

## Starch complexes (Polysaccharides)

Polysaccharides (of which starch is an important example) are carbohydrates whose molecules consist simply of a number of monosaccharide residues, which are bound together. These molecules are frequently very large in molar mass and, as such, may not lend themselves to separation via size-exclusion chromatography (SEC) because they elute beyond the exclusion limits of currently-available columns. When this is the case, Wyatt Technology's DAWN can be employed in a batch or "micro-batch" mode to produce weight-average molar masses and z-average sizes for very high molar mass starches, *without* separation.

Before the commercialization of the DAWN systems, performing static molar mass determinations was time-consuming and tedious. But with the advent of the DAWN's solid-state electronics and Windows-based software, these measurements are made on a routine basis—in a fraction of the time it used to take.

The starch samples reported here were dissolved at precise concentrations in a DMSO-water mixture. In the "batch" mode, the samples are placed in a scintillation vial, whereas in the "micro-batch" mode, the samples are injected directly into the instrument's flow cell. For the micro-batch experiment, the data were collected and analyzed using the ASTRA software's Zimm plot module. The angular dependence—extrapolated to zero angle—yields the root mean square radius; the concentration dependence—extrapolated to zero concentration—gives the second virial coefficient (a measure of the solvent-solute interaction), and the intercepts of both lines determine the weight-average molar mass.

Figure 1 shows the results of a micro-batch analysis for an acid-thinned starch. The weight-average molar mass,  $(7.47 \pm 0.09) \times 10^6$ , is believed to correlate with some of the critical properties of the starch sample. Mr. Jerry Klavons, from the U.S.D.A. (NCAUR, Peoria, IL), used standard scintillation vials, prepared with an oxygen plasma "cleaner", in order to construct Fig. 2.

An off-line measurement of the specific refractive index increment,  $dn/dc$ , was made in an Optilab differential refractometer operating at the *same* wavelength as the DAWN's He-Ne laser ( $\lambda = 633\text{nm}$ ).

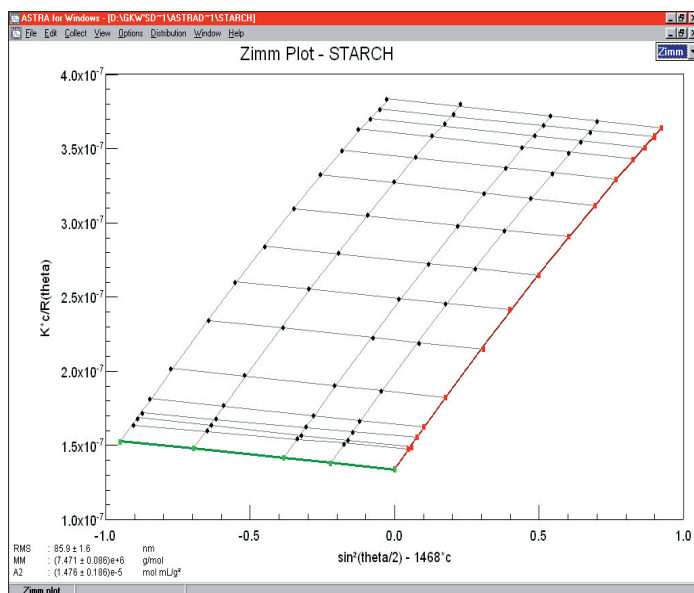


Figure 1. A Zimm plot for acid-thinned starch obtained from a DAWN DSP micro-batch analysis.

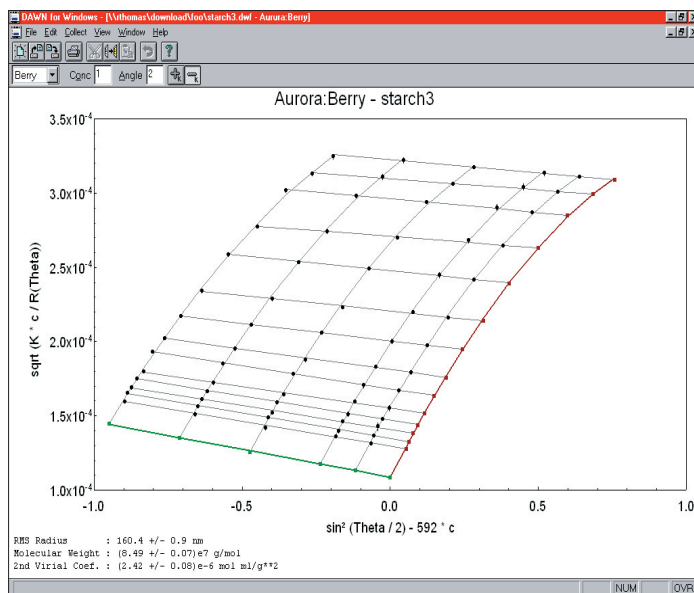
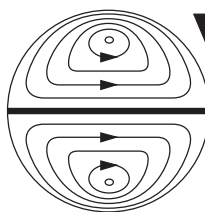


Figure 2. A Berry plot for a high molar mass starch obtained using scintillation vials with the DAWN.



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