

Size Exclusion Chromatography

Water-soluble Polymers

PW

PW_{XL}

PW_{XL}-CP Cationic Polymers

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Size Exclusion Chromatography

TSK-GEL Columns for Analyzing Water-soluble Polymers

TSK-GEL PWxl- and PW-type columns are the columns of choice for analyses of water-soluble polymers. All TSK-GEL polymer-based gel filtration columns are prepared from polymethacrylate resin.

PWxl- and PW-type

- Use higher efficiency PWxl-type columns for optimal resolution, to reduce analysis time, or in sample limited applications.
- Use PW-type columns when analysis time is not critical, when sample mass is not limited, to collect fractions, or to obtain maximum number of plates (at the expense of analysis time).

PWxl-CP columns

- PWxl-CP columns have been chemically modified to improve recovery of cationic polymers.

Highlights:

- **PW, PWxl and PWxl-CP columns**
 - Hydrophilic methacrylate beads.
 - Particle sizes are 7-13 μ m for PWxl and PWxl-CP columns, and 12-17 μ m for PW-type.
 - Higher % crosslinking for smaller particle size PWxl-type resins.
 - Stable from pH 2 to 12
 - Eluent: water or buffer (up to 20% methanol/80% aqueous)
 - G6000PW is available in PEEK column hardware for ultra-low sample adsorption during virus analysis.
 - Temperatures up to 80°C (50°C for TSKgel G-DNA-PW).
- **PWxl-CP columns**
 - Minimal adsorption of cationic polymers.

TSK-GEL PW and PWxl

As TSK-GEL PW-type columns, there are seven TSK-GEL PWxl-type columns varying in pore size from less than 100Å to more than 1000Å. Mixed-bed columns are also available.

The TSK-GEL PWxl product line also offers specialty columns for analyzing:

- Carbohydrate oligomers
- DNA and RNA fragments

TSK-GEL PWxl-CP

TSK-GEL PWxl-CP columns have the same base resin as the PWxl columns and were specifically developed for the analysis of water-soluble cationic polymers and allow elution under low salt conditions.

Available PWxl-CP-type columns and pore sizes:

- G3000PWxl-CP [200Å]
- G5000PWxl-CP [1000Å]
- G6000PWxl-CP [>1000Å]

Size Exclusion Chromatography

TSK-GEL PW-type Columns for Analysis of Water-soluble Polymers

TSK-GEL PW columns are composed of spherical, hydrophilic polymethacrylate beads. Particle sizes range from 12 μ m for the smaller pore size columns to 17 μ m for the larger pore size columns.

The main application areas for PW columns are the analysis of water-soluble polymers, such as celluloses, acrylamides, glycols, dextrans, polyvinylalcohol, and oligosaccharides.

The figure to the right shows the calibration curves for all PW-type columns. Suitable solvents for various polymer samples are shown in the table below.

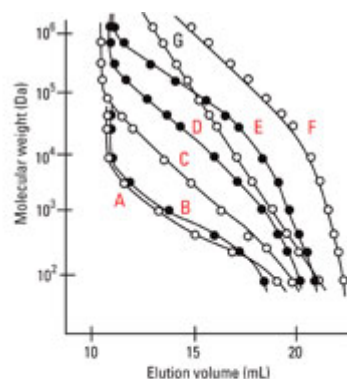
Specialty PW-type Columns

The mixed-mode column, TSKgel GMPW, has an extended linear calibration range, suitable for samples with a broad MW distribution, as well as unknown samples.

TSKgel G2000PW, the larger particle size equivalent of TSKgel G-Oligo-PW, is most suitable for semipreparative and preparative isolation of oligosaccharides.

TSKgel G1000PW is the preferred column for analysis of low MW oligomers.

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
Elution: distilled water
Flow Rate: 1.0mL/min
Detection: RI

Size Exclusion Chromatography

Recommended eluents for GFC of water-soluble polymers on TSK-GEL PW-type columns

Type of polymer	Typical sample	Suitable eluent
Nonionic hydrophilic	polyethylene glycol	distilled water
	soluble starch, methyl cellulose, pullulan	0.01N NaOH
	dextran, hydroxyethyl cellulose	20% DMSO
	polyvinyl alcohol, polyacrylamide	Buffer or salt solution (e.g. 0.1-0.5M NaNO ₃)
Nonionic hydrophobic	polyvinylpyrrolidone	Buffer or salt solution with organic solvent (e.g. 20% CH ₃ CN in 0.1M NaNO ₃)
Anionic hydrophilic	sodium chondroitin sulfate, sodium alginate, carboxymethyl cellulose, sodium polyacrylate, sodium hyaluronate	Buffer or salt solution (e.g. 0.1M NaNO ₃)
Anionic hydrophobic	sulfonated lignin sodium salt, sodium polystyrenesulfonate	Buffer or salt solution with organic solvent (e.g. 20% CH ₃ CN in 0.1M NaNO ₃)
Cationic hydrophilic	glycol chitosan, DEAE-dextran, poly(ethyleneimine), poly(trimethylaminoethyl methacrylate) iodide salt	0.5M acetic acid with 0.3M Na ₂ SO ₄ or 0.8M NaNO ₃
Cationic hydrophobic	poly(4-vinylbenzyltrimethylammonium chloride), poly(N-methyl-2-vinylpyridinium) iodide salt	0.5M acetic acid with 0.3M Na ₂ SO ₄
Amphoteric hydrophilic	peptides, proteins, poly- and oligosaccharides, DNA, RNA	Buffer or salt solution (e.g. 0.1M NaNO ₃)
Amphoteric hydrophobic	blue dextran, collagen, gelatin, hydrophobic proteins, hydrophobic peptides	Buffer or salt solution with organic solvent (e.g. 20% CH ₃ CN in 0.1M NaNO ₃ or 35-45% CH ₃ CN in 0.1% TFA)

Size Exclusion Chromatography

TSKgel G1000PW

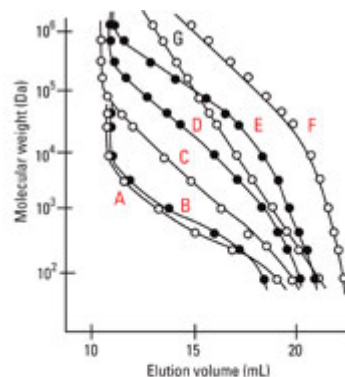
TSKgel G1000PW is ideally suited for analysis of water-soluble polymers with molecular weights up to 1,000 Da.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	12 μ m
Pore size (mean):	< 100Å
Exclusion limit:	< 1,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
05760	TSKgel G1000PW	12 μ m	Stainless Steel	7.5	30	1,346
06763	Guard Column for P/N 05760	13 μ m	Stainless Steel	7.5	7.5	486

Size Exclusion Chromatography

TSKgel G2000PW

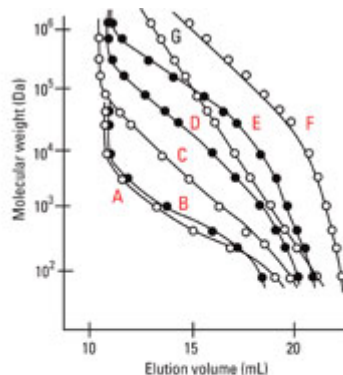
TSKgel G2000PW is ideally suited for analysis of water-soluble polymers with molecular weights up to 2,000 Da.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	12µm
Pore size (mean):	125Å
Calibration range:	up to 2,000 Da (polyethylene glycols and oxides)
Max. % Organic	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
05761	TSKgel G2000PW	12µm	Stainless Steel	7.5	30	1,346
05105	TSKgel G2000PW	12µm	Stainless Steel	7.5	60	2,193
06763	Guard Column for P/N 05761 and 05105	13µm	Stainless Steel	7.5	7.5	486

Size Exclusion Chromatography

TSKgel G2500PW

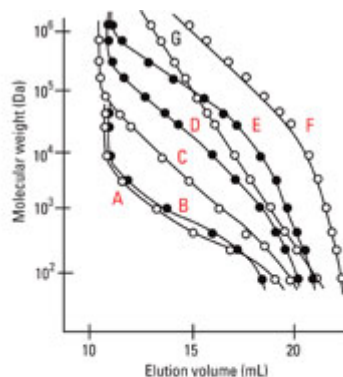
TSKgel G2500PW is ideally suited for the analysis of water-soluble polymers with molecular weights of less than 3,000 Da.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	12 and 17µm
Pore size (mean):	<200Å
Calibration range:	up to 3000 Da (polyethylene glycols & oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08028	TSKgel G2500PW	12µm	Stainless Steel	7.5	30	1,346
08029	TSKgel G2500PW	12µm	Stainless Steel	7.5	60	2,193
06762	Guard Column for P/N 08028, 08029	13µm	Stainless Steel	7.5	7.5	486
16248	TSKgel G2500PW	17µm	Stainless Steel	21.5	30	3,809
08030	TSKgel G2500PW	17µm	Stainless Steel	21.5	60	5,529
06758	Guard Column for P/N 16248, 08030	17µm	Stainless Steel	21.5	7.5	1,157

Size Exclusion Chromatography

TSKgel G3000PW

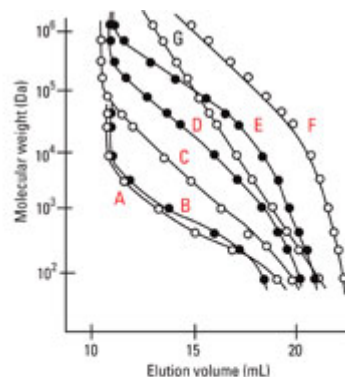
TSKgel G3000PW is ideally suited for the analysis of water-soluble polymers of less than 50,000 Da molecular weight.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	12, 17 and 20 μ m
Pore size (mean):	200 Å
Calibration range:	up to 50,000 Da (polyethylene glycol and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
05762	TSKgel G3000PW	12 μ m	Stainless Steel	7.5	30	1,346
05106	TSKgel G3000PW	12 μ m	Stainless Steel	7.5	60	2,193
06762	Guard Column for P/N 05762, 05106	13 μ m	Stainless Steel	7.5	7.5	486
16249	TSKgel G3000PW	17 μ m	Stainless Steel	21.5	30	3,809
06758	Guard Column for P/N 16249	17 μ m	Stainless Steel	21.5	7.5	1,157

Size Exclusion Chromatography

TSKgel G4000PW

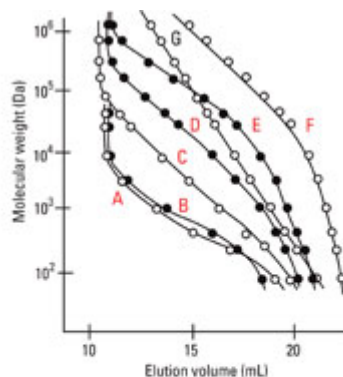
TSKgel G4000PW is ideally suited for water analysis of water-soluble polymers of less than 300,000 Da molecular weight.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	17 μ m
Pore size (mean):	500Å
Calibration range:	up to 300,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
05763	TSKgel G4000PW	17 μ m	Stainless Steel	7.5	30	1,346
05107	TSKgel G4000PW	17 μ m	Stainless Steel	7.5	60	2,193
06762	Guard Column for P/N 05763 and 05107	13 μ m	Stainless Steel	7.5	7.5	486

Size Exclusion Chromatography

TSKgel G5000PW

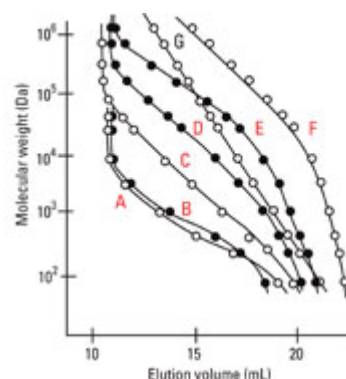
TSKgel G5000PW is ideally suited for the analysis of water-soluble polymers with a molecular weight of less than 1,000,000 Da.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	17 and 20 μ m
Pore size (mean):	1,000Å
Calibration range:	up to 1,000,000 Da (polyethylene glycols & oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
05764	TSKgel G5000PW	17 μ m	Stainless Steel	7.5	30	1,346
05108	TSKgel G5000PW	17 μ m	Stainless Steel	7.5	60	2,193
06762	Guard Column for P/N 05764 and 05108	13 μ m	Stainless Steel	7.5	7.5	486

Size Exclusion Chromatography

TSKgel G6000PW

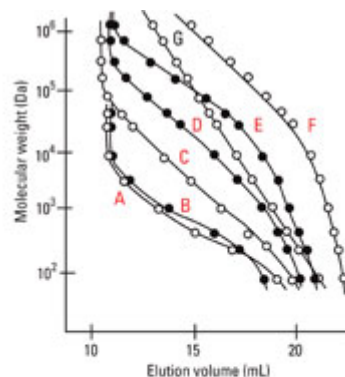
TSKgel G6000PW It is ideally suited for the analysis of water-soluble polymers up to 8,000,000 Da molecular weight.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	17 μ m
Pore size (mean):	>1,000Å
Calibration range:	up to 8,000,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves for TSK-GEL PW columns



Column: TSK-GEL PW columns: A. G2000PW, B. G2500PW, C. G3000PW, D. G4000PW, E. G5000PW, F. G6000PW, G. GMPW, all 7.5mm x 60cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
05765	TSKgel G6000PW	17 μ m	Stainless Steel	7.5	30	1,346
05109	TSKgel G6000PW	17 μ m	Stainless Steel	7.5	60	2,193
06762	Guard Column for P/N 05765 and 05109	13 μ m	Stainless Steel	7.5	7.5	486
20024	TSKgel BioAssist G6PW	17 μ m	PEEK	7.8	30	1,503

Size Exclusion Chromatography

TSKgel GMPW

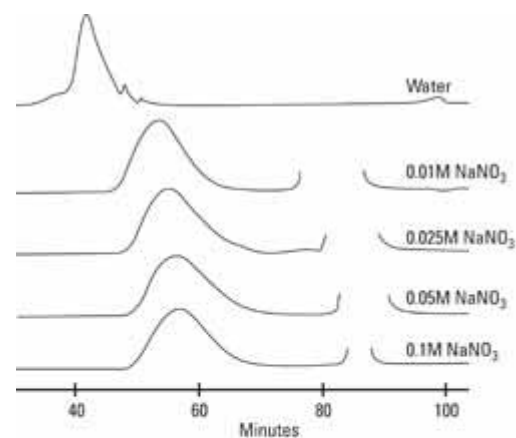
TSKgel GMPW is a mixed bed scouting column for water-soluble linear polymers. The pore volume can be accessed by polymers ranging in molecular weight from 500 to 8,000,000 Da. By quickly categorizing the MW profile of an unknown sample, the column enables a fast selection of the best TSK-GEL PW column for routine analysis. Mixed bed columns are also used when a sample has a very broad MW distribution.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	17 μ m
Pore size (range):	< 100Å - 1000Å
Calibration range	500 - 8,000,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Effect of ionic strength on the elution of anionic polymers



Column: TSKgel GMPW, two 17 μ m, 7.5mm x 60cm columns in series
 Sample: 0.5mL of 0.05-0.1% of the sodium salt of polyacrylic acid, an anionic polymer
 Elution: water, 0.01M, 0.025M, 0.05M or 0.1M NaNO₃ in water
 Flow Rate: 0.5mL/min
 Detection: RI

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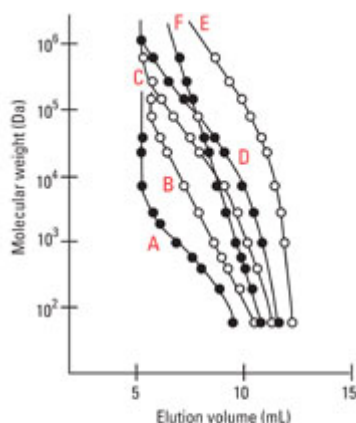
P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08026	TSKgel GMPW	17 μ m	Stainless Steel	7.5	30	1,346
08027	TSKgel GMPW	17 μ m	Stainless Steel	7.5	60	2,193
06762	Guard Column for P/N 08026 and 08027	13 μ m	Stainless Steel	7.5	7.5	486

Size Exclusion Chromatography

TSK-GEL PWxl-type Columns for Analysis of Waters-soluble Polymers

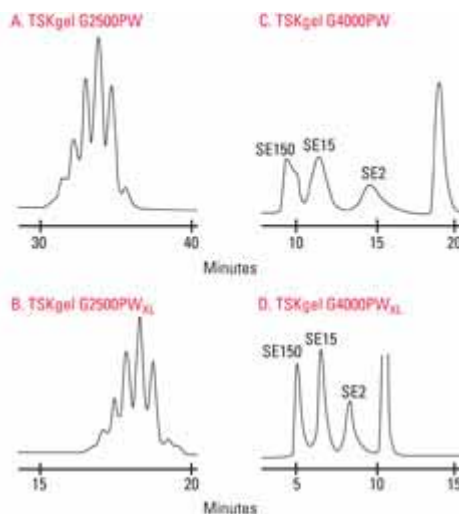
TSK-GEL PWxl columns are composed of spherical, hydrophilic polymethacrylate beads. The main application area for PWxl columns is the analysis of water-soluble polymers, such as celluloses, acrylamides, glycols, dextrans, polyvinylalcohol, and oligosaccharides. See the table on the TSK-GEL PW page for typical samples and suitable eluents. *Figure 1* shows the calibration curves for all PWxl-type columns. *Figure 2* shows the benefits of PWxl columns over PW columns, namely the improved resolution due to the smaller particle sizes used in PWxl columns.

Figure 1: Polyethylene glycol and oxide calibration curves on TSK-GEL PWxl columns



Column: TSK-GEL PW columns: A. G2500PW_{XL},
 B. G3000PW_{XL}, C. G4000PW_{XL}, D. G5000PW_{XL},
 E. G6000PW_{XL}, F. GMPW_{XL}, all 7.8mmID x 30cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

Figure 2: Faster analysis and higher resolution with TSK-GEL PWxl columns



Column: A. TSKgel G2500PW, two 10 μ m, 7.5mm x 60cm columns in series
 B. TSKgel G2500PW_{XL}, two 6 μ m, 7.8mm x 30cm columns in series
 C. TSKgel G4000PW, 17 μ m, 7.5mm x 60cm
 D. TSKgel G4000PW_{XL}, 10 μ m, 7.8mm x 30cm
 Sample: A. & B.: polyethylene glycol 200
 C. & D.: polyethylene oxide standards: SE-150, SE-15 and SE-2 in 100 μ L
 Elution: A. & B.: distilled water; C. & D.: 0.1M NaCl
 Flow Rate: 1.0mL/min
 Temperature: A. & B.: 25°C; C. & D.: 50°C
 Detection: RI

Size Exclusion Chromatography

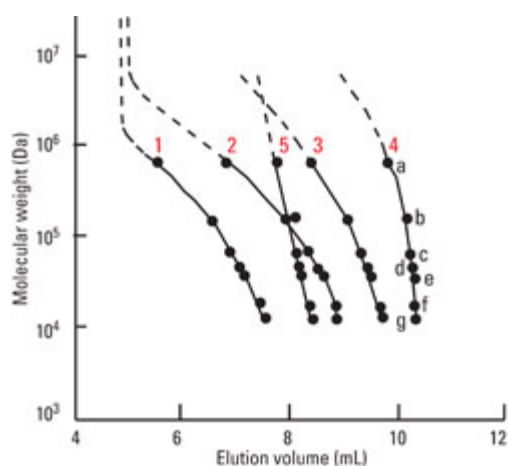
Although proteins can be analyzed on PWxl columns, pore volumes are much smaller than on SW-type columns.

Figure 3 demonstrates the limited separation power of PWxl for protein samples.

Specialty Columns

TSKgel G-DNA-PW is available for the analysis of DNA fragments. Similarly, TSKgel G-Oligo-PW is the preferred column for the analysis of oligosaccharides. The mixed-mode column, TSKgel GMPWxl, has an extended linear calibration range, suitable for samples with a broad MW distribution and unknowns.

Figure 3: Protein Calibration curves for TSK-GEL PWxl



Column: 1. G3000PW_{XL}
2. G4000PW_{XL}
3. G5000PW_{XL}
4. G6000PW_{XL}
5. GMPW_{XL}

Sample: a. thyroglobulin (660,000 Da)
b. γ -globulin (150,000 Da)
c. albumin (67,000 Da)
d. ovalbumin (43,000 Da)
e. β -lactoglobulin (36,000 Da)
f. myoglobin (16,900 Da)
g. cytochrome C (12,400 Da)

Elution: 0.2M phosphate buffer (pH 6.8)
Flow Rate: 1.0mL/min
Detection: UV @ 280nm

Size Exclusion Chromatography

TSK-GEL G2500PWxl

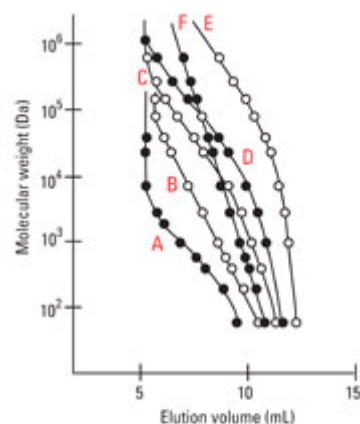
TSK-GEL G2500PWxl columns are ideally suited for analysis of water-soluble linear polymers with molecular weights up to 3,000 Da. Because of the presence of cationic groups on the base bead of G2500PWxl, this column is not suited for separating anionic polymers. The smaller particle size of PWxl-type columns provide 1.7X higher resolution than their PW counterpart, making PWxl-type columns more suitable for analytical purposes.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	7 μ m
Pore size (mean):	< 200Å
Calibration range:	< 3,000Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves on TSK-GEL PWxl columns



Column: TSK-GEL PW columns: A. G2500PW_{xl}, B. G3000PW_{xl}, C. G4000PW_{xl}, D. G5000PW_{xl}, E. G6000PW_{xl}, F. GMPW_{xl}, all 7.8mmID x 30cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08020	TSKgel G2500PWxl	7 μ m	Stainless Steel	7.8	30	1,503
08033	Guard Column for P/N 08020	12 μ m	Stainless Steel	6	4	508
08035	TSKgel Top-Off for PWxl, 1g	10 μ m				94

Size Exclusion Chromatography

TSK-GEL G3000PWxl

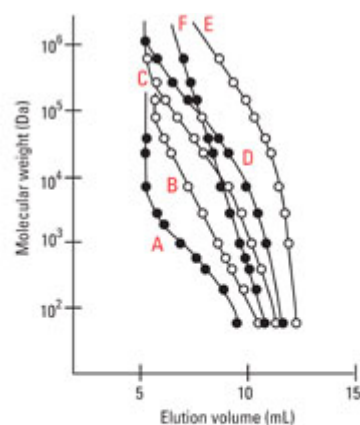
TSK-GEL G3000PWxl columns are ideally suited for analysis of water-soluble linear polymers with molecular weights up to 50,000 Da. The smaller particle size of PWxl-type columns provide 1.7X higher resolution than their PW counterpart, making PWxl-type columns more suitable for analytical purposes.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	7 μ m
Pore size (mean):	200 Å
Calibration range:	< 50,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves on TSK-GEL PWxl columns



Column: TSK-GEL PW columns: A. G2500PW_{xl}, B. G3000PW_{xl}, C. G4000PW_{xl}, D. G5000PW_{xl}, E. G6000PW_{xl}, F. GMPW_{xl}, all 7.8mmID x 30cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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 (\$)
08021	TSKgel G3000PWxl	7 μ m	Stainless Steel	7.8	30	1,503
08033	Guard Column for P/N 08021	12 μ m	Stainless Steel	6	4	508
08035	TSKgel Top-Off for PWxl, 1g	10 μ m				94

Size Exclusion Chromatography

TSK-GEL G4000PWxl

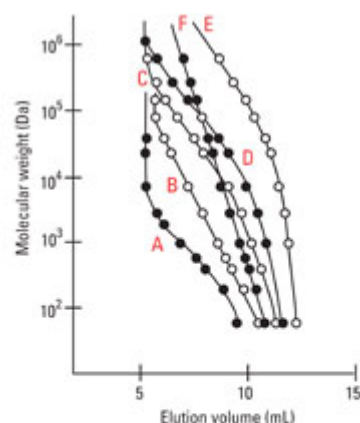
TSK-GEL G4000PWxl columns are ideally suited for analysis of water-soluble linear polymers with molecular weights up to 300,000 Da. The smaller particle size of PWxl-type columns provide 1.7X higher resolution than their PW counterpart, making PWxl-type columns more suitable for analytical purposes.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	10µm
Pore size (mean):	<500Å
Calibration range:	< 300,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves on TSK-GEL PWxl columns



Column: TSK-GEL PW columns: A. G2500PW_{xl}, B. G3000PW_{xl}, C. G4000PW_{xl}, D. G5000PW_{xl}, E. G6000PW_{xl}, F. GMPW_{xl}, all 7.8mmID x 30cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08022	TSKgel G4000PWxl	10µm	Stainless Steel	7.8	30	1,503
08033	Guard Column for P/N 08022	12µm	Stainless Steel	6	4	508
08035	TSKgel Top-Off for PWxl, 1g	10µm				94

Size Exclusion Chromatography

TSK-GEL G5000PWxl

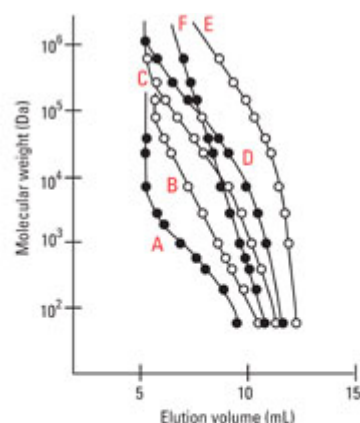
TSK-GEL G5000PWxl columns are ideally suited for analysis of water-soluble linear polymers with molecular weights up to 1 million Da. The smaller particle size of PWxl-type columns provide 1.7X higher resolution than their PW counterpart, making PWxl-type columns more suitable for analytical purposes.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	10 μ m
Pore size (mean):	1000Å
Calibration range:	< 1,000,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Polyethylene glycol and oxide calibration curves on TSK-GEL PWxl columns



Column: TSK-GEL PW columns: A. G2500PW_{xl}, B. G3000PW_{xl}, C. G4000PW_{xl}, D. G5000PW_{xl}, E. G6000PW_{xl}, F. GMPW_{xl}, all 7.8mmID x 30cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08023	TSKgel G5000PWxl	10 μ m	Stainless Steel	7.8	30	1,503
08033	Guard Column for P/N 08023	12 μ m	Stainless Steel	6	4	508
08035	TSKgel Top-Off for PWxl, 1g	10 μ m				94

Size Exclusion Chromatography

TSKgel G6000PWxl

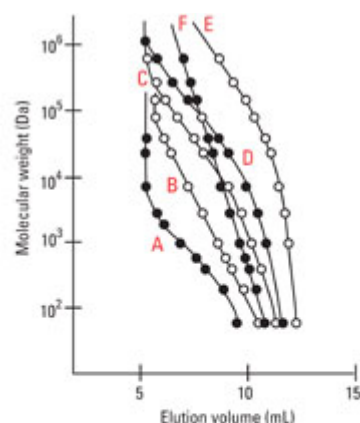
TSKgel G6000PWxl columns are ideally suited for analysis of water-soluble linear polymers with molecular weights up to 8 million Da. The smaller particle size of PWxl-type columns provide 1.7X higher resolution than their PW counterpart, making PWxl-type columns more suitable for analytical purposes.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	13 μ m
Pore size (mean):	> 1000Å
Calibration range:	less than 8,000,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shpιοing solvent:	water

Applications

Polyethylene glycol and oxide calibration curves on TSK-GEL PWxl columns



Column: TSK-GEL PW columns: A. G2500PW_{xl}, B. G3000PW_{xl}, C. G4000PW_{xl}, D. G5000PW_{xl}, E. G6000PW_{xl}, F. GMPW_{xl}, all 7.8mmID x 30cm
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: RI

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08024	TSKgel G6000PWxl	13 μ m	Stainless Steel	7.8	30	1,503
08033	Guard Column for P/N 08024	12 μ m	Stainless Steel	6	4	508
08035	TSKgel Top-Off for PWxl, 1g	10 μ m				94

Size Exclusion Chromatography

TSKgel G-DNA-PW

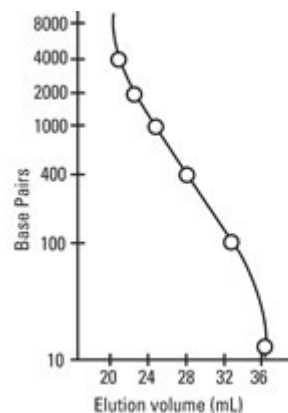
TSKgel G-DNA-PW is a specialty column designed for the separation of large polynucleotides such as DNA and RNA fragments of 500-5000 base pairs. TSKgel G-DNA-PW is a smaller particle size version of TSKgel G6000PWxl.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	10 μ m
Pore size (mean):	>1,000Å
Working range:	500 - 5000 bp DNA
Max. % organic:	20%
Shipping solvent:	water

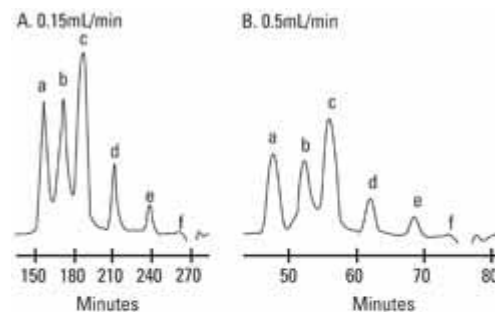
Applications

Calibration curve for double-stranded DNA



Column: TSKgel G-DNA-PW, four 10 μ m, 7.8mm x 30cm columns in series
 Sample: *Eco* RI and *Bst* NI-cleaved pBR322 DNA, void volume determined with λ -DNA
 Elution: 0.3M NaCl in 0.1M Tris-HCl, pH7.5, plus 1mM EDTA
 Flow Rate: 0.15mL/min
 Detection: UV @ 260nm

Separation of large DNA fragments on a TSKgel G-DNA-PW column



Column: TSKgel G-DNA-PW, four 10 μ m, 7.8mm x 30cm columns in series
 Sample: 60 μ L of *Eco* RI and *Bst* NI - cleaved pBR322 DNA, base pairs: a. 4362, b. 1857, c. 1060 & 928, d. 383, e. 121, f. 13
 Elution: 0.3M NaCl in 0.1M Tris-HCl, pH7.5, plus 1mM EDTA
 Flow Rate: A. 0.15mL/min, B. 0.5mL/min
 Detection: UV @ 260nm

Size Exclusion Chromatography

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08032	TSKgel G-DNA-PW	10 μ m	Stainless Steel	7.8	30	1,503
08033	Guard Column for P/N 08032	12 μ m	Stainless Steel	6	4	508
08035	TSKgel Top-Off for P/N 08032, 1g	10 μ m				94

Size Exclusion Chromatography

TSKgel GMPWxl

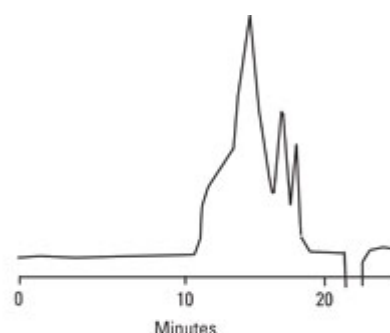
TSKgel GMPWxl is a mixed bed scouting column for aqueous water-soluble linear polymers. Its pore volume is accessible to polymers ranging from molecular weights of 500 up to 8,000,000 Da. By quickly categorizing the MW profile of an unknown sample, TSKgel GMPWxl allows the selection of the most appropriate TSK-GEL PWxl column for best results in a routine analysis. TSKgel GMPWxl is also used for the analysis of samples with broad MW distributions.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	13 μ m
Pore size (range):	100Å - 1000Å
Calibration range:	500-8,000,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Separation of polyethyleneimine



Column: TSKgel GMPW_{XL},
two 7.8mm x 30cm in series
Sample: polyethyleneimine
Eluent: 0.5M acetic acid + 0.5M sodium acetate
Flow Rate: 1.0mL/min
Detection: RI

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08025	TSKgel GMPWxl	13 μ m	Stainless Steel	7.8	30	1,503
08033	Guard Column for P/N 08025	12 μ m	Stainless Steel	6	4	508
08035	TSKgel Top-Off for P/N 08025, 1g	10 μ m				94

Size Exclusion Chromatography

TSKgel G-Oligo-PW

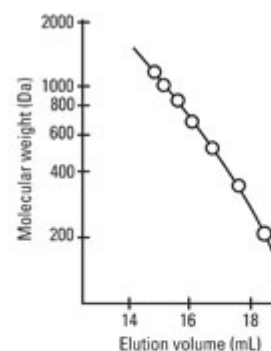
TSKgel G-Oligo-PW is designed for high resolution separations of aqueous nonionic and cationic oligomers, and oligosaccharides such as hydrolyzed cyclodextrins. Because of the presence of cationic groups on the gel matrix, this column is not suited for separating anionic polymers. The PEG and PEO calibration curve is identical to that of G2500PWxl.

Product Attributes:

Base material:	hydroxylated polymethacrylate
Particle size (mean):	7 μ m
Pore size (mean):	125Å
Calibration range:	up to 3,000 Da (polyethylene glycols and oxides)
Max. % organic:	20%
Shipping solvent:	water

Applications

Calibration curve for oligosaccharides



Column: TSKgel G-Oligo-PW, two 6 μ m, 7.8mm x 30cm columns in series
 Sample: hydrolyzed β -cyclodextrin
 Elution: distilled water
 Flow Rate: 1.0mL/min
 Detection: UV @ 260nm

Ordering information:

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08031	TSKgel G-Oligo-PW	7 μ m	Stainless Steel	7.8	30	1,503
08034	Guard Column for P/N 08031	13 μ m	Stainless Steel	6	4	508
08035	TSKgel Top-Off for P/N 08031, 1g	10 μ m				94

Size Exclusion Chromatography

TSKgel PWxl-CP for Cationic Polymers

TSK-GEL PWxl-CP columns were specifically developed for the analysis of water-soluble cationic polymers. Composed of polymethacrylate beads, cationic groups are introduced on the surface of the TSK-GEL PWxl-CP packing material to prevent adsorption of cationic polymers and allow elution under low salt conditions. These columns show high theoretical plate numbers, linear calibration curves and high durability because the base resin is the same as that used in the TSK-GEL PWxl series columns.

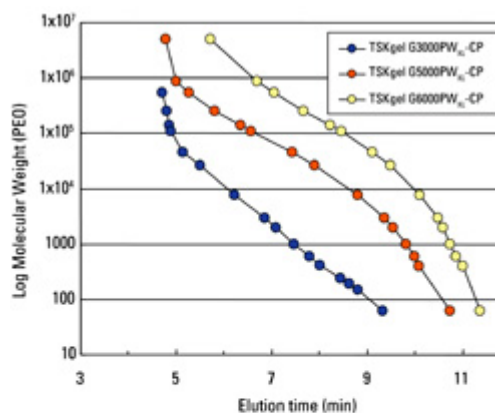
Three columns are available within the TSK-GEL PWxl-CP series, each with a different particle size, separation range and exclusion limit, allowing polymers within a wide molecular mass range to be separated and characterized.

Product Attributes:

	G3000PWxl-CP	G5000PWxl-CP	G6000PWxl-CP
Base material:	polymethacrylate	polymethacrylate	polymethacrylate
Particle size:	7 μ m	10 μ m	13 μ m
Pore size:	200Å	1,000Å	>1,000Å
Exclusion limit (Da):	100,000	1,000,000	20,000,000
Separation range (Da) (PEO,PEG):	200~50,000	400~500,000	1,000~10,000,000
Theoretical plates:	16,000	10,000	7,000

Applications

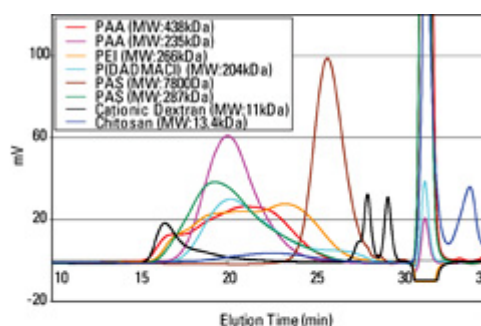
Polyethylene glycol and oxide calibration curves on TSK-GEL PWxl-CP columns.



Columns: TSKgel G3000PW_{xl}-CP, 7 μ m (7.8mm ID x 30cm)
 TSKgel G5000PW_{xl}-CP, 10 μ m (7.8mm ID x 30cm)
 TSKgel G6000PW_{xl}-CP, 13 μ m (7.8mm ID x 30cm)
 Eluent: 0.1mol/L NaNO₃
 Flow Rate: 1mL/min
 Detection: RI
 Temp: 25°C
 Samples: polyethylene oxides (PEO) standards
 polyethylene glycols (PEG) standards

Size Exclusion Chromatography

Analysis of a wide variety of cationic polymers



Columns: TSKgel G3000PW_{XL}-CP, 7 μ m (7.8mm ID x 30cm),
 TSKgel G5000PW_{XL}-CP, 10 μ m (7.8mm ID x 30cm),
 TSKgel G6000PW_{XL}-CP, 13 μ m (7.8mm ID x 30cm)
 Eluent: 0.1mol/L NaNO₃
 Flow Rate: 1mL/min
 Detection: RI
 Temperature: 25°C
 Sample Load: 3g/L, 100 μ L

Various cationic polymers with different functional groups and molecular weights were injected on the TSK-GEL PWXL-CP columns (TSKgel G6000PWXL-CP, G5000PWXL-CP and G3000PWXL-CP, connected in series).

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
21873	TSKgel G3000PWxl-CP	7 μ m	Stainless Steel	7.8	30	1,560
21874	TSKgel G5000PWxl-CP	10 μ m	Stainless Steel	7.8	30	1,560
21875	TSKgel G6000PWxl-CP	13 μ m	Stainless Steel	7.8	30	1,560
21876	Guard Column for P/N's 21873, 21874, 21875		Stainless Steel	6	4	519