#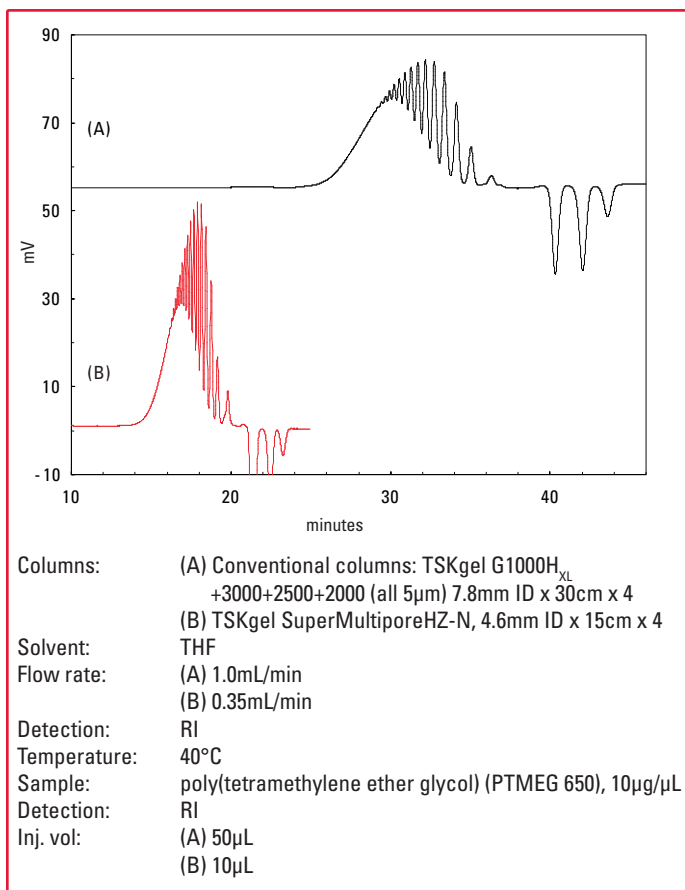 Semi-micro Columns for Size-Exclusion Chromatography in Organic Solvent Systems: TSKgel SuperMultiporeHZ Series Columns

Introduction

In size exclusion chromatography, obtaining calibration curves over a wide range of molecular weights is a difficulty investigators often encounter when analyzing polymers with a broad molar mass distribution. To overcome this problem two procedures are typically used. One option is to use multiple columns of different pore sizes linked together in series. A second is to use a column packed with a mixed bed resin of different pore sizes at an optimized mix ratio. However, problems can occur with both of these methods, which include distortion of the chromatogram or deviations between the actual calibration curve and the calibration curve approximated from data obtained from the molecular weight standards.

Figure 1.

Columns:	(A) Conventional columns: TSKgel G1000H$_{XL}$ +3000+2500+2000 (all 5µm) 7.8mm ID x 30cm x 4
	(B) TSKgel SuperMultiporeHZ-N, 4.6mm ID x 15cm x 4
Solvent:	THF
Flow rate:	(A) 1.0mL/min
	(B) 0.35mL/min
Detection:	RI
Temperature:	40°C
Sample:	poly(tetramethylene ether glycol) (PTMEG 650), 10µg/µL
Detection:	RI
Inj. vol:	(A) 50µL
	(B) 10µL

As is shown in *Figure 1*, a novel approach to solve this problem was developed by Tosoh scientists and is incorporated in TSKgel SuperMultiporeHZ Series columns.

Using proprietary multi-pore particle synthesis technology, packing material composed of monodisperse particles are synthesized in which a wide range of pore sizes are contained within a single particle. The TSKgel SuperMultiporeHZ Series product line further improves performance by reducing column dimensions to the semi-micro level (4.6mm ID x 15cm), which cuts down on solvent consumption costs by one-sixth and running times by one-half.

Table 1. Physical properties of TSKgel SuperMultiporeHZ columns

Product name	TSKgel SuperMultiporeHZ-N	TSKgel SuperMultiporeHZ-M	TSKgel SuperMultiporeHZ-H
Packing material	poly(styrene/divinlybezene)	poly(styrene/divinlybezene)	poly(styrene/divinlybezene)
Particle size	3µm	4µm	6µm
Plate number (15cm)	20,000	16,000	11,000
Exclusion limit	120,000	2,000,000	40,000,000*
Column dimensions	4.6mm ID x 15cm	4.6mm ID x 15cm	4.6mm ID x 15cm

* Applicable to polystyrene in THF

Results

Figure 1 compares the separation of oligomers in poly(tetramethylene ether glycol) (PTMEG 650) of four conventional mixed bed GPC columns (A) to the TSKgel SuperMultiporeHZ-N column (B). The TSKgel SuperMultiporeHZ-N column (B) provides the same or higher resolution at a much shorter analysis time than multiple columns linked together.

Table 2 shows the average molecular weight of silicone resin analyzed on several different lots of TSKgel SuperMultiporeHZ-N columns. The data reveals that there is very little difference between lots.

Table 2. Reproducibility of different lots of TSKgel SuperMultiporeHZ-N columns

Column (Gel Lot)	Mw	Mn	Mz
TSKgel SuperMultiporeHZ-N (A)	3.410	1,340	7,750
TSKgel SuperMultiporeHZ-N (B)	3,400	1,340	7,740
TSKgel SuperMultiporeHZ-N (C)	3,430	1,350	7,850
Avg. (RSD)	3,410 (0.37%)	1,340 (0.35%)	7,780 (0.64%)

Conclusion

TSKgel SuperMultiporeHZ Series size exclusion columns represent an innovative type of semi-micro GPC column. These columns have an extended linear MW range with superior reproducibility. Using these products lowers solvent consumption and disposal expenses while offering higher-throughput capabilities. There are three columns available within the TSKgel SuperMultiporeHZ Series, each with a different particle size, separation range and exclusion limit. These columns can separate and characterize polymers within a wide molecular mass range.

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