Analysis of Polybutadiene by GPC with Triple Detection

Application Note

Introduction

Polybutadiene is a synthetic rubber polymer manufactured from the polymerization of 1,3-butadiene. It is used extensively in commercial applications that require elastomeric properties, the most obvious being in the production of car tires. For these applications, the molecular weight of the material determines many of the final properties of the polymer and therefore the end use suitability.

The accurate molecular weight distributions of two different samples of polybutadiene were investigated by gel permeation chromatography with triple detection, yielding molecular weight independent of a column calibration. An integrated GPC system was used for the analysis.
Results and Discussion

Both samples eluted as clear Gaussian peaks with a small high molecular weight component that was visible on all the detectors (Figure 1). The molecular weight distributions of the samples were similar but some differences were observed between the samples (Figure 2). Similarly, the Mark-Houwink plots indicated that there may be slight structural differences between the two samples (Figure 3).

Conclusion

The PL-GPC 50 Plus is a high resolution, cost effective integrated GPC system designed for operation from ambient to 50 °C. The standard system comprises precision solvent delivery, sample injection, high performance differential refractive index detection and a column oven, with fully integrated software control. When coupled with PLgel 5 μm MIXED-C columns, a PL-BV 400RT viscometry detector and a PL-LS 15/90 dual angle light scattering detector, the PL-GPC 50 Plus uses triple detection for the accurate determination of molecular weight information.

Instrumentation

The samples were assessed by an Agilent PL-GPC 50 Plus with differential refractive index detector, Agilent PL-BV 400RT viscometer, Agilent PL-LS 15/90 dual angle light scattering detector and Agilent PLgel 5 μm MIXED-C columns. These columns provide high resolution of polymers with mid range molecular weights.

Columns: 2 x PLgel 5 μm MIXED-C, 300 x 7.5 mm (p/n PL1110-6500)

Materials and Reagents

Samples: 2 x Polybutadiene
Eluent: Tetrahydrofuran

Conditions

Flow Rate: 1 mL/min
Temperature: 40 °C

Figure 1. Chromatograms of a polybutadiene sample

Figure 2. Overlaid molecular weight distributions for two polybutadiene samples

Figure 3. Overlaid Mark-Houwink plots for two polybutadiene samples