Polyacrylamides (PAMs)

Polyacrylamides (PAMs) have many different applications because of their high viscosity. In agriculture, they make irrigation more efficient and prevent soil erosion. PAMs are also used as an additive in drilling muds used for oil extraction as well as for photographic film and battery housings. In addition, PAMs are the major components used in gel electrophoresis for proteins and nucleic acids. For each of these applications—and a great many more—it is crucial to be able to understand how molar mass and molar mass distributions of PAMs relate to product performance.

The combination of a size-exclusion chromatograph (SEC) and a multi-angle light scattering (MALS) detector has become an indispensable tool for determining *absolute* molar masses and their distributions. In this application note, we report the characterization of a PAM sample using a Shodex (Tokyo, Japan) OHpak SB806 HQ column, a Wyatt Technology DAWN DSP detector, and a Wyatt Technology Optilab DSP interferometric refractometer. Data were collected and analyzed using Wyatt Technology's ASTRA software.

The molar mass and radius are determined at each data slice of the SEC peak, as illustrated by the Debye plot in Figure 1. The results for the data slice at the maximum of the RI peak are shown. Note that the ASTRA software reports the uncertainties of the measurements. By this means, the reliability of the results can be assessed. This analysis was performed at both ambient temperature and 50°C. Molar mass results are plotted *versus* the elution volume in Fig. 2.

The lower polydispersity at ambient temperature can be seen in the Table below, which suggests non-size exclusion effects occurred. Some of the high molar mass polymers may be retained on the column and some might coelute with the smaller molar masses. These effects diminish at 50°C, and it is evident that heating the columns improves sample separation—a conclusion which would be difficult to draw if the analysis were not absolute since the peaks themselves merely shifted, their shape did not change. Consequently, the separation is greatly *improved* by *increasing* the column temperature.

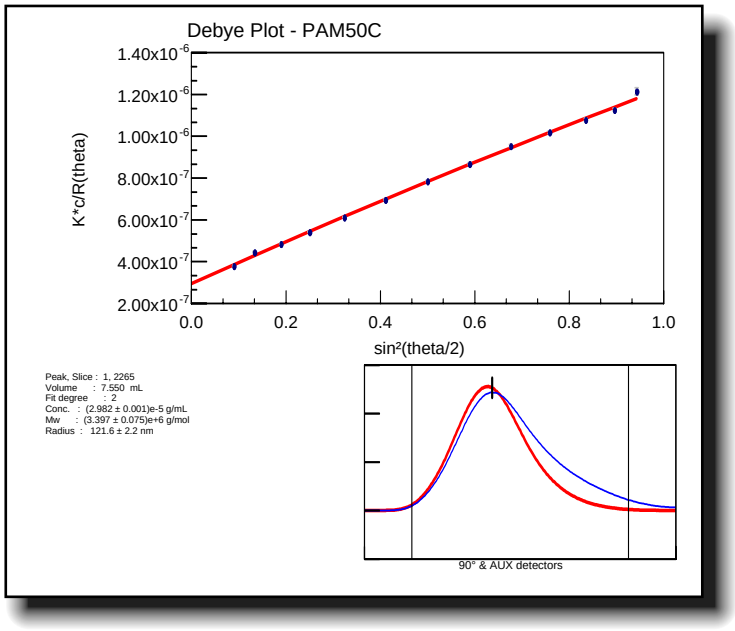

Figure 1. A Debye plot of one data slice of the chromatogram of polyacrylamide.

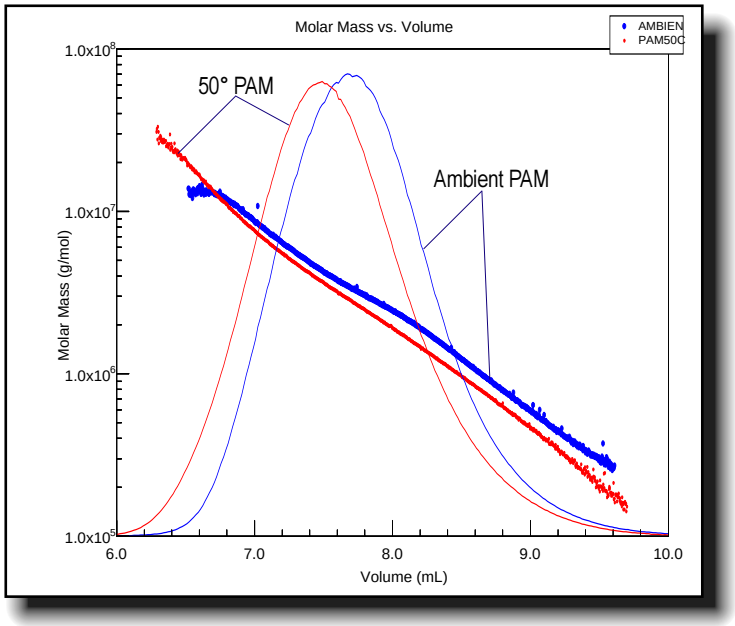

Figure 2. Separation was greatly improved as the temperature was increased from ambient to 50°C.

Shodex Column Temperature	M_n (10^6 D)	M_w (10^6 D)	Polydispersity	R_z (nm)
50° C	1.4±0.1	3.9±0.2	2.8±0.2	221±4
Ambient	1.5±0.1	3.3±0.1	2.2±0.1	169±4

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