

Size Exclusion Chromatography

Polar Organic-soluble Polymers

Alpha

Super AW

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Size Exclusion Chromatography

TSK-GEL Columns for Analyzing Polymers that are soluble in Polar Organic Solvents

TSK-GEL Alpha and SuperAW columns were developed for the GPC analysis of polymers of intermediate polarity. As in the PW- and PWxl-type resins, the particles in TSK-GEL Alpha and SuperAW columns have a hydroxylated methacrylate polymer backbone, but they are crosslinked to a higher degree than PW- and PWxl-type columns to minimize swelling in polar organic solvents.

TSK-GEL Alpha and SuperAW particles are available in a wide variety of pore sizes.

- Use semi-micro TSK-GEL SuperAW columns

- for high-throughput applications
- to reduce solvent consumption
- to reduce solvent disposal cost.

- Use TSK-GEL Alpha columns

- when analysis time is not critical
- when sample mass is not limited
- to collect fractions
- to obtain maximum number of plates (at the expense of analysis time).

Highlights:

- **Alpha and SuperAW columns**
 - Particle sizes
 - SuperAW, 4-9 μ m particles
 - Alpha, 7-13 μ m particles
 - No or minimal swelling in a wide range of polar organic solvents: methanol, acetonitrile, DMSO, isopropanol, THF, and HFIP.
 - For high throughput applications, TSK-GEL SuperAW columns provide equivalent resolution in 1/2 the time compared to TSK-GEL Alpha columns.
 - Accurate MW determination and normal retention of polystyrene polymers in DMF solvent.
 - System peaks from salts in the eluent elute away from the oligomer of interest.
- **Applications:** polymers that are soluble in methanol, acetonitrile, DMSO, isopropanol, or THF; can also be used for water-soluble polymers.

TSK-GEL SuperAW

TSK-GEL SuperAW column line consists of five columns and a mixed-bed column.

High efficiency TSK-GEL SuperAW columns are only available in 6.0mm ID x 15cm columns for High Throughput applications.

TSK-GEL Alpha

TSK-GEL Alpha column line consists of five columns and a mixed-bed column.

TSK-GEL Alpha columns are available in conventional 7.8mm ID x 30cm column formats.

The main application area for Alpha columns is the analysis of polymers that are soluble in polar organic solvents. Examples include cellulose derivatives, polyimide, and sodium dodecylsulfate (all in DMF with 10mmol/L DMF), cleansing gel in methanol, and degree of saponification of polyvinylalcohol in HFIP.

Mixed-bed TSK-GEL Alpha Column

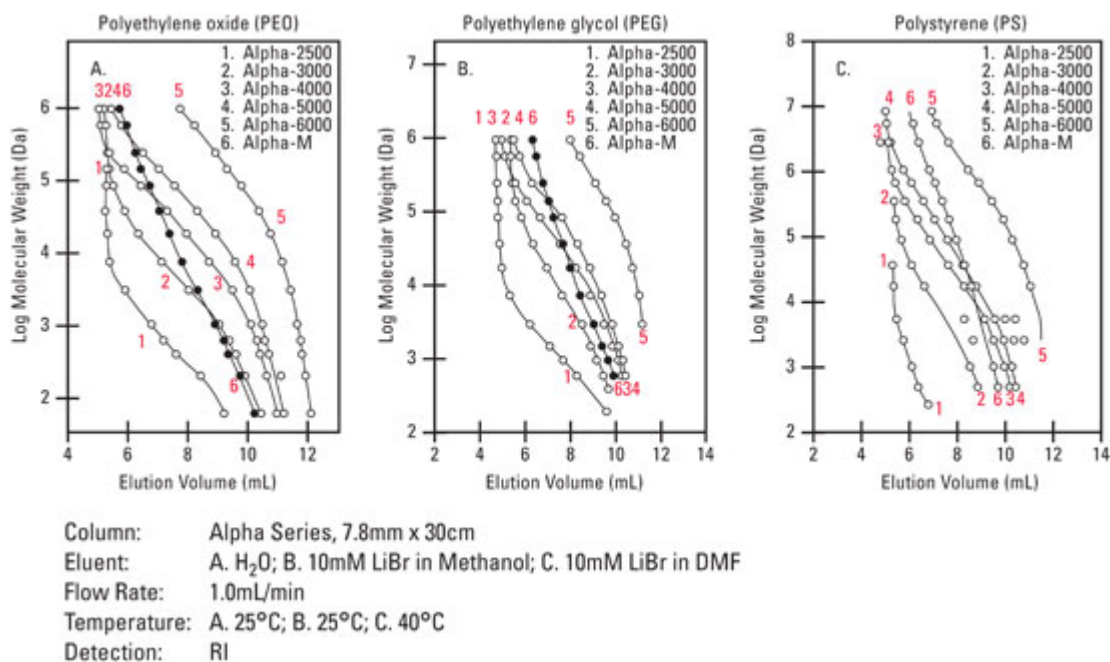
The mixed-bed column, TSKgel Alpha-M, has an extended linear calibration range, and is suitable for samples with a broad MW distribution as well as samples with unknown molecular weight.

Size Exclusion Chromatography

TSK-GEL Alpha-type Columns for the Analysis of Polar Organic-soluble Polymers

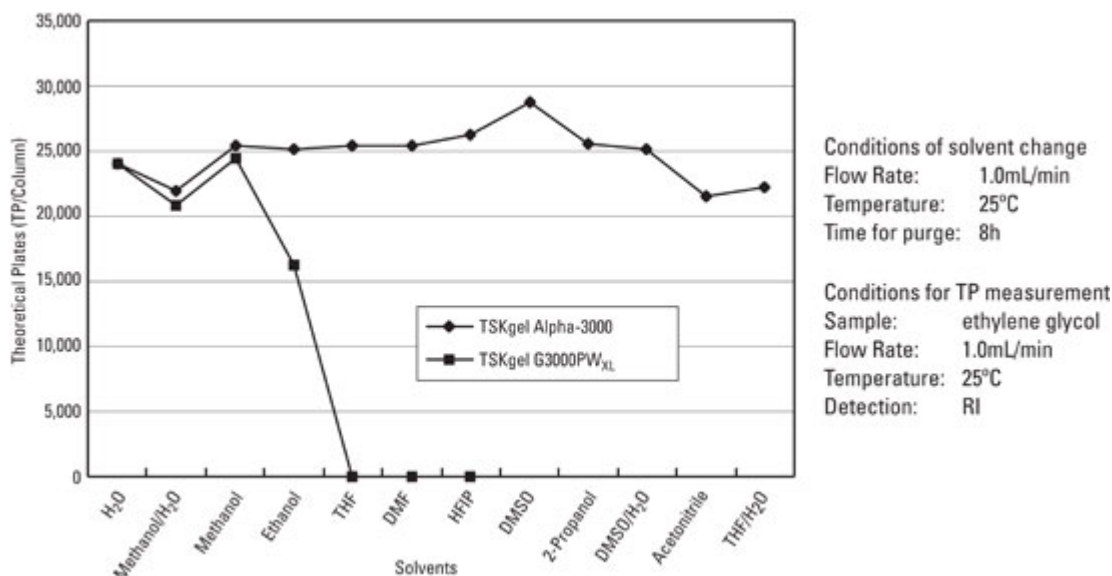
TSK-GEL Alpha columns are composed of spherical, hydrophilic methacrylate beads. *Figure 1* shows the calibration curves of all Alpha columns.

Figure 1: Calibration curves of TSK-GEL Alpha columns



Unlike PW-type columns, which are stable at most to a 50% organic mixed with water, Alpha-type columns are stable in a wide variety of organic solvents at concentrations up to 100%. Suitable solvents are shown in *Figure 2*.

Figure 2: Solvent compatibility for TSKgel Alpha-3000 for organic solvents



Size Exclusion Chromatography

TSK-GEL Alpha-2500

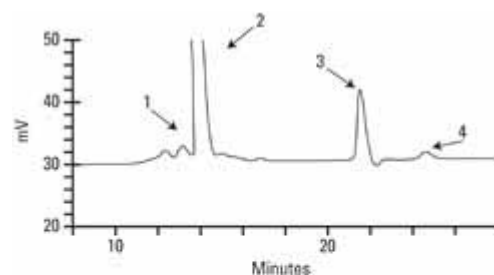
TSK-GEL Alpha-2500 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are best used for the separation of polymers that are soluble in polar organic solvents such as methanol, ethanol, DMF, THF, HFIP, DMSO, 2-propanol, and acetonitrile.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	7 μ m
Pore size (mean):	25Å
Exclusion limits:	
Polyethylene oxide	5,000 Da (water)
Polystyrene (THF)	10,000 Da
Shipping solvent:	water
Max. pressure drop:	4 MPa

Applications

TSKgel Alpha-2500 separation of cleansing gel



Column: TSKgel Alpha-2500, 7.8mm x 30cm
 Sample: cleansing gel: 1. glyceryl monostearate POE (20); 2. glyceryl tri 2-ethylhexanoate; 3. glycerin; 4. sorbitol
 Eluent: methanol
 Flow Rate: 0.5mL/min
 Temperature: 40°C
 Detection: RI

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18339	TSKgel Alpha-2500	7 μ m	Stainless Steel	7.8	30	1,344
18345	Guard Column for P/N 18339	13 μ m	Stainless Steel	6	4	509

Size Exclusion Chromatography

TSK-GEL Alpha-3000

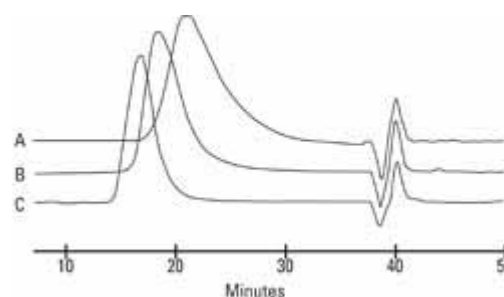
TSK-GEL Alpha-3000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are best used for the separation of polymers that are soluble in polar organic solvents such as methanol, ethanol, DMF, THF, HFIP, DMSO, 2-propanol, and acetonitrile.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	7 μ m
Pore size (mean):	150Å
Exclusion limits:	
Polyethylene oxide	90,000 Da (water)
Polystyrene (THF)	100,000 Da
Shipping solvent:	water
Max. pressure:	4 MPa

Applications

Polyvinylalcohol characterization using TSKgel Alpha-5000 and Alpha-3000 columns in series



Column: TSKgel Alpha-5000 and Alpha-3000, 7.8mm x 30cm in series
 Sample: degree of saponification of polyvinyl alcohol: A. 75%; B. 88%; C. 100%
 Eluent: hexafluoroisopropanol (HFIP)
 Flow Rate: 0.5mL/min
 Temperature: 40°C
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18340	TSKgel Alpha-3000	7 μ m	Stainless Steel	7.8	30	1,344
18345	Guard Column for P/N 18340	13 μ m	Stainless Steel	6	4	509

Size Exclusion Chromatography

TSK-GEL Alpha-4000

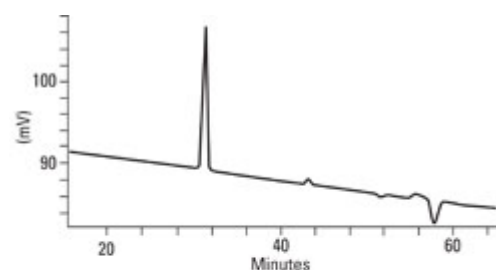
TSK-GEL Alpha-4000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are best used for the separation of polymers that are soluble in polar organic solvents such as methanol, ethanol, DMF, THF, HFIP, DMSO, 2-propanol, and acetonitrile.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size:	10 μ m (mean)
Pore size:	450Å (mean)
Exclusion limits:	
PEO	40,000 Da (water)
Polystyrene	1 million Da (THF)
Shipping solvent:	water
Max. pressure:	3 MPa

Applications

Separation of sodium dodecyl sulfate



Columns: (1) TSKgel Alpha-4000, 7.8mm ID x 30cm
 (2) TSKgel Alpha-3000, 7.8mm ID x 30cm
 (3) TSKgel Alpha-2500, 7.8mm ID x 30cm
 in series

Sample: 200 μ L of 1.7% sodium dodecyl sulfate
 Elution: 50mM lithium bromide in DMF
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18341	TSKgel Alpha-4000	10 μ m	Stainless Steel	7.8	30	1,344
18345	Guard Column for P/N 18341	13 μ m	Stainless Steel	6	4	509

Size Exclusion Chromatography

TSK-GEL Alpha-5000

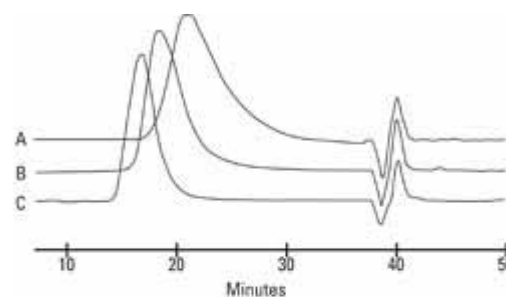
TSK-GEL Alpha-5000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are best used for the separation of polymers that are soluble in polar organic solvents such as methanol, ethanol, DMF, THF, HFIP, DMSO, 2-propanol, and acetonitrile.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	10µm
Pore size (mean):	1000Å
Exclusion limits:	
Polyethylene oxide	1 million Da (water)
Polystyrene (THF)	7 million Da
Shipping solvent:	water
Max. pressure:	3 MPa

Applications

Polyvinylalcohol characterization using TSKgel Alpha-5000 and Alpha-3000 columns in series



Column: TSKgel Alpha-5000 and Alpha-3000, 7.8mm x 30cm in series
 Sample: degree of saponification of polyvinyl alcohol: A. 75%; B. 88%; C. 100%
 Eluent: hexafluoroisopropanol (HFIP)
 Flow Rate: 0.5mL/min
 Temperature: 40°C
 Detection: RI

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18342	TSKgel Alpha-5000	10µm	Stainless Steel	7.8	30	1,344
18345	Guard column for P/N 18342	13µm	Stainless Steel	6	4	509

Size Exclusion Chromatography

TSK-GEL Alpha-6000

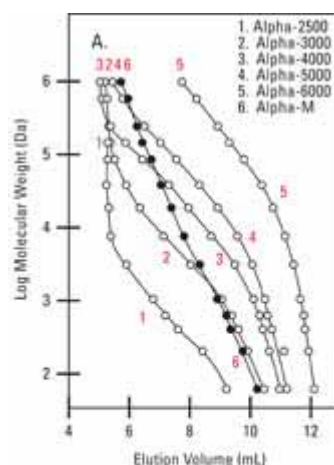
TSK-GEL Alpha-6000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are best used for the separation of polymers that are soluble in polar organic solvents such as methanol, ethanol, DMF, THF, HFIP, DMSO, 2-propanol, and acetonitrile.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	13µm
Pore size (mean):	ND
Exclusion limits:	
Polyethylene oxide	> 1x10 ⁷ Da (water)
Polystyrene (THF)	> 10 million Da
Shipping solvent:	water
Max. pressure:	2 MPa

Applications

Polyethylene oxide (PEO) calibration curves



Column: Alpha Series, 7.8mm x 30cm
 Eluent: A. H₂O; B. 10mM LiBr in Methanol; C. 10mM LiBr in DMF
 Flow Rate: 1.0mL/min
 Temperature: A. 25°C; B. 25°C; C. 40°C
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18343	TSKgel Alpha-6000	13µm	Stainless Steel	7.8	30	1,344
18345	Guard Column for P/N 18343	13µm	Stainless Steel	6	4	509

Size Exclusion Chromatography

TSK-GEL Alpha-M

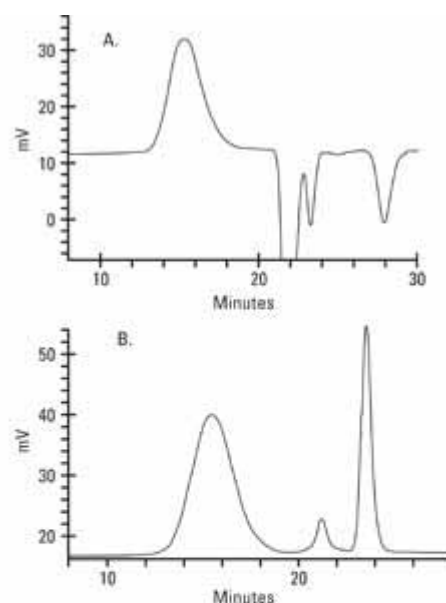
TSK-GEL Alpha-M columns are so-called mixed-bed columns with an extended linear calibration range. They are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are best used for the separation of polymers that are soluble in polar organic solvents such as methanol, ethanol, DMF, THF, HFIP, DMSO, 2-propanol, and acetonitrile.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	13µm
Exclusion limits:	
Polyethylene oxide	> 10 ⁷ Da (water)
Polystyrene (THF)	> 10 million Da
Shipping solvent:	water
Max. pressure:	2 MPa

Applications

TSKgel Alpha-M separation of cellulose derivatives



Column: TSKgel Alpha-M, 7.8mm x 30cm
 Sample: A. 50mL ethylcellulose, 0.1%;
 B. 50mL ethylhydroxyethylcellulose, 0.1%
 Elution: A. 10mM LiBr in DMF; B. 10mM LiBr in methanol
 Flow Rate: 0.5mL/min
 Temperature: 40°C
 Detection: RI

Ordering information:

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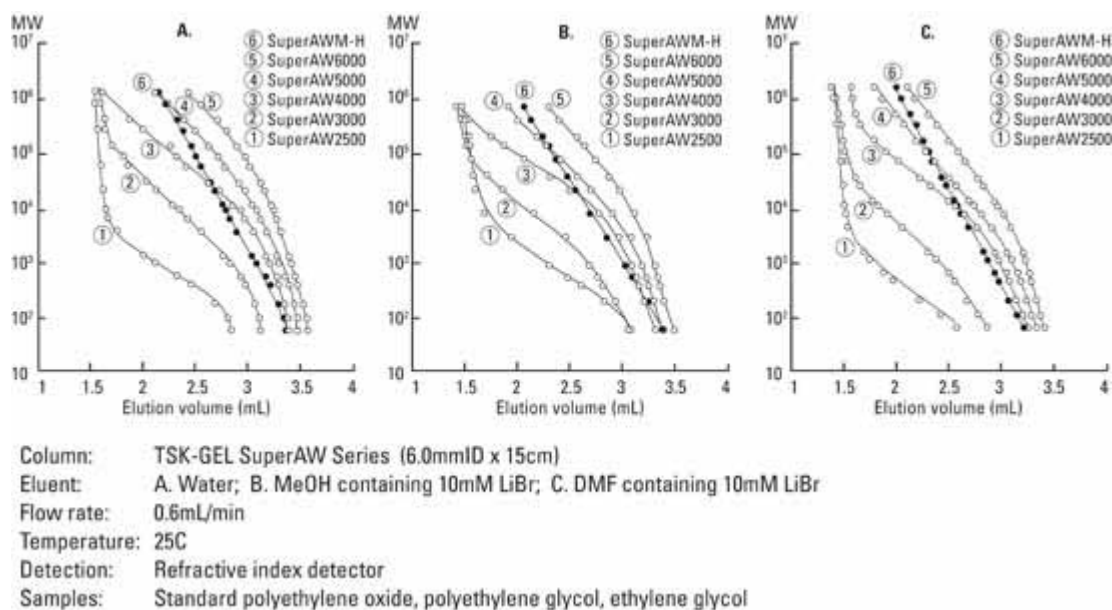
P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18344	TSKgel Alpha-M	13µm	Stainless Steel	7.8	30	1,344
18345	Guard Column for P/N 18344	13µm	Stainless Steel	6	4	509

Size Exclusion Chromatography

TSK-GEL SuperAW-type Columns for the Semi-Micro Analysis of Polar Organic-soluble Polymers

TSK-GEL SuperAW columns are composed of spherical, hydrophilic methacrylate beads. Figure 1 shows the calibration curves of all TSK-GEL SuperAW columns.

Figure 1: Polyethylene oxide (PEO), polyethylene glycol (PEG) and Ethylene glycol (EG) calibration curves for TSK-GEL SuperAW series columns



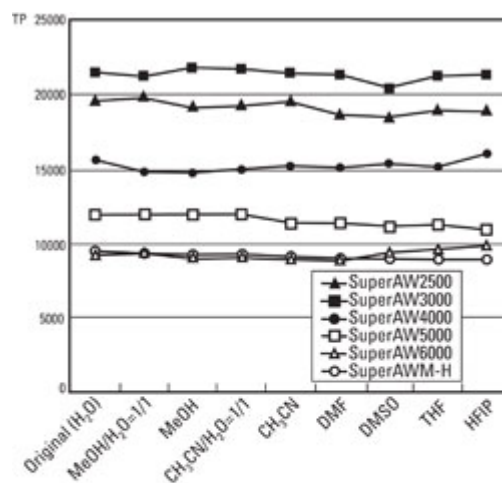
Unlike PW/PWxl-type columns, which are stable up to 50% organic mixed with water, SuperAW and Alpha-type columns are stable in a wide variety of organic solvents at concentrations up to 100%. As shown in Figure 2, efficiency of all SuperAW-type columns is maintained when changing solvents from water via acetonitrile, DMF, DMSO, THF to HFIP.

TSK-GEL SuperAW columns are used for high efficiency and high speed analysis of polymers that are soluble in polar organic solvents. Examples include cleansing gel in methanol, degree of saponification of polyvinylalcohol in HFIP, and sodium dodecylsulfate, polyimide, and cellulose derivatives in DMF with 10mmol/L LiBr.

Mixed-bed TSK-GEL SuperAW Column

The mixed-bed column, TSKgel SuperAWM-H, has an extended linear calibration range, and is suitable for samples with a broad MW distribution as well as samples with unknown molecular weight.

Figure 2: Solvent Compatibility of TSK-GEL SuperAW Series



Column: TSK-GEL Super AW Series (6.0mmID x 15cm)
 Eluent: Water
 Flow rate: 0.6mL/min
 Temperature: 25°C
 Detection: Refractive index detector
 Sample: Ethylene glycol
 Inj. volume: 5µL (2.5g/L)

Size Exclusion Chromatography

TSK-GEL SuperAW2500

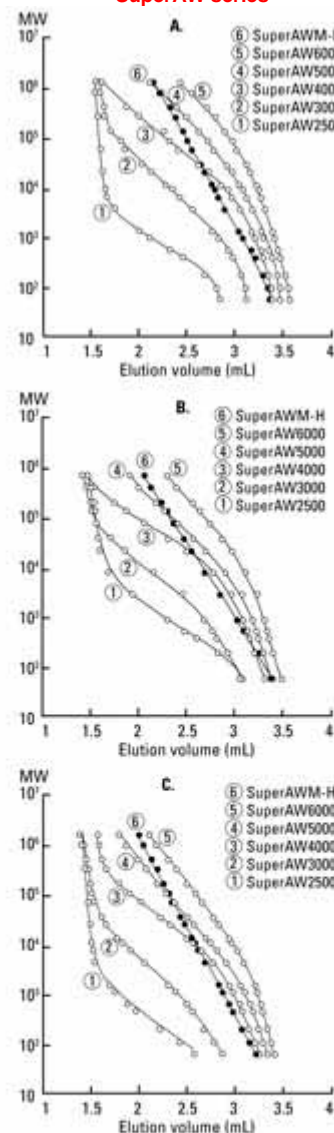
TSK-GEL SuperAW2500 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are used for the separation of polymers that are soluble in polar organic solvents.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	4 μ m
Pore size (mean):	25Å
Exclusion limit (DMF):	
Polyethylene oxide	2,000 Da
Shipping solvent:	water
Max. pressure:	6.0 MPa

Calibration Curves

Polyethylene oxide (PEO), polyethylene glycol (PEG) and ethylene glycol (EG) calibration curves for TSK-GEL SuperAW series



Column: TSK-GEL SuperAW Series
(6.0mmID x 15cm)
Eluent: A. Water; B. MeOH containing 10mM LiBr;
C. DMF containing 10mM LiBr
Flow rate: 0.6mL/min
Temperature: 25°C
Detection: Refractive index detector
Samples: Standard polyethylene oxide,
polyethylene glycol, ethylene glycol

Size Exclusion Chromatography

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
19315	TSKgel SuperAW2500	4 μ m	Stainless Steel	6	15	1,331
19321	Guard Column for P/N 19315	7 μ m	Stainless Steel	4.6	3.5	446

Size Exclusion Chromatography

TSK-GEL SuperAW3000

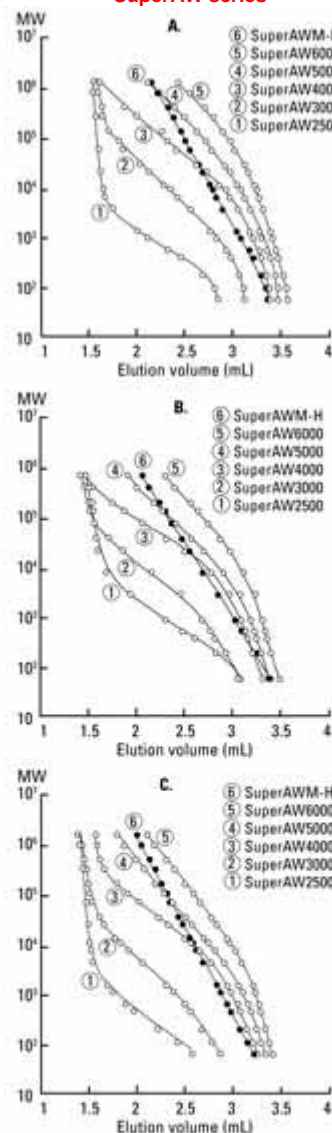
TSK-GEL SuperAW3000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are used for the separation of polymers that are soluble in polar organic solvents.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	4 μ m
Pore size (mean):	150Å
Exclusion limit (DMF):	
Polyethylene oxide	60,000 Da
Shipping solvent:	water
Max. pressure:	6.0 MPa

Calibration Curves

Polyethylene oxide (PEO), polyethylene glycol (PEG) and ethylene glycol (EG) calibration curves for TSK-GEL SuperAW series



Column: TSK-GEL SuperAW Series
(6.0mmID x 15cm)
Eluent: A. Water; B. MeOH containing 10mM LiBr;
C. DMF containing 10mM LiBr
Flow rate: 0.6mL/min
Temperature: 25°C
Detection: Refractive index detector
Samples: Standard polyethylene oxide,
polyethylene glycol, ethylene glycol

Size Exclusion Chromatography

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
19316	TSKgel Super AW3000	4 μ m	Stainless Steel	6	15	1,331
19321	Guard Column for P/N 19316	7 μ m	Stainless Steel	4.6	3.5	446

Size Exclusion Chromatography

TSK-GEL SuperAW4000

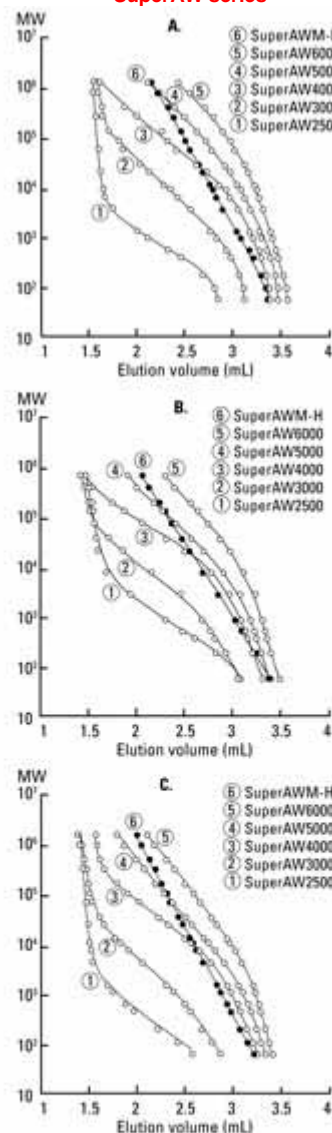
TSK-GEL SuperAW4000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are used for the separation of polymers that are soluble in polar organic solvents.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	6 μ m
Pore size (mean):	450Å
Exclusion limit (DMF):	
Polyethylene oxide	400,000 Da
Shipping solvent:	water
Max. pressure:	4.0 MPa

Calibration Curves

Polyethylene oxide (PEO), polyethylene glycol (PEG) and ethylene glycol (EG) calibration curves for TSK-GEL SuperAW series



Column: TSK-GEL SuperAW Series
(6.0mmID x 15cm)
Eluent: A. Water; B. MeOH containing 10mM LiBr;
C. DMF containing 10mM LiBr
Flow rate: 0.6mL/min
Temperature: 25°C
Detection: Refractive index detector
Samples: Standard polyethylene oxide,
polyethylene glycol, ethylene glycol

Size Exclusion Chromatography

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
19317	TSKgel SuperAW4000	6 μ m	Stainless Steel	6	15	1,331
19321	Guard Column for P/N 19317	7 μ m	Stainless Steel	4.6	3.5	446

Size Exclusion Chromatography

TSK-GEL SuperAW5000

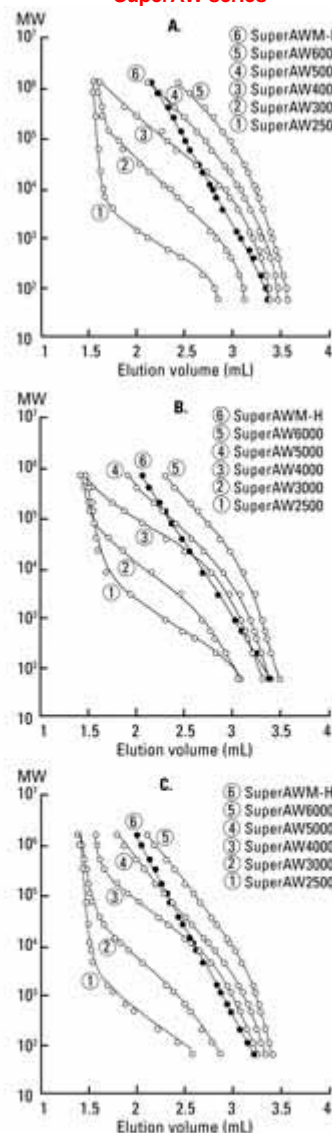
TSK-GEL SuperAW5000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are used for the separation of polymers that are soluble in polar organic solvents.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	7 μ m
Pore size (mean):	1000Å
Exclusion limit (DMF):	
Polyethylene oxide	4,000,000 Da
Shipping solvent	water
Max. pressure:	3.0 MPa

Calibration Curves

Polyethylene oxide (PEO), polyethylene glycol (PEG) and ethylene glycol (EG) calibration curves for TSK-GEL SuperAW series



Column: TSK-GEL SuperAW Series
(6.0mmID x 15cm)
Eluent: A. Water; B. MeOH containing 10mM LiBr;
C. DMF containing 10mM LiBr
Flow rate: 0.6mL/min
Temperature: 25°C
Detection: Refractive index detector
Samples: Standard polyethylene oxide,
polyethylene glycol, ethylene glycol

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
19318	TSKgel SuperAW5000	7 μ m	Stainless Steel	6	15	1,331
19322	Guard Column for 19318	23 μ m	Stainless Steel	4.6	3.5	446

Size Exclusion Chromatography

TSK-GEL SuperAW6000

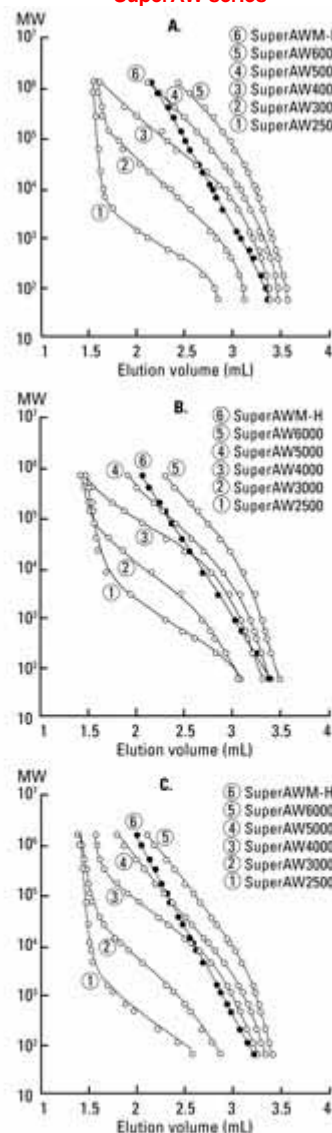
TSK-GEL SuperAW6000 columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are used for the separation of polymers that are soluble in polar organic solvents.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	9µm
Pore size (mean):	ND
Exclusion limit (DMF):	
Polyethylene oxide	> 4x10 ⁷ Da
Shipping solvent:	water
Max. pressure:	2.0 MPa

Calibration Curves

Polyethylene oxide (PEO), polyethylene glycol (PEG) and ethylene glycol (EG) calibration curves for TSK-GEL SuperAW series



Column: TSK-GEL SuperAW Series
(6.0mmID x 15cm)
Eluent: A. Water; B. MeOH containing 10mM LiBr;
C. DMF containing 10mM LiBr
Flow rate: 0.6mL/min
Temperature: 25°C
Detection: Refractive index detector
Samples: Standard polyethylene oxide,
polyethylene glycol, ethylene glycol

Size Exclusion Chromatography

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
19319	TSKgel SuperAW6000	9µm	Stainless Steel	6	15	1,331
19322	Guard Column for P/N 19319	23µm	Stainless Steel	4.6	3.5	446

Size Exclusion Chromatography

TSK-GEL SuperAWM-H

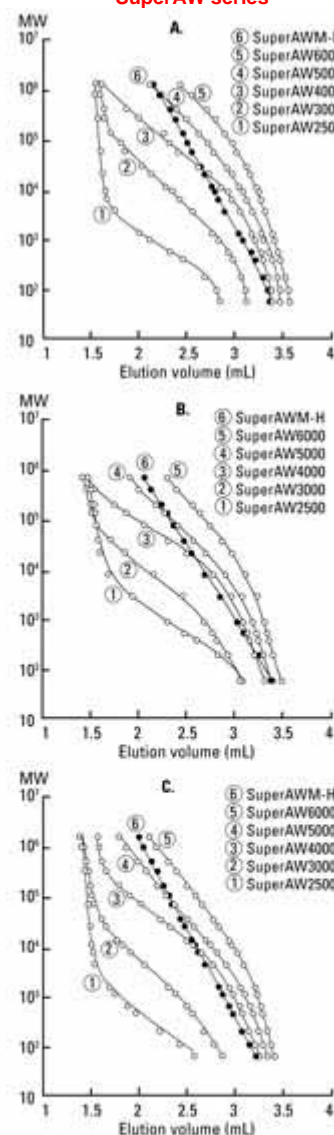
TSK-GEL SuperAWM-H columns are packed with rigid, porous, polymer beads which show minimal shrinkage or swelling in different solvent systems. They are used for the separation of polymers that are soluble in polar organic solvents.

Product Attributes:

Matrix:	hydrophilic methacrylate
Particle size (mean):	9µm
Pore size (mean):	mixed bed
Exclusion limits:	
Polyethylene oxide	1,000,000 Da
Shipping solvent:	water
Max. pressure:	2.0 MPa

Calibration Curves

Polyethylene oxide (PEO), polyethylene glycol (PEG) and ethylene glycol (EG) calibration curves for TSK-GEL SuperAW series



Column: TSK-GEL SuperAW Series
(6.0mmID x 15cm)
Eluent: A. Water; B. MeOH containing 10mM LiBr;
C. DMF containing 10mM LiBr
Flow rate: 0.6mL/min
Temperature: 25°C
Detection: Refractive index detector
Samples: Standard polyethylene oxide,
polyethylene glycol, ethylene glycol

Size Exclusion Chromatography

Ordering information:

Orders can be placed online, or via phone (800-366-4875, option #1) or fax (800-685-7595). Tosoh Bioscience LLC only accepts orders from customers in North and South America. For sales offices in other parts of the world, please visit the *Locations* page under the *About Us* tab on our website.

P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
19320	TSKgel SuperAWM-H	9 μ m	Stainless Steel	6	15	1,331
19322	Guard Column for P/N 19320	23 μ m	Stainless Steel	4.6	3.5	446