

Acclaim size exclusion chromatography (SEC) columns

SEC columns for water soluble polymer analysis

Thermo Scientific™ Acclaim™ SEC-300 and SEC-1000 are 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™ 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.

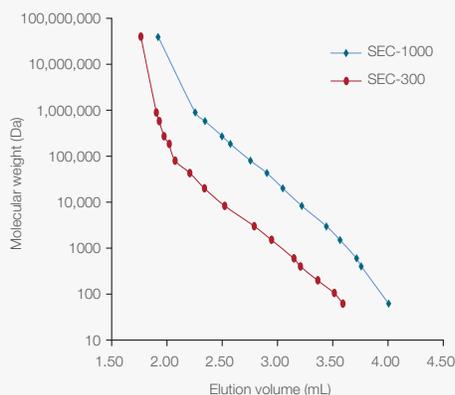
The Acclaim SEC-300 uses polymethacrylate particles with a nominal pore size of 300 Å, giving a linear calibration range from 100 to 50,000 Dalton (Figure 1). As a result, this column offers good resolution for lower molecular weight polymers and oligomers (see Figure 2).

Acclaim SEC columns are available in three different column dimensions. While the 7.8 x 300 mm column is used for high-resolution applications, the 4.6 x 300 mm semi-micro column format allows for high-resolution analysis at a greatly reduced solvent consumption. For high-throughput analysis, the 7.8 x 150 mm format is recommended. Therefore, Acclaim SEC columns cover a wide range of separation needs and flow rate range (0.2–1.0 mL/min).

Applications

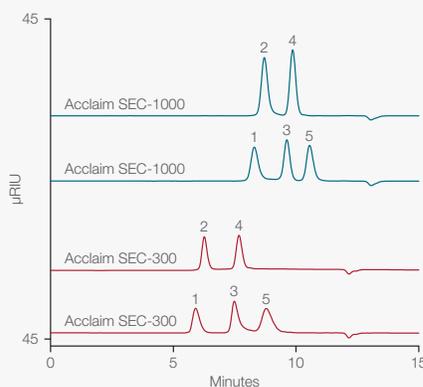
Polyvinylpyrrolidone (PVP),

a water-soluble polymer made from the monomer N-vinylpyrrolidone, is extensively used in pharmaceutical, medical, cosmetics, foods, and industrial applications. While the Acclaim SEC-1000 column is suited to determination of PVP samples with a wide molecular weight range (Figure 3), the Acclaim SEC-300 column provides more detailed information on molecular weight distribution of smaller PVP (Figure 4).



Columns	Acclaim SEC-300 Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	10 mM sodium perchlorate
Temperature	25 °C
Flow rate	0.35 mL/min
Inj. volume	50 µL
Detection	RI
Samples	(0.03% - 0.1% in mobile phase) Dextran (MW 5,000,000-40,000,000), PEO (MW 895,000, 580,000, 272,000, 185,000, 80,000, 43,000, and 20,000), PEG (MW 8,300, 3,000, 1,500, 600, 400 and 200), diethylene glycol (MW 106) and ethylene glycol (MW 62)

Figure 1: Calibration curves of Acclaim SEC-300 and Acclaim SEC-1000 columns



Columns	Acclaim SEC-300 Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	10 mM sodium perchlorate
Temperature	30 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	RI
Samples	5 mg/mL in mobile phase 1. PEG MW 35,000 2. PEG MW 12,000 3. PEG MW 3,400 4. PEG MW 2,000 5. PEG MW 300

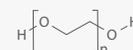
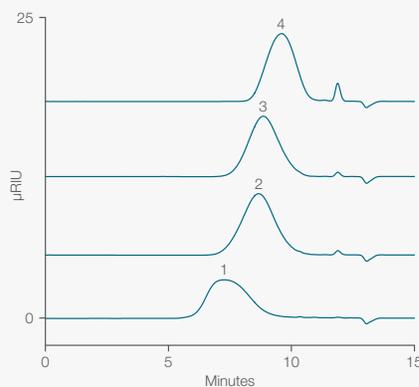


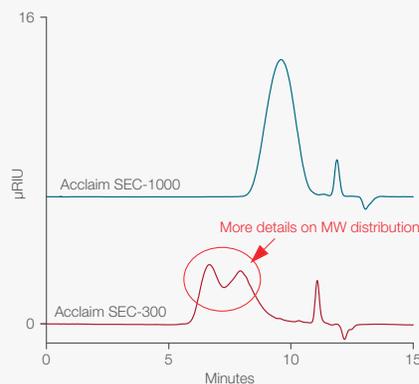
Figure 2: Polyethylene glycols (PEG) on Acclaim SEC-300 vs. Acclaim SEC-1000 columns



Column	Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	10 mM sodium perchlorate
Temperature	30 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	RI
Samples	5 mg/mL in mobile phase 1. PVP, MW 360,000 2. PVP, MW 55,000 3. PVP, MW 24,000 4. PVP, MW 10,000



Figure 3: Polyvinylpyrrolidones (PVP) on Acclaim SEC-1000 column



Columns	Acclaim SEC-300 Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	10 mM sodium perchlorate
Temperature	30 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	RI
Samples	PVP, MW 10,000 (5 mg/mL in mobile phase)

Figure 4: Polyvinylpyrrolidone on Acclaim SEC-300 vs. Acclaim SEC-1000 columns

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).

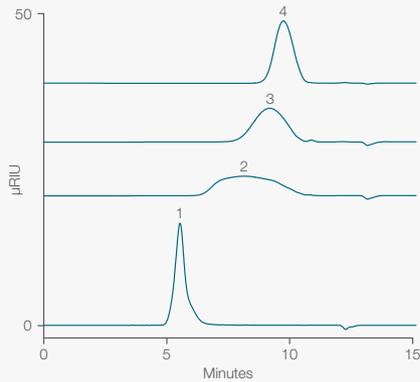
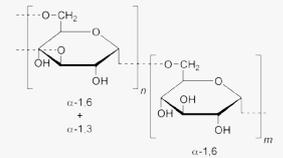


Figure 5: Dextrans on Acclaim SEC-1000 column

Column	Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	10 mM sodium perchlorate
Temperature	30 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	RI
Samples	5 mg/mL in mobile phase 1. Dextran, MW 580,000 2. Dextran, MW 200,000–300,000 3. Dextran, MW 35,000–50,000 4. Dextran, MW 10,000



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.

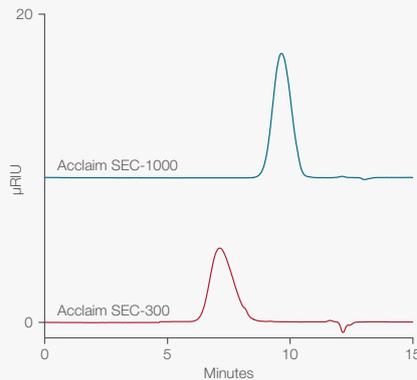


Figure 6: Dextran on Acclaim SEC-300 vs. Acclaim SEC-1000 columns

Columns	Acclaim SEC-300 Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	10 mM sodium perchlorate
Temperature	30 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	RI
Samples	Dextran, MW 10,000 (5 mg/mL in mobile phase)

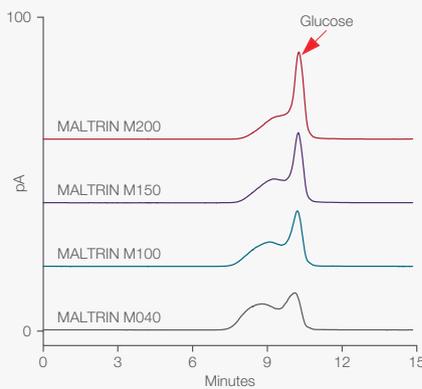
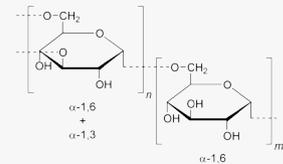
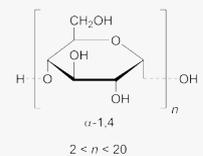


Figure 7: Maltodextrins on Acclaim SEC-1000 column

Column	Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	100 mM ammonium acetate pH 5.0
Temperature	25 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	Corona <i>ultra</i> Charged Aerosol Detector
Samples	MALTRINs, 5 mg/mL each



Polyacrylamide is a polymer (-CH₂CHCONH₂-) 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.

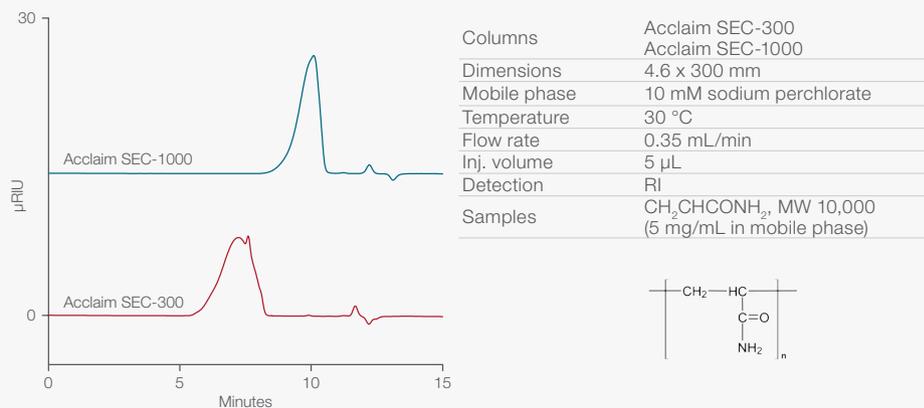


Figure 8: Polyacrylamide CH₂CHCONH₂ on Acclaim SEC-300 vs. Acclaim SEC-1000 columns

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 unbuffered salt solution. For the purpose of molecular weight determination, a buffered mobile phase may be needed.

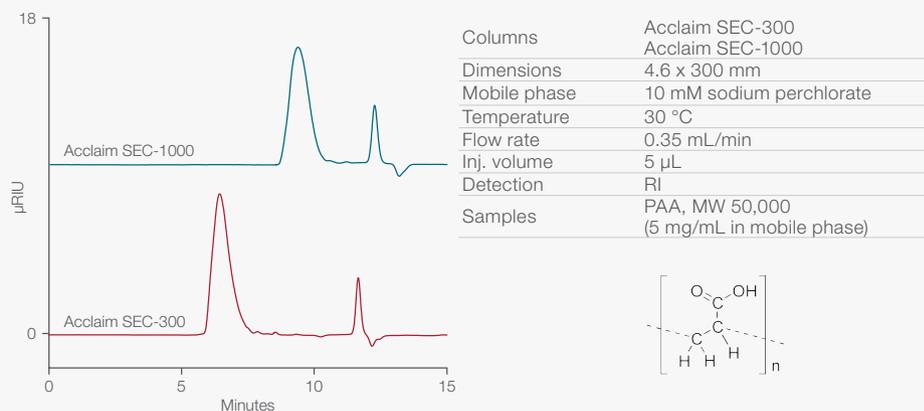
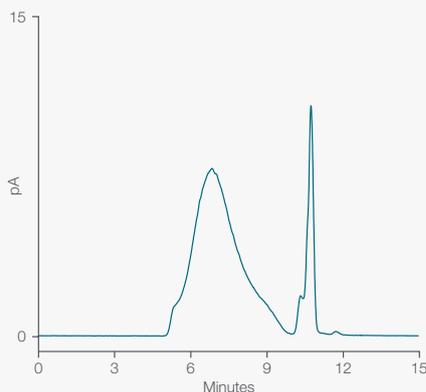


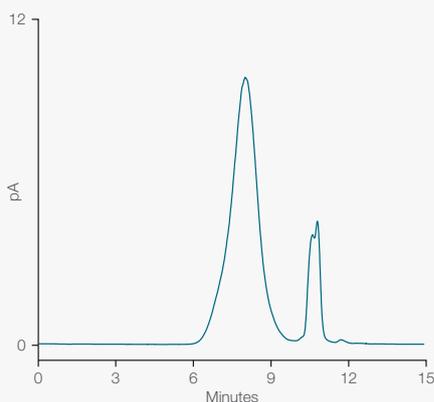
Figure 9: Polyacrylic acid (PAA) on Acclaim SEC-300 vs. Acclaim SEC-1000 columns

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.



Column	Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	50 mM ammonium formate pH 3.5
Temperature	25 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	Corona <i>ultra</i> Charged Aerosol Detector
Samples	Polyquaternium-10, 5 mg/mL

Figure 10: Polyquaternium-10 (quaternized hydroxyethyl cellulose on Acclaim SEC-1000 column)



Column	Acclaim SEC-1000
Dimensions	4.6 x 300 mm
Mobile phase	100 mM ammonium acetate pH 5.0
Temperature	25 °C
Flow rate	0.35 mL/min
Inj. volume	5 µL
Detection	Corona <i>ultra</i> Charged Aerosol Detector
Samples	Gum arabic, 5 mg/mL

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.

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

Column specifications

Specifications	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

Ordering information

Column	Particle size (µm)	Format	Length (mm)	ID (mm)	Part number
Acclaim SEC-300	5.0	Analytical	150	7.8	079726
			300	4.6	079723
		Guard	300	7.8	079725
			33	4.6	082740
Acclaim SEC-1000	7.0	Analytical	150	7.8	079722
			300	4.6	079724
		Guard	300	7.8	079721
			33	4.6	082739

Acclaim Guard Holder ordering information

Guard holder	Part number
Thermo Scientific™ Acclaim™ Guard Cartridge Holder V-2	069580
Thermo Scientific™ Acclaim™ Guard Kit (Holder and coupler) V-2	069707
Guard to Analytical Column Coupler V-2	074188

Expect reproducible results with sample prep, columns and vials



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