

Structure Elucidation with Molar Mass Sensitive Detectors

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GPC/SEC coupled with molar mass sensitive detectors is a powerful method to investigate polymer structure and branching. On-line multi angle light-scattering detectors and on-line viscometers are typical molar mass sensitive detectors.

Besides molar mass distribution, on-line viscometers measure the slice intrinsic viscosity whilst multi angle light-scattering detectors measure the slice radius of gyration. Those values and the values of a linear sample can be used to get the branching coefficients g' and g , respectively.

$$g' = \left[\frac{[\eta]_{\text{branched}}}{[\eta]_{\text{linear}}} \right]_M \quad g = \left[\frac{[R_g]_{\text{branched}}}{[R_g]_{\text{linear}}} \right]_M \quad [1]$$

M indicates, that the intrinsic viscosity/radius of gyration at the same molecular weight are compared.

The intrinsic viscosity/radius of gyration is always smaller for a branched sample than for a linear one of the same molecular weight. This results in: $g', g < 1$.

Much information can already be drawn from the quantitative analysis, Figure 1 shows the specific (a) and intrinsic (b) viscosity of a linear sample compared with the specific (c) and intrinsic (d) viscosity of a branched sample.

The low intrinsic viscosity (at the same molecular weight) shows at a glance that the sample is really branched.

The slope of the plot of log molar mass versus log $[\eta]$ gives information about the structure of the polymer in solution. WINGPC Unity fits the data automatically and calculates the Mark-Houwink exponent "a" as one of the many results .

A sign that a change in structure within the polymer has occurred is if the slope "a" changes with the molecular weight. This is, for example, the situation for long chain branching.

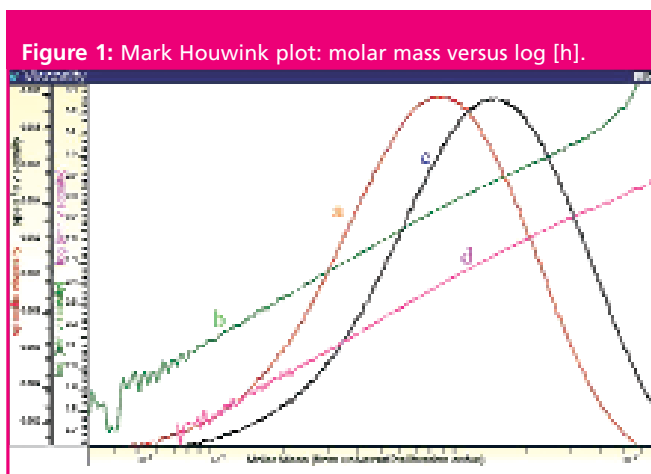


Figure 1: Mark Houwink plot: molar mass versus log $[\eta]$.

WINGPC Unity also determines the structure coefficients when the "K" and "a" values for the linear sample are known. The dependence can be displayed versus the molecular weight or versus the elution volume.

Saving 30% or Even More of your GPC Analysis Time

Overlaid injection saves up to 30% of time between two injections. Reduction of injection intervals yields a higher sample throughput reducing costs for solvent and waste and more efficient use of manpower and equipment.

What does overlaid injection mean? In SEC/GPC no sample can elute before the columns exclusion limit is roughly 30% of the

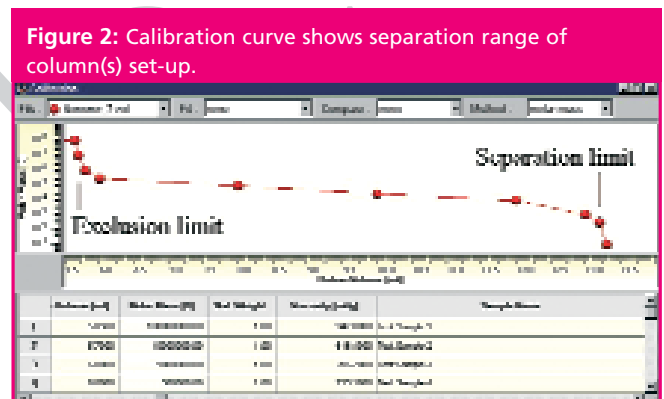


Figure 2: Calibration curve shows separation range of column(s) set-up.

time between the injection and the end of the chromatogram are lost. With the new WINGPC Unity there is no need to close a sample file before the next injection so you can inject the next sample while the preceding one is eluting, thus optimizing sample throughput. The minimum injection time can be calculated easily as

$$t_{\min} = \frac{V_t - V_{\text{ex}}}{F} + \text{Base} \quad [2]$$

Users often run samples which contain quite low molecular weight compounds only. In that instance injection times can be reduced even more without changing the column set. Simply replace V_{ex} by V_{\min} — the slowest possible elution time of the injected sample.

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