

Acclaim Size Exclusion Chromatography (SEC) Columns

High Performance SEC Columns for Water Soluble Polymer Analysis

Thermo Scientific™ Acclaim™ SEC-300 and SEC-1000 are a family of high performance size exclusion chromatography columns specifically designed for the separation of water soluble polymers and oligomers.

Product Highlights

- Proprietary mono-dispersed multi-pore hydrophilic resin: no inflection points in calibration curve
- Two stationary phases with different pore sizes offer wide linear calibration range (100 to 1,000,000 Dalton)
- Availability of small particle sizes packed in 4.6 x 300 mm dimension allows for high-resolution analysis at reduced solvent consumption
- Stable surface bonding with low column bleed and compatibility with UV, RI, MS, ELSD and Thermo Scientific Dionex™ Corona™ Charged Aerosol Detectors



Introduction

Water soluble polymers cover a wide range of highly varied families of products, both of natural or synthetic origin, and have numerous uses in pharmaceuticals, medicines, cosmetics, food products, industrial processes, etc. Size exclusion chromatography (SEC) is the most commonly used method to characterize the molecular weight distribution of polymers. Acclaim SEC columns are designed for determining molecular weight distribution of various water soluble polymers/oligomers from 100 to over 1,000,000 Daltons.

Column Technology

Acclaim SEC columns are packed with spherical, mono-dispersed, hydrophilic polymethacrylate particles synthesized by the multi-pore particle synthesis technology. Combined with the use of small particle sizes (5 μm for Acclaim SEC-300 and 7 μm for Acclaim SEC-1000), they provide high-resolution and good linearity of the calibration curve for accurate and reliable analysis for a variety of water soluble polymers.

Acclaim SEC columns offer two pore sizes, 300 Å and 1000 Å, to cover a broad molecular weight range. The Acclaim SEC-1000 uses polymethacrylate particles with a nominal pore size of 1000 Å, resulting in a wide linear calibration range from 1,000 to 1,000,000 Dalton (Figure 1). Thus it is suitable for characterizing high molecular weight polymers.

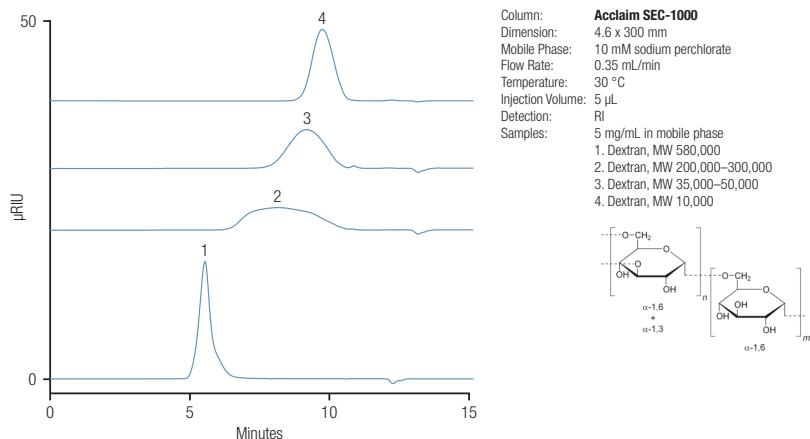


Figure 5: Dextrans on Acclaim SEC-1000 column

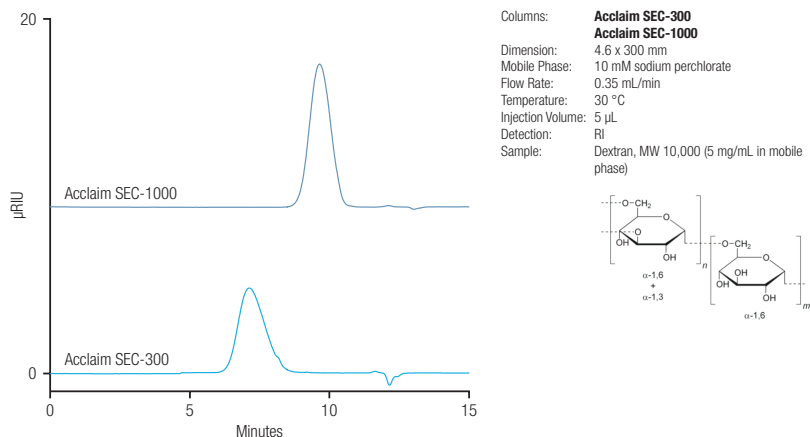


Figure 6: Dextran on Acclaim SEC-300 vs. Acclaim SEC-1000 columns

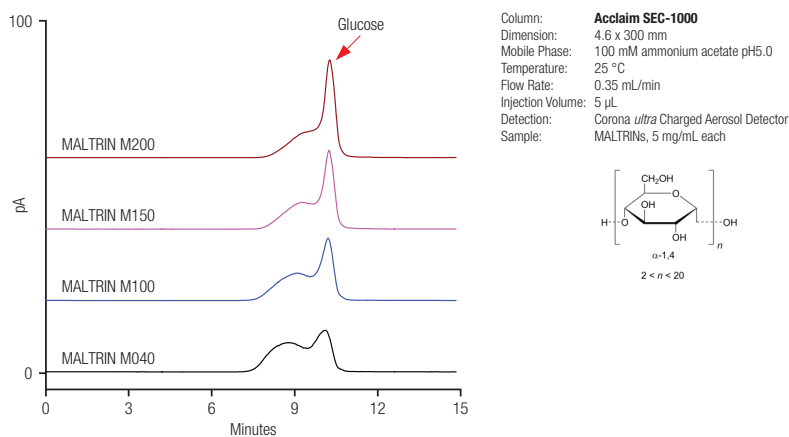


Figure 7: Maltodextrins on Acclaim SEC-1000 column

Dextran is a class of complex, branched polymers called glucan that is composed of chains of various lengths (from 3 to 2000 kilodaltons). It has broad medical and industrial applications. Figure 5 shows the overlay of chromatogram traces of dextrans with different sizes obtained on an Acclaim SEC-1000 column. For a lower molecular weight dextran (MW 10,000), the Acclaim SEC-300 column elutes the analytes farther away from the void, resulting in better data quality (Figure 6).

Maltodextrin is a polysaccharide that is used as a food additive. It is produced from starch by partial hydrolysis. Maltodextrin is easily digestible, being absorbed as rapidly as glucose and is commonly used as an ingredient in a variety of food production, such as sodas and candy. As shown in Figure 7, maltodextrin samples with different degree of hydrolysis are clearly differentiated using the Acclaim SEC-1000 column.

Polyacrylamide is a polymer $(-\text{CH}_2\text{CHCONH}_2-)$ formed from acrylamide monomer. It is highly water-absorbent, forming a soft gel when hydrated, used in such applications as polyacrylamide gel electrophoresis and in manufacturing soft contact lenses. The straight-chain polyacrylamide is often used as a thickener and suspending agent. Figure 8 exhibits elution profiles of a polyacrylamide polymer with an average molecular weight of 10,000 Dalton on both Acclaim SEC-300 and Acclaim SEC-1000 columns.

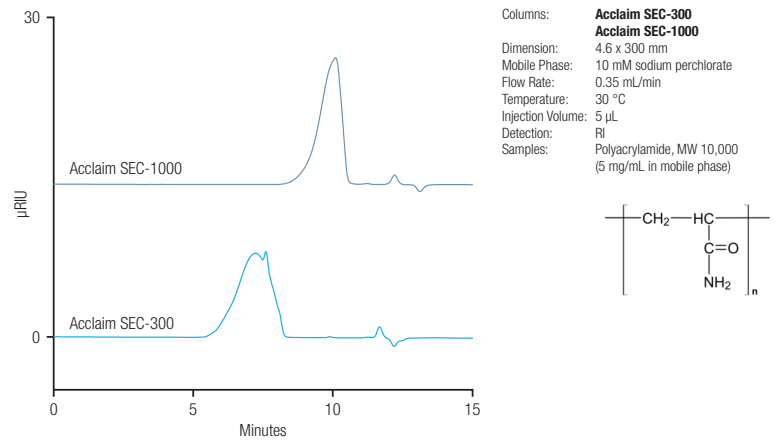


Figure 8: Polyacrylamide on Acclaim SEC-300 vs. Acclaim SEC-1000 columns

Polyacrylic Acid (PAA) is the generic name for synthetic polymers from acrylic acid monomer. In a water solution PAA is an anionic polymer, which makes PAA a polyelectrolyte, with the ability to absorb and retain water and swell to many times their original volume. Thus, it is widely used in disposable diapers, and as thickening, dispersing, suspending and emulsifying agents in pharmaceuticals and cosmetics. It is noted that a small amount of carboxylate groups are present in the stationary phase. As the result, the elution times of PAAs are usually shorter than those of neutral water soluble polymers with the similar size due to the electrostatic repulsion between anionic polymers like PAAs and the stationary phase. This feature makes PAA peak free from interference from the void, resulting in accurate measurement of total quantity of PAA in the sample. Figure 9 shows the elution profiles of a PAA (MW 10,000) on both Acclaim SEC-300 and Acclaim SEC-1000 columns using an un-buffered salt solution. For the purpose of molecular weight determination, a buffered mobile phase may be needed.

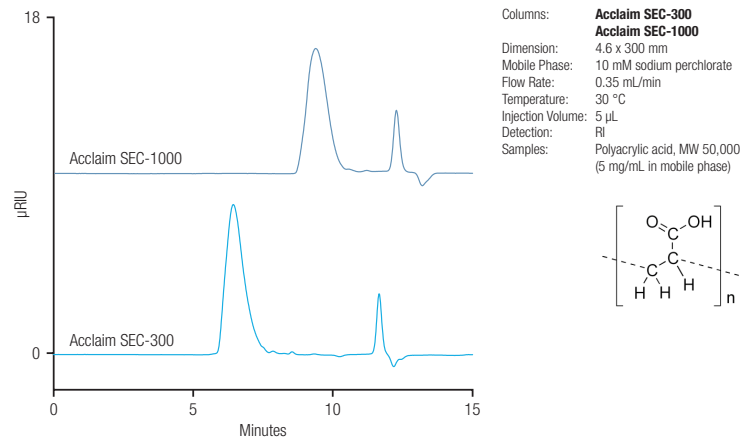


Figure 9: Polyacrylic Acid on Acclaim SEC-300 vs. Acclaim SEC-1000 columns

Polyquaternium-10 is a polymeric quaternary ammonium salt of hydroxyethyl cellulose that is positively charged. At high pH, the presence of hydroxyl groups may reduce the normally high water solubility of quaternary ammonium compounds. The charge on Polyquaternium-10 makes this compound an antistatic agent which helps prevent the condition commonly known as fly-away hair. It is also used as a film former and a hair fixative. Due to the presence of small amount of carboxylate groups in the stationary phase, an acidic buffered mobile phase is often used to suppress electrostatic attraction between cationic water-soluble polymers like Polyquaternium-10 and the stationary phase, as shown Figure 10.

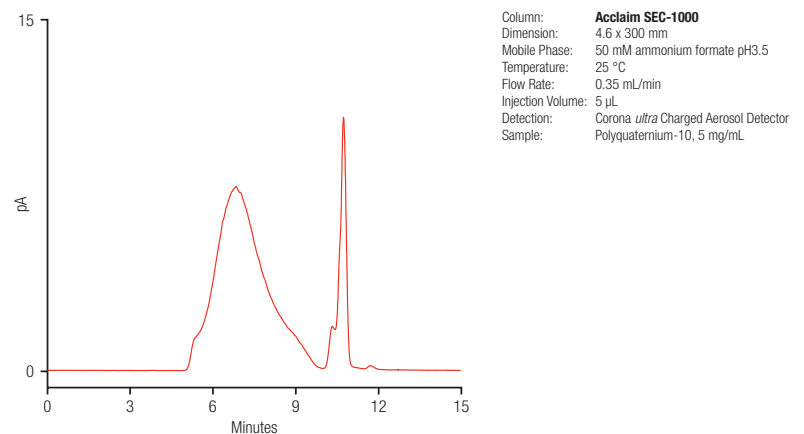


Figure 10: Polyquaternium-10 (quaternized hydroxyethylcellulose)

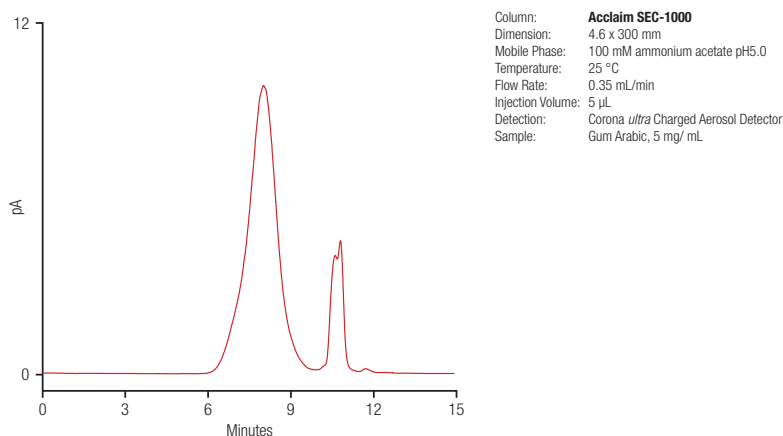


Figure 11: Gum Arabic profile on Acclaim SEC-1000 column

Gum Arabic is a complex mixture of glycoproteins and polysaccharides. It is used primarily in the food industry as a stabilizer. Gum Arabic is a key ingredient in traditional lithography and is used in printing, paint production, glue, cosmetics and various industrial applications. As shown in Figure 11, the Acclaim SEC-1000 column, combined with a charged aerosol detector and a volatile mobile phase, provides a viable solution to determine the molecular weight distribution of Gum Arabic.

Reproducible Manufacturing

Each Acclaim SEC column is manufactured to strict specifications to ensure column-to-column reproducibility. Each column is individually tested and shipped with a qualification assurance report.

Physical Data

	Acclaim SEC-300	Acclaim SEC-1000
Substrate	Hydrophilic polymethacrylate resin	Hydrophilic polymethacrylate resin
Particle shape	Spherical	Spherical
Particle size	5 µm	7 µm
Pore size	300 Å (multi-pore)	1000 Å (multi-pore)
Separation range for PEO*	100–50,000 Daltons	1,000–1,000,000 Daltons
Exclusion limit for PEO*	50,000–150,000 Daltons	3,000,000–7,500,000 Daltons

*PEO = polyethylene oxides

Operational Specifications

Column	Dimension (mm)	Flow Rate (mL/min)	Pressure Limit (psi)	Temperature (°C)	pH Range	Sample Loading (µL)
SEC-300, 5 µm	4.6 x 300	≤ 0.35	< 1200	< 60	2 – 12	< 100
SEC-300, 5 µm	7.8 x 300	≤ 1.00	< 1200	< 60	2 – 12	< 300
SEC-300, 5 µm	7.8 x 150	≤ 1.00	< 700	< 60	2 – 12	< 150
SEC-1000, 7 µm	4.6 x 300	≤ 0.35	< 600	< 60	2 – 12	< 100
SEC-1000, 7 µm	7.8 x 300	≤ 1.00	< 600	< 60	2 – 12	< 300
SEC-1000, 7 µm	7.8 x 150	≤ 1.00	< 350	< 60	2 – 12	< 150

Ordering Information

Description	Part Number
Acclaim SEC-1000, 7 µm, Analytical, 4.6 x 300 mm	079724
Acclaim SEC-1000, 7 µm, Analytical, 7.8 x 300 mm	079721
Acclaim SEC-1000, 7 µm, Analytical, 7.8 x 150 mm	079722
Acclaim SEC-300, 5 µm, Analytical, 4.6 x 300 mm	079723
Acclaim SEC-300, 5 µm, Analytical, 7.8 x 300 mm	079725
Acclaim SEC-300, 5 µm, Analytical, 7.8 x 150 mm	079726
Acclaim SEC-1000, 7 µm, Guard, 4.6 x 33 mm	082739
Acclaim SEC-300, 5 µm, Guard, 4.6 x 33 mm	082740



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