

High-Temperature GPC (Thermoplastics)

A DAWN DSP with a high-temperature option can be connected to a Waters 150C ALC/GPC for characterizing materials that are only soluble at elevated temperatures. Because these materials are developed to possess unique physical properties, standards have limited relevance for traditional GPC/SEC calibration. Nevertheless, the concept of using standards is applied commonly because of habit and hope, yet often without any physical basis. Adding a DAWN to the 150C obviates the need for column calibration, so that the net results are absolute molecular weights and sizes.

In Figure 1 a polypropylene sample was injected and analyzed. The DAWN's read head was maintained at a temperature of 135°C and connected to the 150C with a one meter long temperature controlled ($\pm 0.1^\circ\text{C}$) dual transfer line manufactured by WTC. The response of the DAWN and the RI detectors are illustrative of the DAWN's response to the product of molecular weight and concentration, while the RI responds only to concentration.

Polypropylenes are a class of thermoplastic material that have no adequate standards, making their characterization with a DAWN essential. Figure 2 shows the calculated molecular weight vs. elution volume from the collection indicated by Figure 1.

Using ASTRA with Waters Corporation's Millennium software package provides the most powerful technology for the unequivocal characterization of polyethylenes and polypropylenes—or any other thermoplastics for which standards are not available.

The results are absolute because they do not depend upon flow rate, retention time, or sample conformation. In addition, the DAWN can determine the *size* of these macromolecules, the degree of branching, and detect very low concentrations of very high molecular weight microgels that are usually invisible to most refractive index detectors.

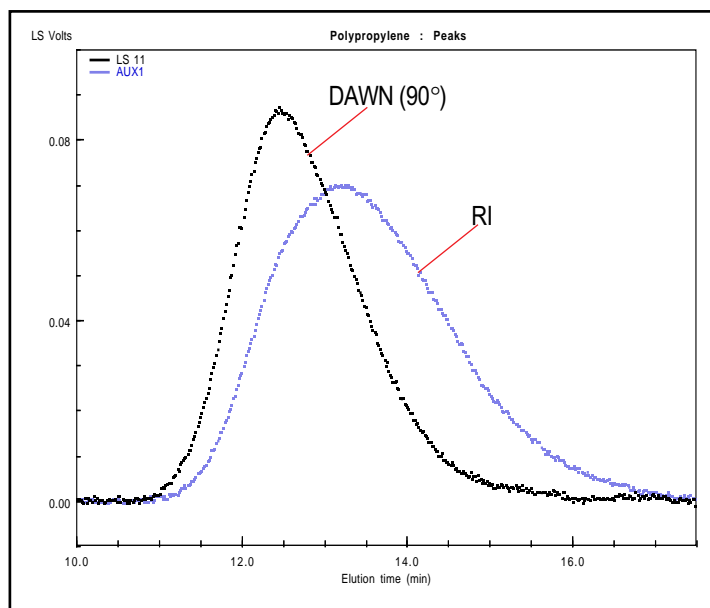


Figure 1. Peak selection screen in ASTRA overlaying one LS trace (90°) with the RI.

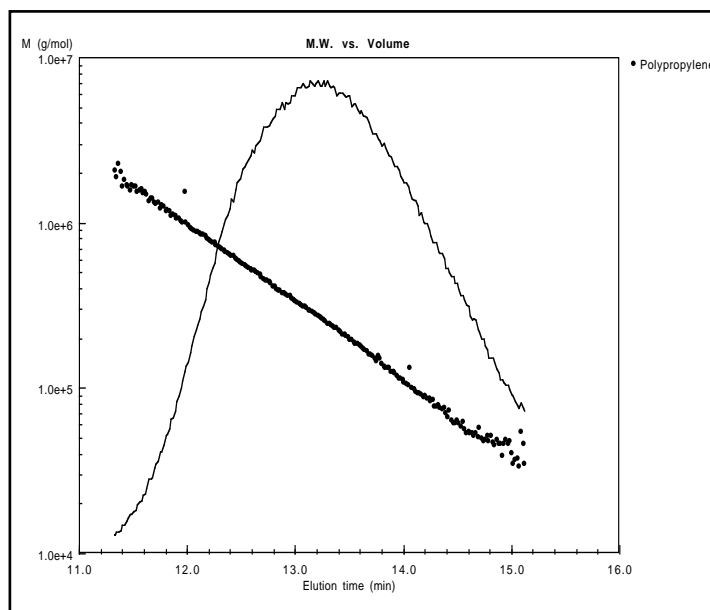


Figure 2. Analysis of LS data yields the "calibration curve" of M_w vs. elution volume. The concentration (RI) profile is superimposed.