Application Brief

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Characterization of Hydroxypropyl Cellulose with GPC/SEC

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Abstract

This application brief shows the GPC/SEC separation of two typical hydroxypropyl cellulose (HPC) samples. GPC/SEC is a well-known technique for assessing the molecular weight distribution (MWD) of polymers, a property that influences many physical characteristics of polymeric materials.

Introduction

HPC is an O-hydroxypropyl modified cellulose. The polymer is soluble in cold water (below 45 °C) and polar organic solvents such as dimethyl sulfoxide (DMSO). HPC has gelation and viscosity enhancing properties and is widely used in the food and pharma industries. The viscosity enhancing properties are strongly molar mass dependent.[1]

HPC belongs to the family of thermoresponsive polymers. At a certain temperature (about 48 °C for HPC), the hydrogen bonding between the water molecules and the HPC breaks down, and the polymer becomes increasingly hydrophobic and precipitates in water.

Experimental

Table 1. Instrument and sample conditions.

	Conditions
Pump	Isocratic pump Flow rate: 1 mL/min Mobile phase: dimethyl sulfoxide, lithium bromide 5 g/L
Injection System	Autosampler Injection volume: 20 µL
Columns	Agilent GRAM 10 µm precolumn, 8 × 50 mm (p/n AMA080510) Agilent GRAM 10 µm linear, 8 × 300 mm (p/n AMA083010lin)
Temperature	60 °C
Sample Concentration	3 to 5 mg/mL
Calibration	Agilent ReadyCal-Kit Polymethylmethacrylate (p/n PSS-MMKITR1)
Detectors	Refractive index (RI) detector
Software	Agilent WinGPC

Results and discussion

Two HPC samples were analyzed using DMSO with 0.5% lithium bromide as mobile phase and a GRAM 10 µm linear column in combination with a 10 µm guard column as stationary phase.

An overlay of the elugrams is shown in Figure 1.

Performing a conventional calibration with polymethyl methacrylate (PMMA) reference material allows the analysis of the relative MWD as depicted in Figure 2. The measured molar masses are not absolute values.

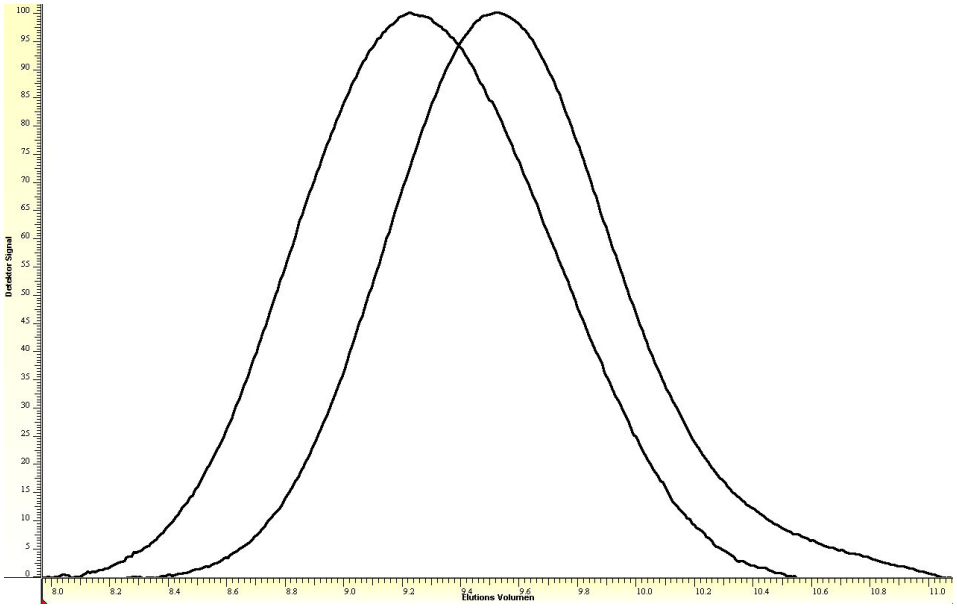

Figure 1. Overlay of two HPC samples (RI traces, normalized detector response).

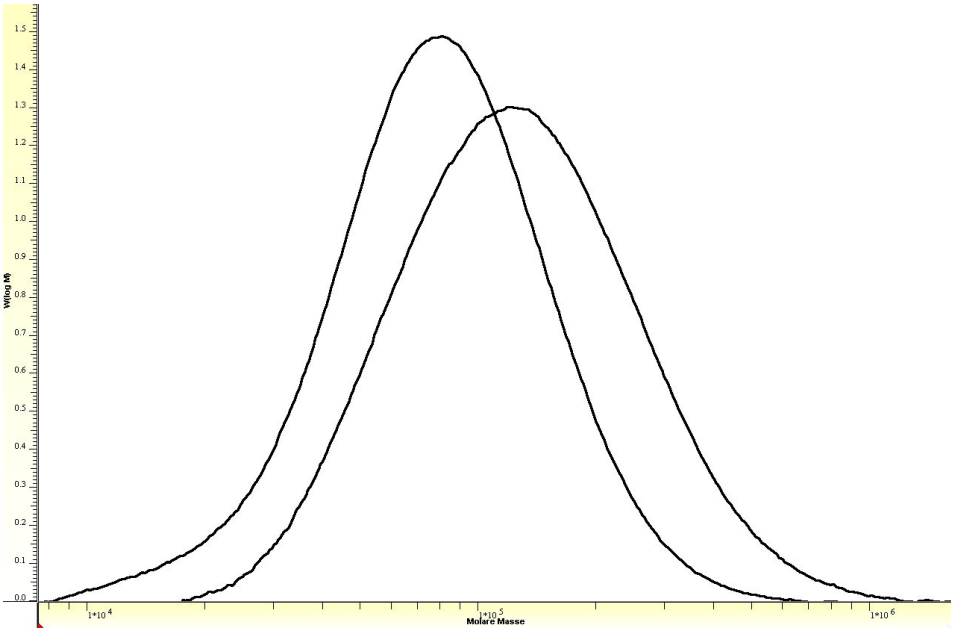

Figure 2. Overlay of the MWDs of two HPC samples (based on calibration with PMMA reference materials, Agilent ReadyCal-Kit PMMA, p/n PSS-MMKITR1).

Conclusion

Robust and reliable GPC/SEC analysis of HPC samples was achieved using DMSO with salt and Agilent GRAM columns. GRAM is a recommended stationary phase for the use of polar organic solvents, such as DMSO.

References

1. Wüstenberg, T. Cellulose und Cellulosederivate. *Behr's Verlag DE*, **2013**, pp 225–238.

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