

Analysis of Natural Rubber by GPC with Triple Detection

Application Note

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Introduction

The para rubber tree, *Hevea brasiliensis* (A. Juss.) Muell. Arg. (Euphorbiaceae) is the major commercial source of natural rubber latex, essentially a polymer of isoprene units. The material properties of natural rubber make it an elastomer and a thermoplastic. Rubber materials are used in a wide variety of household and industrial applications, either at the intermediate stage or as final products. The largest use of natural rubber is in the manufacture of tires and inner tubes, accounting for around 56% of the total world use.

Two samples of natural rubber were analyzed by gel permeation chromatography with triple detection, yielding molecular weight independent of a column calibration. The objective was to determine why one of the materials had failed in end use. An integrated GPC system was used for the analysis.



Instrumentation

The samples were assessed by a 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 10 μm MIXED-B columns. These columns provide high resolution of polymers that have high molecular weights, even in demanding eluents.

Columns: 3 x PLgel 10 μm MIXED-B, 300 x 7.5 mm
(p/n PL1110-6100)

Materials and Reagents

Samples: 2 x Natural rubber
Eluent: Toluene

Conditions

Flow Rate: 1.0 mL/min
Temperature: 50 °C
Injection Volume: 200 μL

Results and Discussion

Figure 1 is a chromatogram of a natural rubber sample showing responses from the different detectors. Figure 2 indicates that one of the samples has a considerably broader molecular weight distribution than the other, although the Mark-Houwink plots show that the two materials are structurally similar (Figure 3).

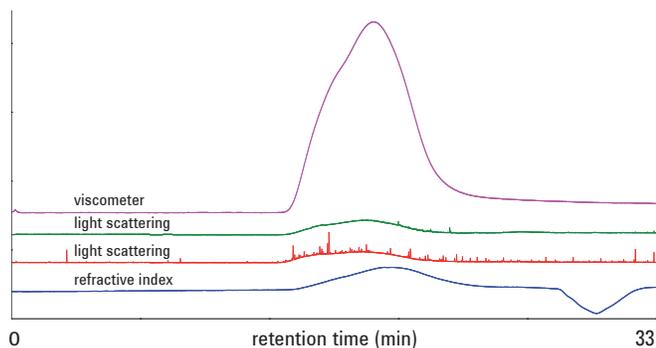


Figure 1. Raw triple detection data for one of the natural rubbers

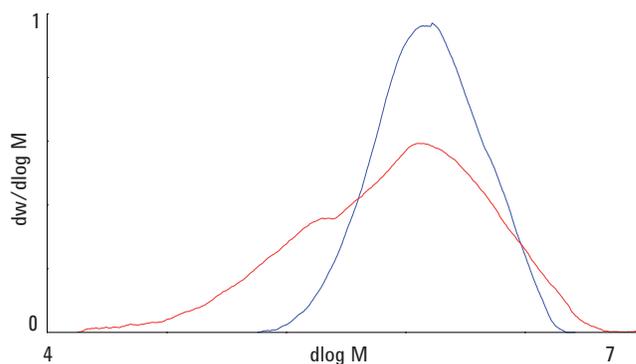


Figure 2. Overlaid triple detection molecular weight distributions of two natural rubbers

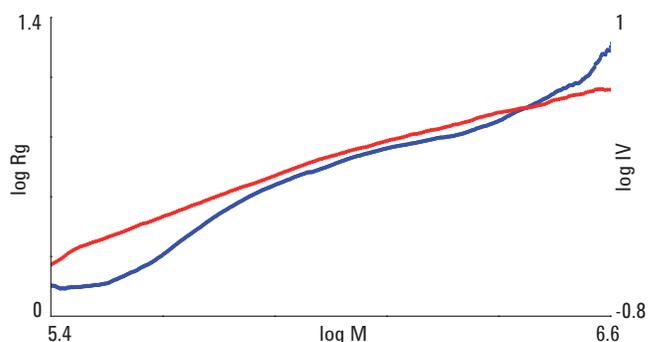


Figure 3. Overlaid Mark-Houwink (\log intrinsic viscosity versus $\log M$) for two natural rubbers

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 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.

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