

Polymer Analysis with Polar Organic Solvents using Agilent PLgel Columns and GPC

Application Note

Materials Testing and Research, Polymers

Introduction

Increasingly, the choice of solvent for use as an eluent in gel permeation chromatography (GPC) is becoming more diverse since the polymers to be analyzed are more demanding in terms of solubility. Polar organic solvents are often the most suitable choice. However, such solvents usually exhibit relatively high viscosity, and demand the application of elevated temperature in order to improve the separation and reduce the column operating pressure. Agilent PLgel columns are used extensively in these application areas.

Polymer Analysis using Polar Organic Solvents

Agilent PLgel 10 µm MIXED-B columns are typically employed for the analysis of high molecular weight, polydisperse materials. Table 1 shows some of these compounds with associated solvents for analysis by GPC. Figures 1 and 2 illustrate typical examples of these types of application.



Agilent Technologies

Authors

Greg Saunders and Ben MacCreath Agilent Technologies (UK) Ltd Essex Rd Church Stretton SY6 6AX UK

Table 1. Appropriate Solvents for a Range of Polymer Types

Polymer	Solvent
Acrylonitrile butadiene styrene (ABS)	Dimethyl formamide (DMF)
Cellulose	Dimethyl sulfoxide/dimethylacetamide (DMSO/DMAC)
Poly(acrylates)	DMF/DMAC
Poly(acrylonitrile)	DMF
Poly(ethylene oxide)	DMF
Poly(urethane)	DMF/DMAC
Poly(vinyl pyrrolidone)	DMF/DMAC

Conditions for Figure 1

Columns	2 × Agilent PLgel 10 μm MIXED-B, 7.5 × 300 mm (p/n PL1110-6100)
Eluent	DMAC + 0.02 M LiBr
Flow rate	1.0 mL/min
Temp	60 °C
Detector	390-MDS Multi Detector Suite RI



Figure 1. Polyurethane copolymer analysis using an Agilent PLgel 10 µm MIXED-B two-column set.

Conditions for Figure 2

Columns	2 × Agilent PLgel 5 μm MIXED-D, 7.5 × 300 mm (p/n PL1110-6504)
Eluent	THF
Flow rate	1.0 mL/min
Temp	40 °C
Detector	390-MDS Multi Detector Suite RI



Figure 2. Acrylonitrile butadiene styrene analysis on an Agilent PLgel 5 μm MIXED-D two-column set.

Low pore size PLgel columns are also fully compatible with polar organic solvents, and have applications in resin analysis and the determination of low molecular weight species in polymers, as illustrated in Figure 3.

Conditions for Figure 3

Columns	2 × Agilent PLgel 5 μm 50Å, 7.5 × 300 mm (p/n PL1110-6515)
Eluent	DMF + 0.1% LiBr
Flow Rate	1.0 mL/min
Temp	60 °C
Detector	390-MDS Multi Detector Suite RI

excluded polymer



Figure 3. Analysis of residual monomers in acrylonitrile butadiene styrene on an Agilent PLgel 5 µm two-column set.

Conclusions

The compatibility of packing materials for gel permeation chromatography with polar organic solvents assumes increasing importance in high performance separations of modern polymer systems. Column performance should be unaffected by solvent transfer, which demands a high degree of chemical and physical stability in the column bed, as delivered by Agilent PLgel packing.

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.

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.

© Agilent Technologies, Inc., 2011 Printed in the USA June 27, 2011 5990-8495EN

