

TB096: Analysis of Polybutadienes by GPC with Triple Detection

Keywords

SEC, GPC, PL-GPC 50 Plus, RI, PL-BV 400, PLgel 5µm MIXED-C, Tetrahydrofuran (THF)

Polybutadienes are a type of synthetic rubber, commonly used to make tires, along with other car parts such as belts, hoses and gaskets, because of their resilience to temperature and wear. They also offer a high level of electrical resistivity. Polybutadiene was one of the first types of synthetic elastomer to be invented and now synthetic rubber has largely replaced natural rubber in a wide variety of industrial applications.

Triple detection size exclusion chromatography (SEC) employs a concentration detector, a viscometer and a light scattering detector to assess the molecular weight distribution and molecular structure of polymers without having to rely on column calibrations. This can be important when analysing complex materials for which no structurally similar standards are available.

In this technical bulletin, a sample of polybutadiene was analysed on a PL-GPC 50 Plus integrated GPC system running at 30°C. The system was fitted with a refractive index detector, a PL-BV 400 four capillary bridge viscometer and a PL-LS dual angle light scattering detector (collecting scattered light at 45° and 90°).

Two PLgel 5µm MIXED-C columns were used for this analysis. The polybutadiene sample was prepared accurately at a nominal concentration of 2.0mg/ml in Tetrahydrofuran and injected into the system without further treatment. For the purpose of light scattering calculations, an average dn/dc was used for the sample.

Figure 1 shows an overlay of the triple detector chromatograms for the sample.

Sample: Polybutadiene
Columns: 2xPLgel 5µm MIXED-C, 300x7.5mm (PL1110-6500)
Inj Vol: 100µl
Eluent: THF
Flow Rate: 1.0ml/min
Detector: PL-GPC 50 Plus, RI, PL-BV 400, PL-LS

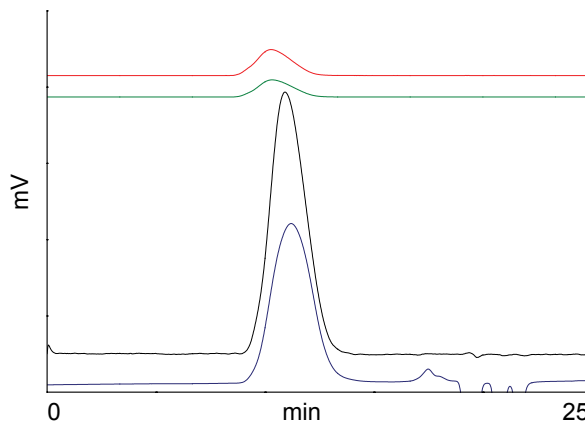
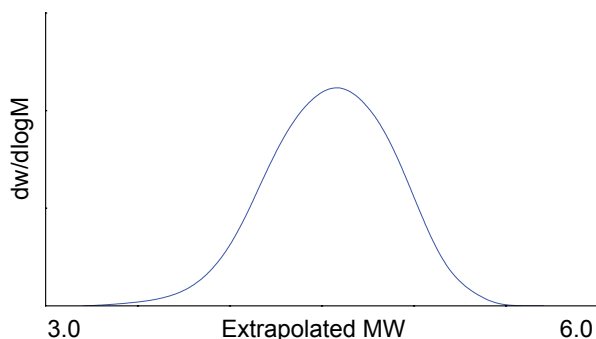
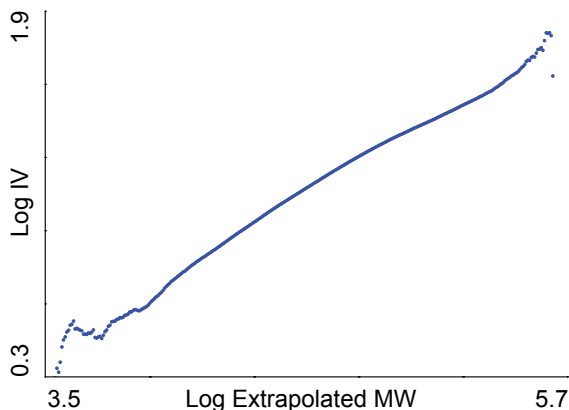


Figure 2 below shows the molecular weight distribution calculated for the polybutadiene.



Mark Houwink (log intrinsic viscosity versus log M) plots were generated from the viscometry and light scattering data and are shown in Figure 3 below. The curvature in the Mark-Houwink Plot maybe a result of structural changes in the polymer as a function of molecular weight.



This technical bulletin demonstrates how the new PL-GPC 50 Plus can be used for the analysis of structurally complex but commercially important materials by multi detector GPC.

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