SEC Analysis of Star Branched Polyethylene Glycol without Column Interaction

Application Note

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Introduction

Recent advances in polymer chemistry have led to the development of novel materials with both controlled functionality and structure resulting in unusual rheological properties. Examples include the many di- and triblock copolymer architectures and dendritic systems. These materials often include regions of different polarity and hydrophobicity and therefore represent a challenge to the analytical chemist. This application note illustrates the analysis of a star-branched polyethylene glycol with a significant hydrophobic component by aqueous SEC.

The basic structure of the star-branched polyethylene glycol is shown in Figure 1, where R represents an aromatic hydrophobic component. Unmodified polyethylene glycol can be analyzed in aqueous solution at pH 7. However, the star-branched material contained a significant hydrophobic component that could interact with the column packing material resulting in non-SEC effects.

To investigate the effect of the hydrophobic component on the elution profile, the sample was analyzed in buffer at pH 7 both before and after the inclusion of 30% methanol (by volume). The presence of a miscible organic solvent such as methanol significantly lowers the polarity of the eluent and serves to minimize hydrophobic interactions between the sample and column packing material. Agilent PL aquagel-OH columns were chosen because they can be used with up to 50 % methanol in the eluent. These high performance columns operate across a wide range of eluent conditions for high performance analysis of analytes with neutral, ionic and hydrophobic moieties, singly or combined.

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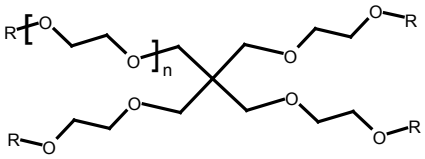

Figure 1. Structure of the star-branched polyethylene glycol

Conditions

Samples:	Star branched PEG
Columns:	2 x PL aquagel-OH 30 8 µm, 300 x 7.5 mm (part number PL1120-6830)
Eluent:	Water + 0.2 M $NaNO_3$ + 0.01 M NaH_2PO_4 + 30 % methanol
Flow Rate:	1.0 mL/min
Injection Volume:	100 µL
Detection:	RI

Results and Discussion

The resulting chromatograms are shown in Figures 2 and 3.

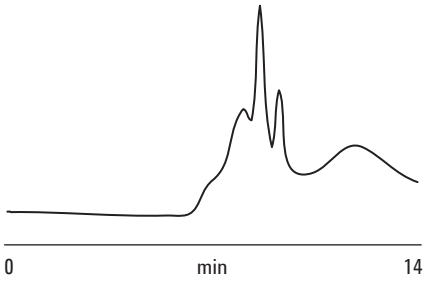

Figure 2. Chromatogram of the star-branched polyethylene glycol obtained in buffer at pH 7

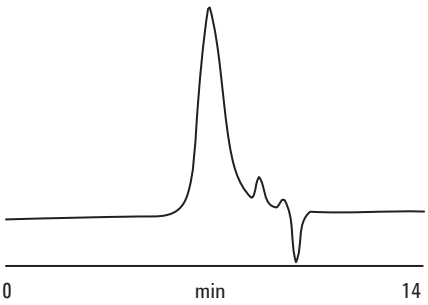

Figure 3. Chromatogram of the start-branched polyethylene glycol obtained in buffer at pH 7 with 30 % methanol

Clearly, the chromatogram obtained without methanol shows that the sample is interacting strongly with the column, with some material eluting after the total permeation limit. However, the presence of 30% methanol has inhibited the interaction and a normal Gaussian peak shape has been obtained, which can be integrated for SEC calculations.

Conclusion

The presence of significant hydrophicity in a star branched polymer is no barrier to its resolution by SEC with PL aquagel-OH columns. In addition, the column's ability to handle eluents containing up to 50% methanol means that star-branched polymers can be resolved without interactions.

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