

Rapid Multi-Angle Light Scattering (RMALS)

This Application Note presents results obtained using an experimental set-up consisting of an HPLC pump, a sample injector, a multi-angle light scattering (MALS) photometer, a differential refractive index (DRI) detector, and an SEC guard column. Several polymers of different composition and molar mass were measured to demonstrate the feasibility of very fast determinations of absolute weight-average molar mass (M_w) and z-average root mean square radius (R_z). The measurements were carried out in either tetrahydrofuran or aqueous mobile phases at flow rates in the range of 1–3 mL/min.

Figure 1 shows the chromatograms recorded by a DAWN MALS and a DRI detector for a broad polystyrene standard [NIST 706]. The figure demonstrates how, in a run-time of less than 1 minute, absolute molar masses may be determined *without* chromatographic separation.

Table 1 compares M_w values of several samples determined by rapid light scattering with those measured by SEC-MALS using standard SEC columns.

The data show that accurate and highly reproducible results can be obtained in very short periods of time. The major advantages of the RMALS are:

- ✓ Ability to screen large numbers of samples or the ability to monitor polymerization reactions.
- ✓ Low column pressure *reduces* the possibility of shearing degradation of ultra-high molar mass samples.
- ✓ Less injected mass is required: At least five times less compared to standard SEC analysis with MALS.

The RMALS method can be used as an alternative to micro-batch light scattering experiments. RMALS is significantly faster and simplifies sample preparation since the sample concentration is determined on-line.

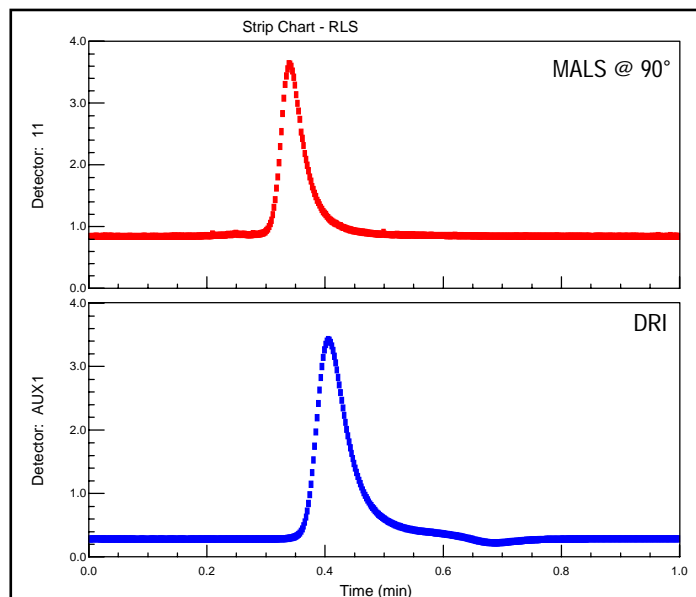
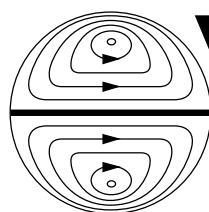


Figure 1. Light scattering and DRI chromatograms from NIST 706 polystyrene at a flow rate of 3 mL/min.

Sample	M_w [10^3 g/mol]	
	Rapid MALS	SEC-MALS
Epoxy resin	3.5	3.4
PS 30K	30.5	29.4
BSA (Contains aggregates)	97.2	97.8
PS 200K	208	203
PS NIST 706	281	277
PS	326	331
Dextran	467	465
PMMA	544	561

Table 1. Comparison of M_w values determined by rapid MALS (RMALS) and SEC-MALS



**Wyatt
Technology**
CORPORATION

6300 Hollister Avenue • Santa Barbara, CA 93117
TEL (805) 681-9009 • FAX (805) 681-0123
E-mail: info@wyatt.com • URL http://www.wyatt.com