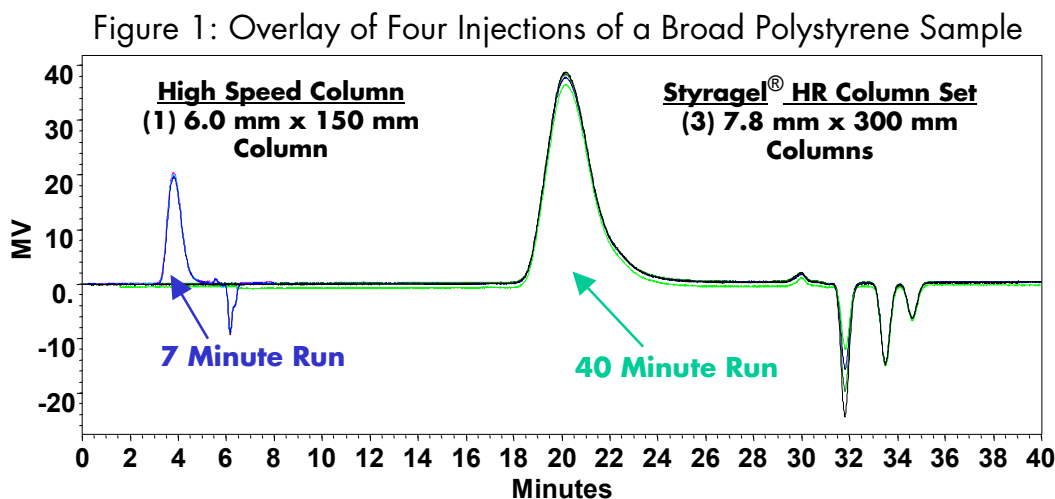


Waters® Alliance System: High Speed GPC Fast, Reproducible MW Results (Part 1 of 2)

Gel Permeation Chromatography (GPC) is a technique for the determination of the molecular weights and molecular weight distributions of polymeric samples. Traditionally, GPC has been carried out using column sets most commonly consisting of three or four columns of approximately 7.8 mm internal diameter with a length of 30 cm each. Banks of three or four columns have generally been chosen in order to obtain sufficient pore volume to provide adequate resolution for accurate and reproducible determination of molecular weight results. However, the use of these large column banks results in analysis times of 45-60 minutes per injection. In addition, the higher volume column banks minimize the negative effects of system band spreading and the less reproducible solvent delivery of older technology chromatographic pumps. With the advent of higher performance solvent management systems, many polymers can now be analyzed accurately and reproducibly utilizing lower volume columns resulting in total analysis times of 7 minutes or less.

Using a High Speed GPC Column, the analysis of a typical broad polymer sample can be reduced from approximately 40 minutes to only 7 minutes as shown in Figure 1. The overlay of four replicate injections demonstrates the reproducibility obtained by combining a High Speed GPC Column with Waters Alliance® System 2695 Separations Module and Waters 2414 Refractive Index Detector.



High Speed GPC
System: Alliance (2695 Separations Module)
Detector: 2414 RI at 5 pts/sec (35° C)
Columns: (1) 6.0 X 150 mm High Speed Column (35° C)
Sample: Broad Polystyrene Sample
Eluent: THF (Stabilized) at 0.6 mL/min
Inj. Vol.: 5 µL
Data: Millennium® 32 Chromatography Manager

Traditional GPC
System: Alliance (2695 Separations Module)
Detector: 2414 RI at 5 pts/sec (35° C)
Columns: (2) Styragel® HR5E, (1) HR2 columns
 7.8 X 300 mm (35° C)
Sample: Broad Polystyrene Sample
Eluent: THF (Stabilized) at 1 mL/min
Inj. Vol.: 50 µL
Data: Millennium® 32 Chromatography Manager

Using a typical polystyrene narrow standard calibration, molecular weight data can be determined for the High Speed GPC chromatograms of the broad polystyrene sample shown in Figure 2. The average molecular weight (Mw) obtained from High Speed GPC is essentially identical to that observed using a traditional GPC column set with comparable percent relative standard deviations as shown in Table 1.

Figure 2: Overlay of Four Injections of a Broad Polystyrene Sample

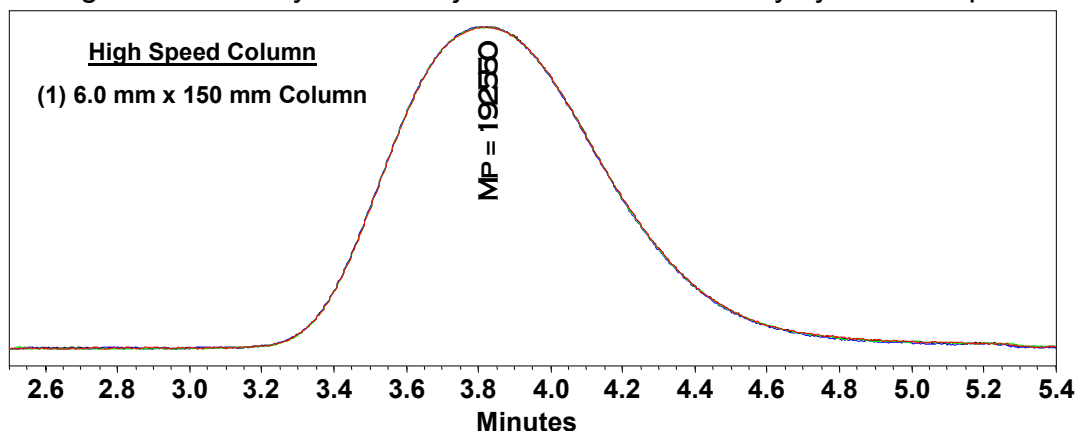


Table 1 - Component Summary Table

	Sample Name	Inj	Mw High Speed	Mw Traditional
1	Polystyrene	1	232,060	233,268
2	Polystyrene	2	232,589	233,164
3	Polystyrene	3	234,368	234,225
4	Polystyrene	4	232,127	233,760
Mean			232,785	233,600
% RSD			0.5 %	0.2 %

The use of High Speed GPC Columns with a narrow standard calibration results in low values for number-average molecular weight and high values for Z-average molecular weight. However, with the use of broad standard calibration routines, accurate values for all molecular weight averages and molecular weight distributions can be obtained. (See Waters Alliance System: High Speed GPC Fast, Accurate Molecular Weight Averages and Distributions: WPP232).

Summary:

- The use of High Speed GPC Columns can reduce analysis times of polymer samples from 40 minutes to less than 7 minutes. This allows scientists to get precise molecular weight information very quickly.
- Accurate and reproducible Mw values can be obtained for polymer samples using narrow standard calibration data processing.
- Broad standard calibration routines should be used if accurate Mn, Mz, and molecular weight distribution information is required. (See Waters Alliance System: High Speed GPC Fast, Accurate Molecular Weight Averages and Distributions: WPP232).