

## Dendrimers and Hyperbranched Polymers

Dendrimers have been the subject of many studies for many years, owing to the supposed cavity in their center. Among the dendrimer “family” are polyamidoamines—the most popular and the most commercialized for some time. However, their synthesis remains long and tedious.

One way to overcome this drawback would be to use hyperbranched polymers synthesized in a one pot reaction. Chemically analogous hyperbranched polyamidoamines have thus been synthesized by a polycondensation method and characterized using MALS-SEC.

The weight-average absolute molar masses were determined in a carbonate buffer solution at pH 10 (flow rate 0.5 mL/min) on an SEC apparatus equipped with a refractive index detector and a miniDAWN light scattering detector. The refractive index increments for PAMAM dendrimers were measured in the same eluent at ambient temperature. The values for the hyperbranched polyamides were assumed to be identical. Considering the fact that these polymers can trap some solvent—even after prolonged drying under vacuum—the accuracy for the molecular weight measurement is estimated around 20%.

Figures 1 and 2 show, respectively, SEC chromatograms for PAMAM (4<sup>th</sup> generation) and the hyperbranched polymer. The chromatogram for PAMAM4 presents a narrow peak, although traces of 3<sup>rd</sup> and 5<sup>th</sup> generations are visible. The calculated molar mass is 13000 g.mol<sup>-1</sup> (theoretical one 14215 g.mol<sup>-1</sup>). On the other hand, the peak of the hyperbranched polymer is much wider, owing to the method of synthesis. The calculated molar mass is 13600 g.mol<sup>-1</sup> and the polydispersity index 1.4. In such systems however, the curve of molecular weight *versus* elution volume has shown that some adsorption of the polymer existed, partially explaining the wide peak.

As can be seen here, MALS-SEC is a valuable method for the characterization of hyperbranched polymers—even in aqueous solutions. However, some precautions are necessary in analyzing the results.

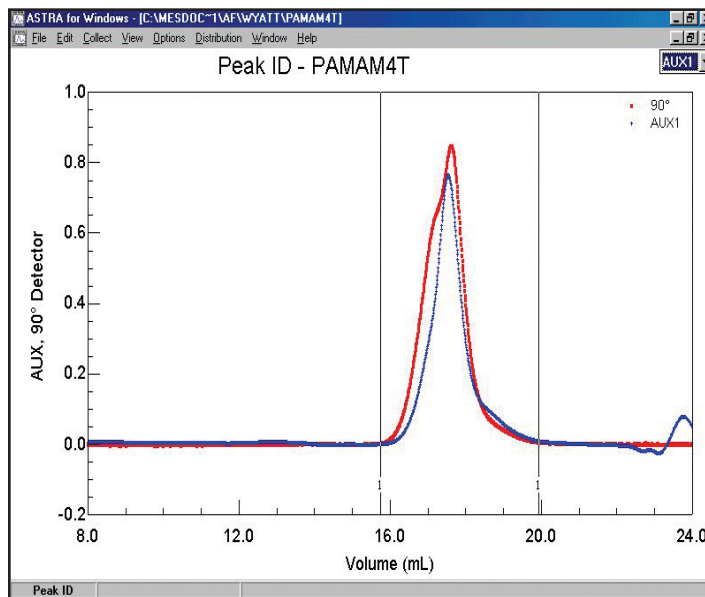


Figure 1. PAMAM (4<sup>th</sup> generation) polymer showing the narrow peak corresponding to a narrow molar mass range.

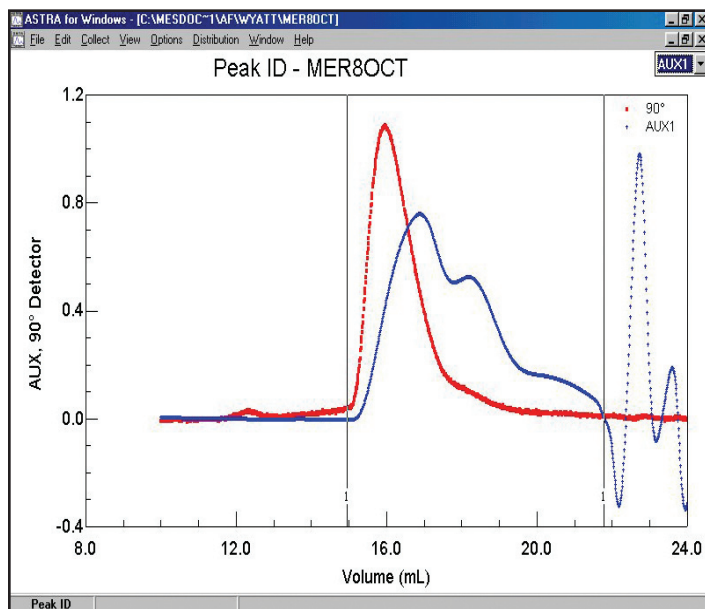


Figure 2. The hyperbranched polymer showing the much wider peak corresponding to a broader molar mass range.

