Waters Lab Highlights

An Internal Communication of Applications and Techniques

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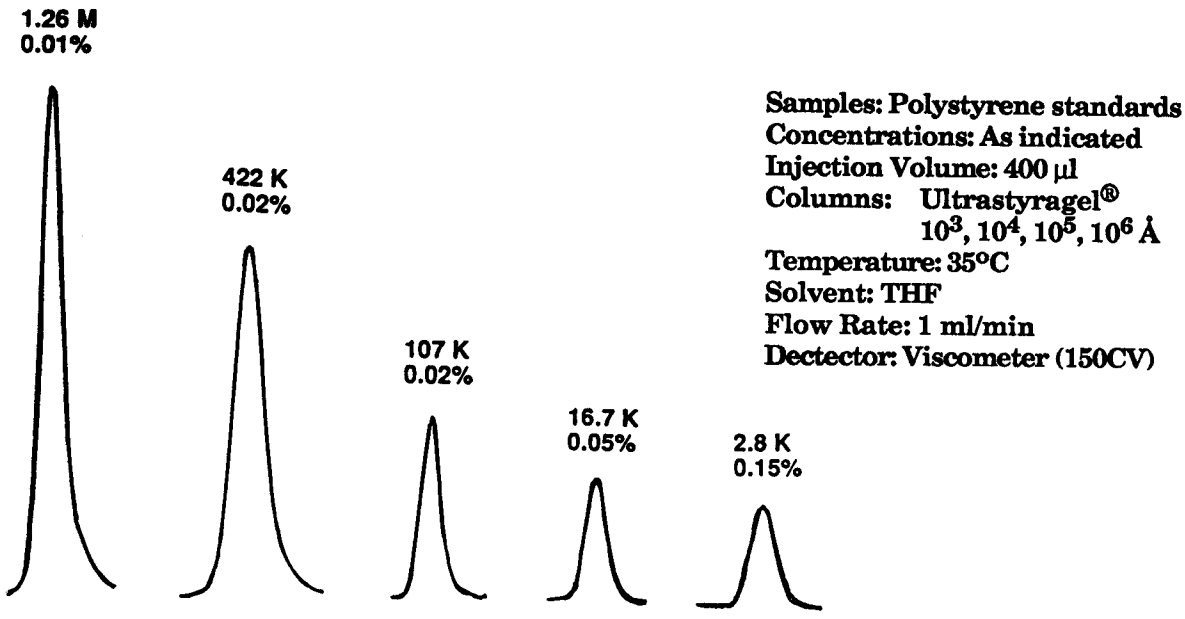
The 150CV GPC/Viscometer System
V. Viscometer Response as a Function of Sample Molecular Weight

This is the fifth in a series[1-4] of Lab Highlights which describe the operation and performance of the 150CV GPC/Viscometer System. This Lab Highlight demonstrates the increased response of the viscometer detector (vs. the refractive index detector) to high molecular weight components.

The viscometer detector responds relatively more to high molecular weight materials and relatively less to low molecular weight materials than does a concentration detector, e.g. RI, which responds to sample concentration for a given polymer. This is demonstrated in Figure 1 which shows a series of five individual injections of narrow distribution polystyrene standards. Analysis conditions, especially viscometer detector sensitivity and injection volumes, were identical for each standard. Sample concentrations were decreased from 0.15% for the lowest molecular weight standard (2,800) to 0.01% for the highest molecular weight standard (1,260,000).

With a concentration detector, such as the RI, the relative areas of the standards in Figure 1 would have been the same as the relative concentrations of each

Figure 1. Viscometer Response as a Function of Molecular Weight



Waters
Division of MILLIPORE 34 Maple Street Milford, MA 01757 508-478-2000

Juris Ekmanis

sample. With the viscometer detector, even though the concentrations of the polymer samples were decreased by a factor of 15 from the lowest to highest molecular weight, the viscometer response increased by a factor of 5. Thus the response of the viscometer detector increased by a factor of 75 relative to the RI detector over the range of molecular weights in Figure 1. For the two standards injected at the same concentration (422,000 and 107,000), the increased response of the viscometer can be observed directly.

The viscometer response is proportional to the product of effluent concentration and intrinsic viscosity while the refractometer response is proportional only to the concentration of polymer in the column effluent[4]. The next Lab Highlight in this series will show how the synergy afforded by a combination of both detectors will generate true molecular weight averages for polymer samples using the principle of Universal Calibration.

References

1. LAH 0436 6/90.
2. LAH 0437 6/90.
3. LAH 0441 11/90.
4. LAH 0442 11/90.

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