

# Quality Control of Epoxy Resins

**E**poxy resins are an important group of synthetic resins. They find applications in a wide variety of industries, and are used for the production of coatings, adhesives, laminates, casting materials, etc.

Traditionally, simple analytical characteristics (e.g. content of epoxy groups, chlorine,  $\alpha$ -glycol groups, viscosity or softening point) are used to identify epoxy resins. But these quantities are often *unable* to distinguish among particular samples and to find relations between the epoxy structure and its properties.

For virtually all synthetic resins, there are no suitable SEC calibration standards available. The preparation of standards by fractional precipitation is laborious and frequently leads to unsatisfactory results. Polystyrene calibration standards are used universally, but are far from the true values of the resins they purport to mimic, so the absolute analysis can only be completed by DAWN or miniDAWN multi-angle light scattering (MALS) coupled to SEC.

In this application note, the chromatograms recorded from the SEC analysis of an epoxy resin sample are depicted in Fig. 1. The light scattering signal proves conclusively that the miniDAWN MALS detector can be used to detect even very low molar masses of the epoxy. In fact, the  $M_n$  value determined by SEC-MALS agrees with those determined by vapor pressure osmometry (VPO), which measures absolute  $M_n$  directly.

Figure 2 contrasts differential molar mass distribution curves of two epoxy resin samples with *identical* epoxide equivalent weights. It demonstrates that the capabilities brought to SEC by MALS is the most direct way to determine correctly the molar mass of synthetic resins. The MALS detection reveals differences that are *not* seen by traditional analytical methods or by using SEC with column calibration and RI detection alone.

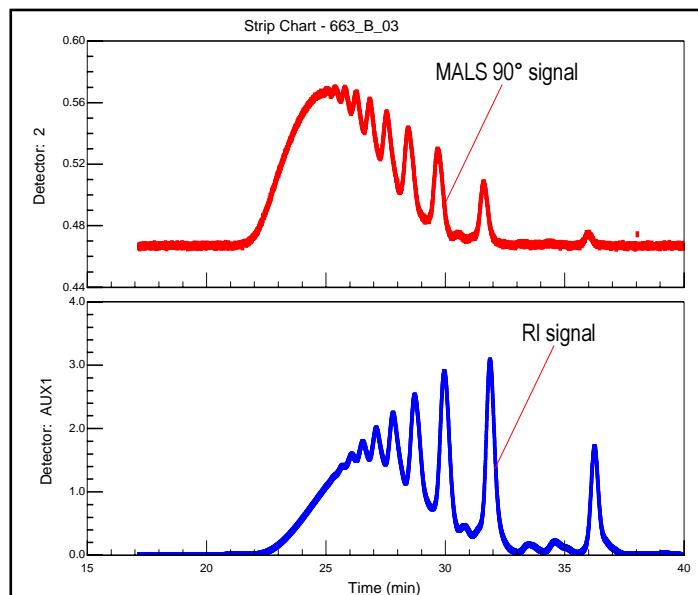


Figure 1. Light scattering (top) and RI (bottom) chromatograms from SEC of bisphenol A based epoxy resin.

$M_n$  (SEC-MALS) = 1,520 g/mol,  $M_n$  (VPO) = 1,470 g/mol.

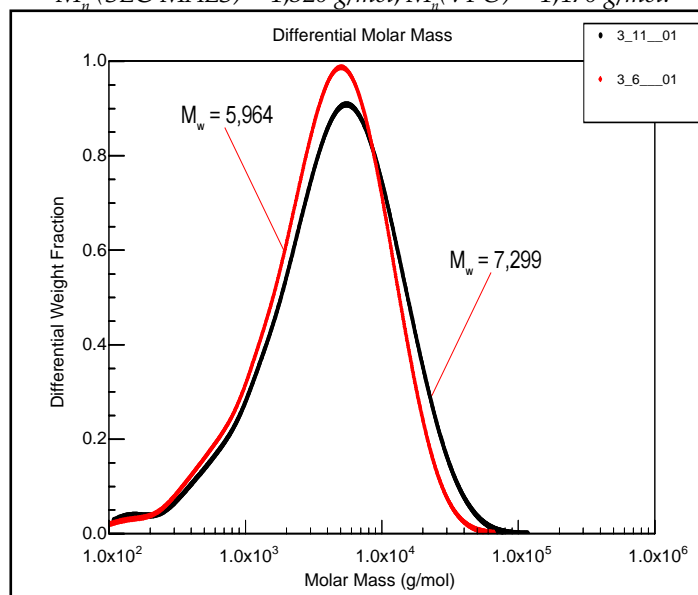
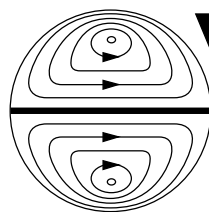


Figure 2. Differential molar mass distributions of two epoxy resin samples with equal epoxide equivalent weights of 1,670.



**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>