Artifact Free Analysis of Lignins by GPC using Agilent PolarGel-M

Application Note

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Introduction

Lignin is commonly derived from wood and is one of the most abundant organic compounds on earth, being an integral part of the cell wall of plants. It is a large, cross-linked biopolymer with several unusual but useful properties. For example, wood with a high abundance of lignin is durable and therefore makes a good raw material for construction. However, the presence of lignin is detrimental to the paper making industry and the biopolymer must be removed during the chemical process of pulping the wood to form the paper, an expensive activity. In this chemical pulping - or Kraft – process, the lignin is removed from wood pulp by the breaking down of the cross-links and through sulfonation. The resultant sulfates are considered to be environmentally friendly and have many uses, including forming the bases of many other chemicals such as ethanol and vanillin. They can also be used as additives in agricultural chemicals, as dispersants in water treatment formulations and as textile dyes.

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GPC Analysis

PolarGel-M GPC columns are packed with low swell, macroporous copolymer beads that have a surface of balanced polarity, comprizing hydrophobic and hydrophilic components. These allow PolarGel-M to be used in the analysis of high polarity polymers that are insoluble in water to give a more accurate representation of the molecular weight distribution of the polymer. If these polar polymers were to be analyzed with traditional styrene/divinyl benzene columns, interactions would cause artifacts in the peak shape and longer retention times, which would translate into apparently much lower molecular weight averages.

Sample Preparation

Three varieties of lignin from different sources were analyzed to obtain an indication of differences in molecular weight, if any. The samples were made up at 0.2 % (w/v) in DMSO, with 0.1 % LiBr added to reduce sample aggregation, and injected without further treatment.

Conditions

Columns:	2 x PolarGel-M, 300 x 7.5 mm (p/n PL1117-6800)
Eluent:	DMSO & 0.1 % LiBr
Flow Rate:	1.0 mL/min
Injection Volume:	100 µL
Temperature:	50 °C
Detectors:	Agilent PL-GPC 50, RI

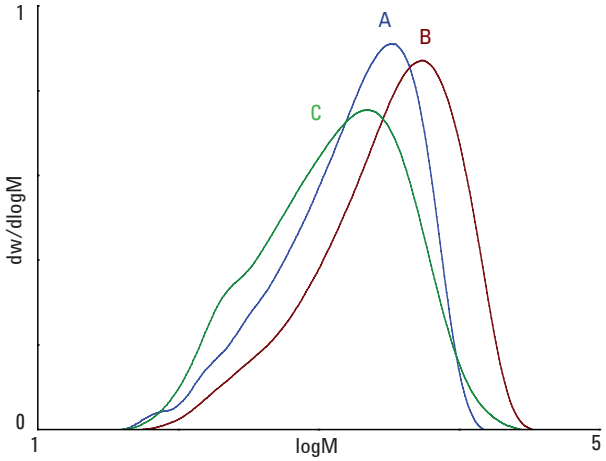

Figure 1. Overlaid molecular weight distributions of the three lignins

Results

Figure 1 shows overlaid molecular weight distributions of three lignins.

Conclusion

GPC with PolarGel-M columns allows for the artifact, interaction free analysis of a wide range of high polarity polymers that are difficult to analyze on traditional, organic (PS/DVB) GPC columns.

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