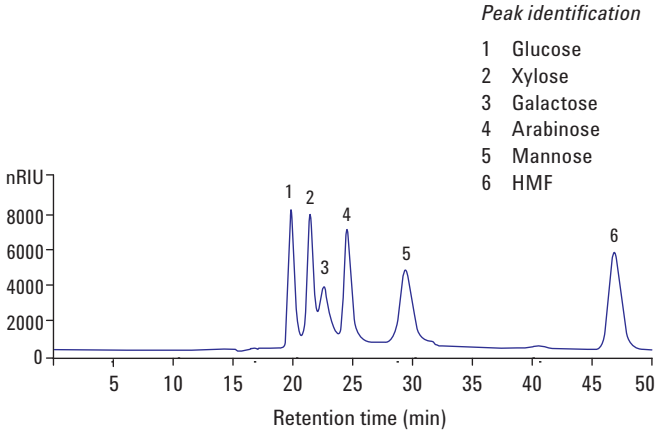

Figure 2. Standard curve of the main hemicellulose-forming monosaccharides and hydroxymethylfurfural (HMF), an oxidation product of sugars.

www.agilent.com/chem

Agilent shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Information, descriptions, and specifications in this publication are subject to change without notice. This publication was originally published in 2009.

© Agilent Technologies, Inc., 2011
Published in USA, August 3, 2011
SI-1944

Agilent Technologies