Polymerization Study using Agilent PLgel Columns and Gel Permeation Chromatography

Application Note

Materials Testing and Research, Polymers

Authors

Greg Saunders and Ben MacCreath

Agilent Technologies (UK) Ltd

Essex Rd

Church Stretton

SY6 6AX

UK

Introduction

Gel permeation chromatography (GPC) can be used to monitor the effect of process variables on materials. As the mechanism in GPC separates molecules according to their size in solution, it is ideal for monitoring polymerization reactions and the effect of external influences on the synthesis of polymers, or both. Oligomeric species may be completely resolved and the formation of higher molecular weight species can be detected as an increasing broad polymer distribution.

Polymerization Study

This example features a study of the polymerization of soya oil. The original GPC chromatogram at 0 h shows essentially a monomeric species present corresponding to the starting sample of soya oil. An initiator was then mixed with the oil and a thin film was spread onto a glass plate which was exposed to light. After a period of 4 h and 7 h, a sample of the oil film was removed and analyzed by GPC. The resultant chromatograms were compared with that of the starting oil (Figure 1). Increasing amounts of high molecular weight species eluting at earlier retention times are quite clearly evident in the aged samples. Furthermore, the polymerization reaction can be seen to be progressing with increasing time.

An indication of the polymerization kinetics could be derived from normalized peak area determinations for the monomer and the higher molecular weight components.

Agilent Technologies

Conditions

Column	Agilent PLgel 5 µm 10^3Å, 7.5 × 300 mm (p/n PL1110-6530)
	Agilent PLgel 5 µm 100Å, 7.5 × 300 mm (p/n PL1110-6520)
Eluent	THF
Flow rate	1.0 mL/min
Detector	RI
System	Agilent PL-GPC 50

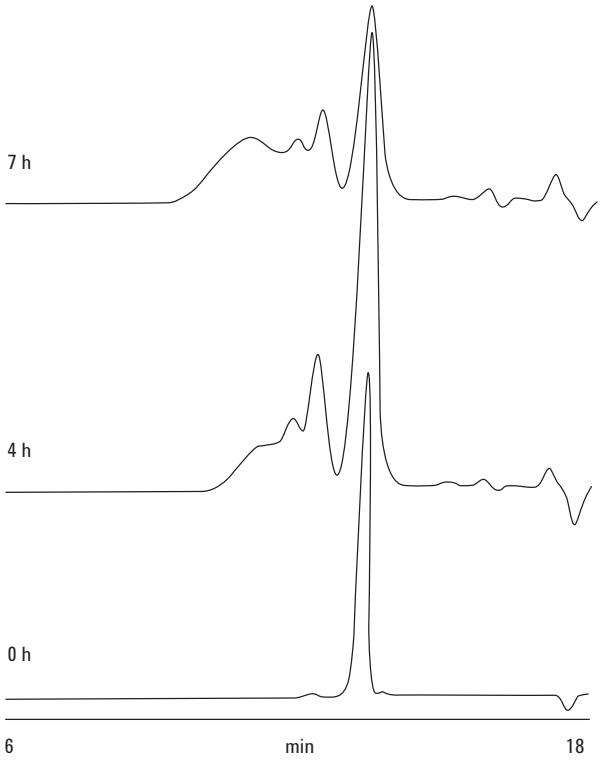

Figure 1. Increasing polymerization of a soya oil over a seven hour period revealed by Agilent PLgel 5 µm columns.

Conclusions

Gel permeation chromatography with Agilent PLgel columns can be used to follow the evolution of molecular weight that occurs during polymerization reactions.

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

Printed in the USA
June 29, 2011
5990-8491EN

Agilent Technologies