

ULTRA-HIGH PERFORMANCE MACROMOLECULAR CHROMATOGRAPHY: SCOPE AND LIMITATIONS

Daniela Held, Peter Kilz, Michael Möller

PSS Polymer Standards Service GmbH, POB 3368, Mainz, Germany, info@pss-polymer.com

ABSTRACT

Modern polymeric materials, as well as many biologics in health care applications, consist of fine-tuned macromolecules with very specific structure-property-function dependencies. Optimization of synthetic, fermentation, and modification routes is required to achieve best performance and reproducible product properties. Size-exclusion chromatography (GPC, SEC) is the most widely used and versatile method for in-depth investigation of molecular structure^{1, 2}.

Novel chromatographic instrumentation, high-resolution column technologies, and comprehensive characterization methods open up new opportunities for faster, high resolution analysis of such macromolecular species.

The figure below compares the most current technology with the traditional one with regard to resolution and reduced time-requirements: the left chromatogram shows the classical separation of an oligomeric polystyrene with no indication of individual chain length, the right one an ultra performance separation which is 5 times faster and 20 times more efficient.

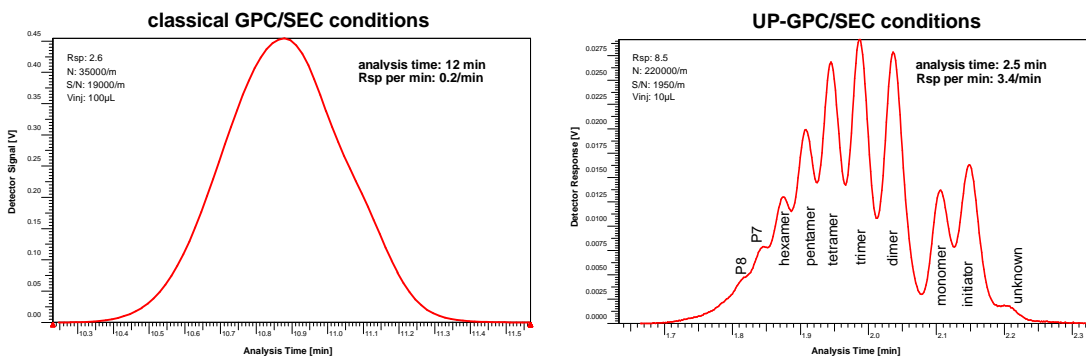


Fig. 1: Comparison of past (left) and present (right) GPC/SEC separations

Based on a review of most current technologies, the scope and limitations of each technological invention will be discussed taking into account

- ultra-high performance and micro SEC/GPC instrumentation
- usage of sub 3µm particles in current column technologies
- the utilization of information-rich detectors.

References:

¹ Held, D.; Kilz, P., Characterization of Polymers by Liquid Chromatography, *Macromolecular Symposia*, **2006**, *231*, 145

² Kilz, P., Two-Dimensional Chromatography as an Essential Means for Understanding Macromolecular Structure, *Chromatographia*, **2003**, *59*, 3