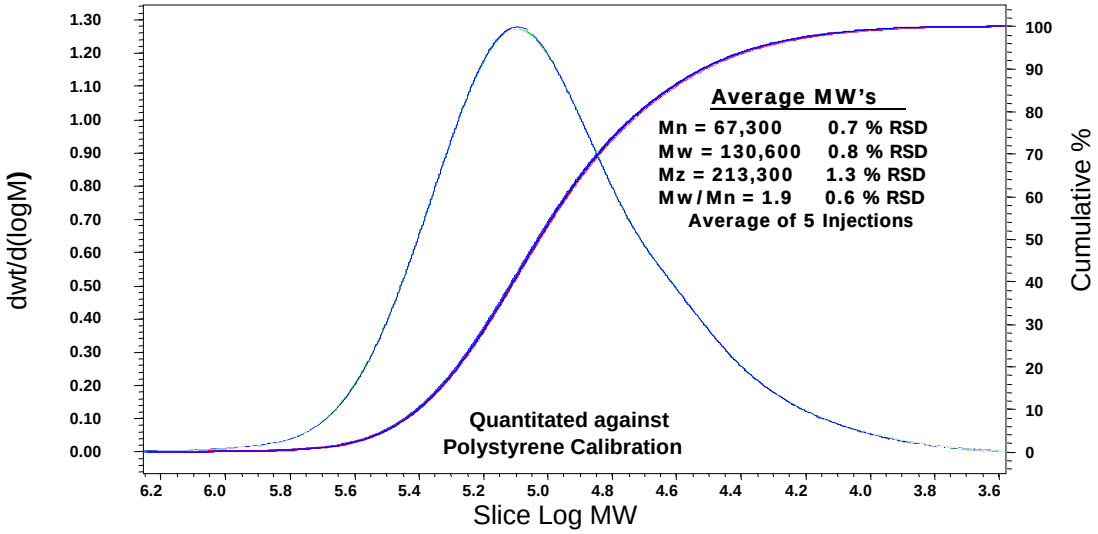
Performance PerSPECtives

Waters® Breeze™ Systems: GPC Performance (Part 2)

Introduction: Gel Permeation Chromatography (GPC) requires an HPLC system that delivers precise flow. A previous Waters Performance PerSPECtive entitled “Waters Breeze Systems: GPC Performance” (WPP1501_720000311EN) clearly demonstrates the excellent flow precision of Breeze pumps in the GPC analysis of polystyrene. This Performance PerSPECtive provides examples that attest to Waters Breeze System performance for additional GPC applications.

Importance of Flow Rate Precision in GPC Analysis: Deviations in flow precision of a GPC system can severely compromise the quality of results. Calculated molecular weights are obtained from an elution volume calibration curve generated using standards and plotted on a log scale. Any change in flow (elution volume as plotted on the linear X axis) will result in a large deviation in molecular weight (plotted as a log function on the Y axis). For a linear calibration curve, a 1% change in flow rate translates to a 10% change in calculated molecular weight. If a polynomial calibration curve is used (e.g., 3rd order typical in many GPC applications), the error in calculated molecular weight is larger. Breeze Systems for GPC analyses offer flow precision of better than 0.10% (e.g., Retention time relative standard deviation (RSD) for polystyrene standards = 0.03% or better.). This level of performance ensures excellent molecular weight reproducibility, producing weight average (Mw) and number average (Mn) RSD’s of <1.5%. Figure 1 demonstrates the excellent quality of data obtained on Waters Breeze System for the GPC analysis of polyvinylchloride (PVC).

Figure 1: Five Molecular Weight Distribution Overlays of a PVC Resin



Columns: (2) Waters Styragel® HR5E and (1) Waters Styragel HR2. Temp: 40° C. Mobile phase: THF at 1 mL / min. Detector: Waters 2414 RI. PVC Conc: 0.10%. Injection volume: 50 µL.

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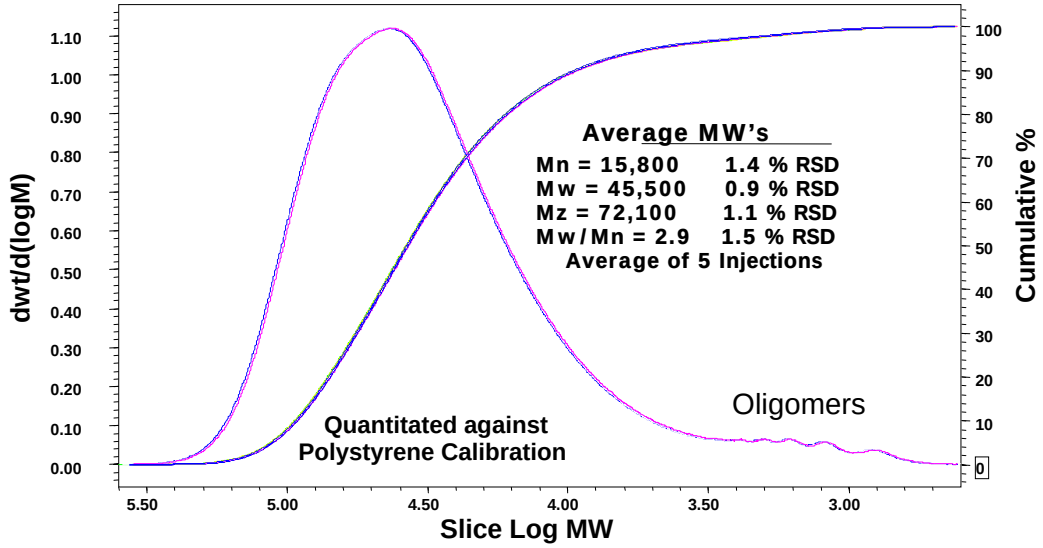
Polycarbonates: Polymer for Many Applications: Polycarbonate is commonly used in the manufacture of digital compact discs (CD's). They are also present in structural flame retardant foams, windows and windshields, electrical insulators, helmets, medical devices, and clear storage bottles. Manufacturers of polycarbonate "raw material" as well as "end-use" fabricators routinely perform GPC analysis to monitor the molecular weight distribution (MWD) of the material. Precise MWD determinations are critical to confirm the intended physical properties of the finished products, particularly when used in medical, personal safety, and/or automotive applications.

GPC Analysis of Polycarbonate with Breeze™ System: Aromatic polycarbonates are fairly low molecular weight polymers (<100,000) prepared by the condensation of bisphenols and carbonic acid derivatives. The low molecular weight portion of the distribution extends down to the oligomer region. With adequate GPC detector sensitivity, these oligomers can be observed. Due to the presence of aromatic structures, polycarbonates strongly absorb in the UV region making their detection by UV absorption possible (versus the traditional use of a RI detector of nonabsorbing compounds.) The ability to detect the oligomer distribution, at the low MW end of the distribution curve, is possible using Waters 2487 Dual Wavelength detector on a Breeze "GPC" System. Figure 2 displays results obtained on Waters Breeze System for the GPC analysis of polycarbonate. Note the oligomer separation at the low MW end of the distribution .

Figure 2: Five Molecular Weight Distribution Overlays of Polycarbonate



Columns: (2) Waters Styragel® HR5E and (1) Waters Styragel HR2. Temp: 40° C.
Mobile phase: THF at 1 mL / min. Detector: Waters 2487 Dual Wavelength Detector at 280 nm.
Polycarbonate Conc: 0.10%. Injection volume: 50 µL.

Summary: Breeze HPLC systems provide excellent Molecular Weight precision for GPC analysis using either RI or UV detection.

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