

Polylactic Acid

Polylactic acid (a.k.a. poly-lactide) is a polymer with a future. Best known for its ability to biodegrade, the polymer can be processed to replace less environmentally friendly hydrocarbon-based polymers, such as polystyrene or polyethylene. Since it does biodegrade, and can be processed to have such a wide variety of properties, it can be used in everything from packaging to surgical sutures. It also finds uses as resorbable microspheres and implants for the delivery of drugs and vaccines.

As is true of all polymers, the properties of PLA are tied closely with its molar mass and molar mass distribution. From the initial synthesis, to piloting, to control during manufacturing, the success of the product depends upon knowledge of the molar mass of the polymer and the molar mass distributions.

A conventional molar mass determination by SEC using external calibration standards is especially problematic for the analysis of PLA. As is the case with so many polymers, there simply are no external polymer calibration standards similar to PLA! The use of a multiangle light scattering (MALS) detector with an HPLC/SEC system eliminates the need for polymer calibration standards since the *absolute* molar mass of the PLA is measured *directly*.

PLA can be analyzed successfully by SEC/MALS using a solvent with a relatively low refractive index as the mobile phase. The low refractive index mobile phase (lower than chloroform or methylene chloride) increases the dn/dc value which increases both the light scattering response and the RI detector signal. This, of course, ensures excellent sensitivity over the widest molar mass range. The addition of an organic modifier to the mobile phase results in excellent separation as indicated by the plot of molar mass versus elution volume (Fig. 1). To the right, the results of this powerful analysis can be seen in two important graphs: the molar mass versus elution volume, and the cumulative molar mass distribution.

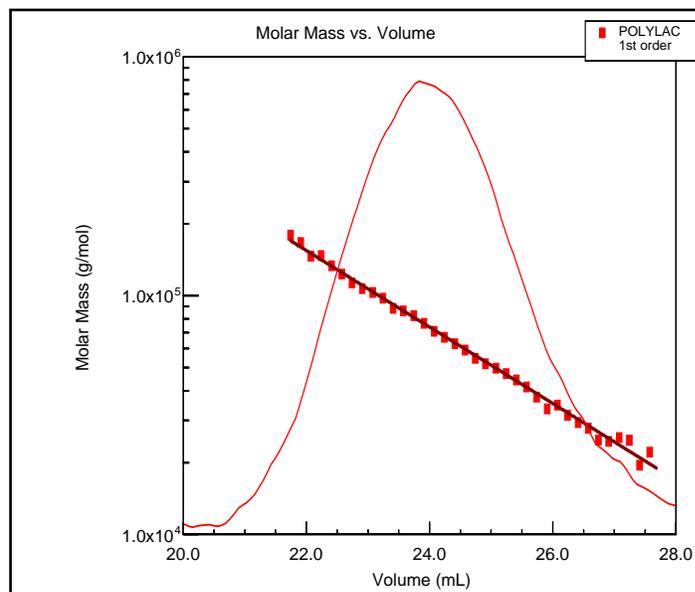


Figure 1. A plot of the Molar Mass versus Elution Volume for Poly(lactide) (Sigma P 1691 Poly (Lactide)).

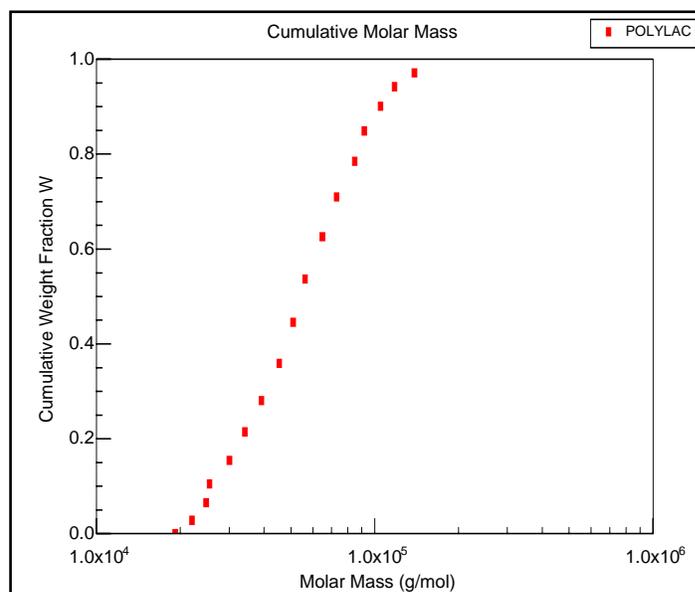
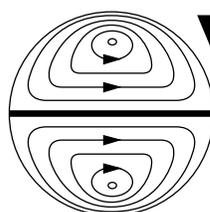


Figure 2. A Cumulative Molar Mass distribution plot of Poly(lactide) (Sigma P 1691 Poly (Lactide)).



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