

Ion Exchange Chromatography

Anion Exchange

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Fax: (215) 283-5035
www.tosohbioscience.com
email: info.tbl@tosoh.com

Ion Exchange Chromatography

Anion Exchange Chromatography

Anion exchange chromatography is practiced with either a strong or a weak anion exchange column, containing a quarternary ammonium ion, or with a weak anion exchanger, having either a tertiary or secondary amine functional group, such as DEAE (diethylaminoethyl). A counter ion, often Cl⁻ maintains electroneutrality.

In ion exchange chromatography the pH of the mobile phase buffer must be between the pI or pKa of the charged molecule and the pKa of the charged groups on the solid support. For instance, in anion exchange chromatography a molecule with a pI of 6.8 is run in a mobile phase buffer at pH 8.0 with the solid support pKa at 10.3.

Speciality Column

- Oligonucleotide fragments, PCR reagents (DNA-NPR)

Highlights:

- Pore structure and bonding chemistry of BioAssist Q columns provides high capacity for small to very large molecular weight proteins and nucleic acids
- TSKgel SuperQ-5PW columns have higher capacity than TSKgel DEAE-5PW due to novel bonding chemistry; effective pore size is smaller for SuperQ-5PW
- Binding capacity for small to medium size proteins on TSKgel DEAE-3SW is roughly double that of the 5PW packings due to the smaller pore size and larger surface area.
- TSKgel DEAE-5PW and DEAE-2SW columns are available in 2mm ID format
- Specialty columns for analysis of mono- and disaccharides, sugar alcohols, and organic acids.
- TSKgel DNA-NPR columns for PCR fragment analysis
- BioAssist columns are packed in PEEK hardware, while other columns are available in glass and stainless steel.
- Very efficient chromatography can be achieved with the TSK-GEL STAT columns due to the novel bonding chemistry and the absence of micro-pores.

Strong Anion Exchange	Weak Anion Exchange
Methacrylate <ul style="list-style-type: none">• TSKgel BioAssist Q• TSKgel SuperQ-5PW Silica: TSKgel QAE-2SW Polymer: TSKgel Q-STAT Polystyrene <ul style="list-style-type: none">• TSKgel SAX• TSKgel Sugar AXI• TSKgel Sugar AXG	Methacrylate <ul style="list-style-type: none">• TSKgel DEAE-5PW• TSKgel DEAE-NPR• TSKgel DNA-NPR Silica <ul style="list-style-type: none">• TSKgel DEAE-2SW• TSKgel DEAE-3SW Polymer: TSKgel DNA-STAT

Ion Exchange Chromatography

TSKgel BioAssist Q

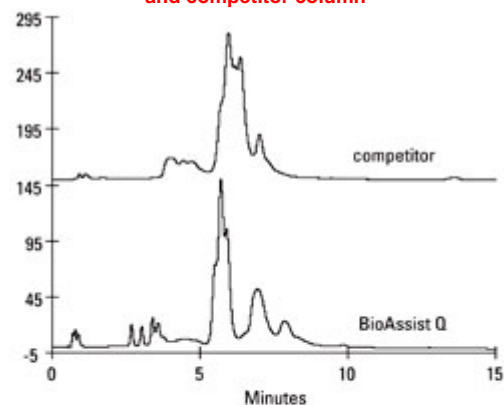
TSKgel BioAssist Q columns are packed with spherical, polymer beads with approx. 4000Å pores. They are surface modified with a strong anion exchanger. The very large pores allow large biomolecules to freely enter and exit the pores resulting in higher binding capacity and better recovery of activity than other competitive materials. The standard column is 4.6mm ID x 5cm, while a 10mm ID x 10cm semi-preparative column is available for scale-up. Both columns are made of PEEK to reduce protein adsorption.

Product Attributes:

Matrix:	polymethacrylate
Particle size (mean):	10 and 13 µm
Pore size (mean):	4000Å
Functional group:	polyamine
Counter ion:	Cl ⁻
pH range:	2.0 -12.0
Capacity (mg BSA/mL):	70
Small ion capacity:	0.1meq/mL
pKa:	9.4

Applications

Analysis of mouse ascites fluid on TSKgel BioAssist Q and competitor column



Column: TSKgel BioAssist Q, 4.6mm x 5cm
 Competitor Q 5.0mm x 5cm
 Elution: 15 min linear gradient of NaCl from 0 to 1.0M in 20mM Tris-HCl buffer, pH 8.0
 Flow Rate: 1.0mL/min
 Detection: UV @ 280nm
 Temperature: 25°C
 Injection: 5µL
 Sample: Mouse ascites fluid (3-fold dilution with initial eluent)

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
19685	TSKgel BioAssist Q	10µm	PEEK	4.6	5	1,060
21410	TSKgel BioAssist Q	13µm	PEEK	10	10	4,055

Ion Exchange Chromatography

TSKgel DEAE-2SW

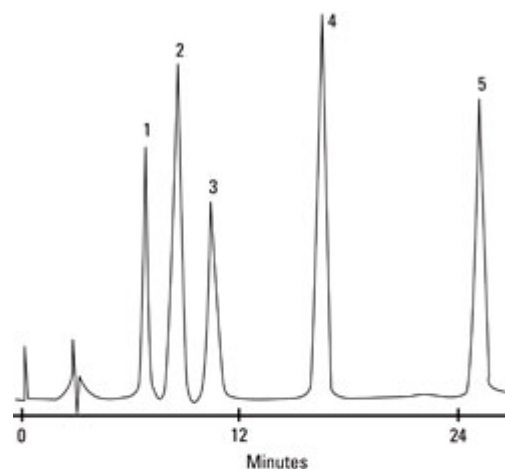
TSKgel DEAE-2SW columns are packed with 5µm porous spherical silica beads which are surface modified with a weak anion exchanger. They are used for the separation and analysis of nucleotides, nucleosides, peptides, small proteins and other biologically active molecules. A 2mm ID column is available for applications that are sample limited.

Product Attributes:

Matrix:	hydrophilic silica
Particle size (mean):	5µm
Pore size (mean):	125Å
Functional group:	CH ₂ CH ₂ N ⁺ (C ₂ H ₅) ₃
Counter ion:	H ₂ PO ₄ ⁻
pH range:	2.0 -7.5
Capacity (mg BSA/mL):	ND
Small ion capacity:	>0.3 meq/mL
pKa:	11.2

Applications

Separation of nucleotides with TSKgel DEAE-2SW



Column: TSKgel DEAE-2SW, 4.6mm x 25cm
 Sample: 1. AMP, 2. IMP, 3. GMP, 4. ADP, 5. ATP
 Buffer A: CH₃CN in 0.1M phosphate, pH 3.0, 20/80
 Buffer B: CH₃CN in 0.5M phosphate, pH 3.0, 20/80
 Elution: 30min linear gradient from buffer A to B
 Flow Rate: 1.0mL/min
 Detection: UV @ 260nm

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18761	TSKgel DEAE-2SW	5µm	Stainless Steel	2	25	881
07168	TSKgel DEAE-2SW	5µm	Stainless Steel	4.6	25	1,060
42154	Guard Cartridge 2mmID for P/N 18761, 3pk		Stainless Steel	2	1	319
19308	Guard Cartridge Holder for P/N 42154		Stainless Steel	2	1	292
07648	Guardgel Kit for P/N 07168					566

Ion Exchange Chromatography

TSKgel DEAE-3SW

TSKgel DEAE-3SW columns are packed with 10µm porous spherical silica beads which are chemically modified with a weak anion exchanger. They are used for the separation and analysis of proteins, peptides, nucleotides, nucleosides and other biologically active molecules.

Product Attributes:

Matrix:	hydrophilic silica
Particle size (mean):	10µm
Pore size (mean):	250Å
Functional group:	CH ₂ CH ₂ N ⁺ (C ₂ H ₅) ₃
Counter ion:	Cl ⁻
pH range:	2.0 - 7.5
Capacity (mg BSA/mL):	ND
Small ion capacity:	>0.3 meq/mL
pKa:	11.2

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
07163	TSKgel DEAE-3SW	10µm	Stainless Steel	7.5	7.5	1,060
07648	Guardgel Kit for P/N 07163		Stainless Steel			566

Ion Exchange Chromatography

TSKgel DEAE-5PW

TSKgel DEAE-5PW columns are packed with porous hydrophilic polymer beads which are surface modified with a weak anion exchanger. They are used for the separation and analysis of proteins, nucleotides, nucleosides and other biologically active molecules. Columns are available in internal diameters varying from 2mm to 55mm ID. Column housings are either glass or stainless steel.

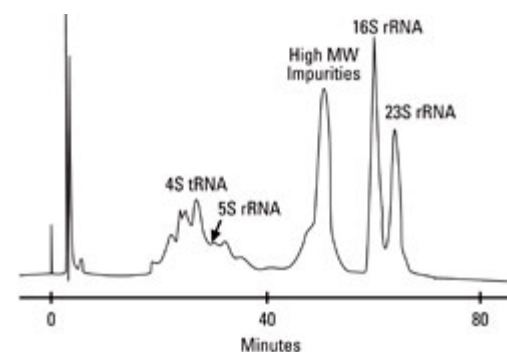
They have the same backbone chemistry and selectivity as the bulk process scale resins Toyopearl DEAE-650 and TSK-GEL DEAE-5PW.

Product Attributes:

Matrix:	hydroxylated methacrylate polymer
Particle size (mean):	10, 13, 20 μ m
Pore size (mean):	1000 Å
Functional group:	$\text{CH}_2\text{CH}_2\text{N}+(\text{C}_2\text{H}_5)_3$
Counter ion:	Cl^-
pH range:	2.0 -12.0
Capacity (mg BSA/mL):	30
Small ion capacity:	0.1 meq/mL
pKa:	11.5

Applications

Large pore TSKgel DEAE-5PW resolves high MW RNA



Column: TSKgel DEAE-5PW, 6mm x 15cm
Sample: total *E. coli* RNA
Elution: 300min linear gradient from 0.3M to 1.0M NaCl in 0.1M Tris-HCl, pH 7.6
Flow Rate: 1.0mL/min
Detection: UV @ 260nm

Ion Exchange Chromatography

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
13061	TSKgel DEAE-5PW	10µm	Glass	5	5	920
08802	TSKgel DEAE-5PW	10µm	Glass	8	7.5	1,200
08806	Glass Guardgel Kit for P/N 13061, 08802		Glass			580
14016	TSKgel DEAE-5PW	13µm	Glass	20	15	5,171
14466	Glass Guard Column for P/N 14016		Glass			1,079
18757	TSKgel DEAE-5PW	10µm	Stainless Steel	2	7.5	881
42152	Guard Cartridge for P/N 18757		Stainless Steel	2	1	319
19308	Cartridge Holder for P/N 42152		Stainless Steel	2	1	292
07164	TSKgel DEAE-5PW	10µm	Stainless Steel	7.5	7.5	1,173
07210	Guardgel Kit for P/N 07164		Stainless Steel			543
07574	TSKgel DEAE-5PW	13µm	Stainless Steel	21.5	15	4,088
16092	Guardgel Kit for P/N 07574		Stainless Steel			838
07930	TSKgel DEAE-5PW	20µm	Stainless Steel	55	20	13,134
07928	Guard Column for P/N 07930		Stainless Steel	45	5	3,825

Ion Exchange Chromatography

TSKgel DEAE-NPR

TSKgel DEAE-NPR columns are packed with spherical 2.5 micron, non-porous, high efficiency, hydrophilic polymer beads which are surface modified with a weak anion exchanger. They are used for the high speed separation and analysis of proteins and poly- and oligonucleotides.

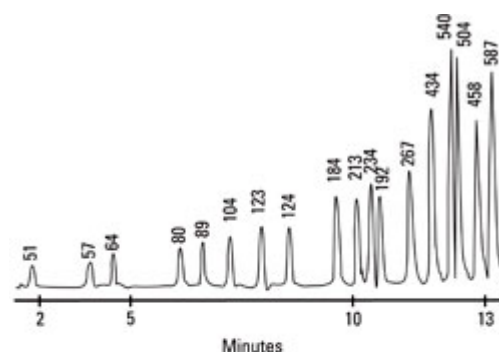
They are particularly useful for high resolution separation of DNA digests or fragments.

Product Attributes:

Matrix:	hydroxylated methacrylic polymer
Particle size (mean):	2.5µm
Pore size (mean):	non-porous
Functional group:	CH ₂ CH ₂ N+(C ₂ H ₅) ₃
Counter ion:	Cl ⁻
pH range:	2.0 - 12
Capacity (mg BSA/mL):	5
Small ion capacity:	>0.1 meq/mL
pKa:	11.2

Applications

**Higher resolution and faster analysis with
TSK-GEL NPR columns**



Column: TSKgel DEAE-NPR, 4.6mm x 3.5cm, with guard column, 4.6mm x 0.5cm
 Sample: *Hae* III digest of pBR322 DNA, (base pair number for each peak is indicated)
 Buffer A: 0.02M Tris-HCl, pH 9.0
 Buffer B: Buffer A plus 1.0M NaCl
 Elution: 15min linear gradient from 48% to 65% buffer B
 Flow Rate: 1.5mL/min
 Pressure: 2000psi
 Temp: 40°C
 Detection: UV @ 260nm

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
13075	TSKgel DEAE-NPR	2.5	Stainless Steel	4.6	3.5	908
17088	Guard Column for P/N13075	5	Stainless Steel	4.6	0.5	307

Ion Exchange Chromatography

TSKgel DNA-NPR

TSKgel DNA-NPR columns are packed with 2.5 micron, non-porous, high efficiency, hydrophilic polymer beads which are surface modified with a weak anion exchanger. Because NPR columns contain non-porous particles, binding capacity is low compared to porous columns with the same ligand functionality.

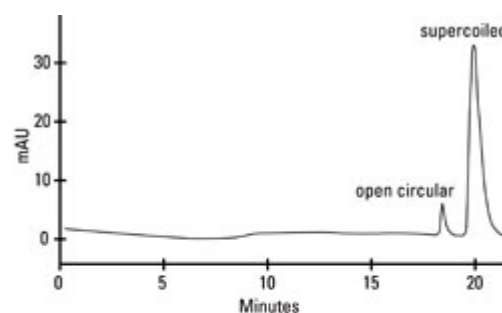
Column dimensions are optimized for the high efficiency separation of DNA fragments, PCR products, or plasmids. A small guard column is available to protect the analytical column.

Product Attributes:

Matrix:	hydroxylated methacrylic polymer
Particle size (mean):	2.5µm
Pore size (mean):	non-porous
Functional group:	proprietary
Counter ion:	ClO ₄ ⁻
pH range:	2-12
Capacity (mg BSA/mL):	5
Small ion capacity:	>0.1 meq/mL
pKa:	11.2

Applications

Plasmid analysis with TSKgel DNA-NPR column



Column: TSKgel DNA-NPR, 4.6mm x 7.5cm
 Sample: PUC19 plasmid
 Elution: A. 20mM Tris, pH 9.0; B. 20mM Tris, pH 9.0 with 1M NaCl linear gradient from 50% to 65% B in 10 column volumes
 Flow rate: 1mL/min
 Detection: UV @ 260nm

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
18249	TSKgel DNA-NPR	2.5µm	Stainless Steel	4.6	7.5	1,237
18253	Guard Column for P/N 18249	5	Stainless Steel	4.6	0.5	307

Ion Exchange Chromatography

TSK-GEL DNA-STAT

TSK-GEL DNA-STAT columns are packed with 5µm hydrophilic non-porous resin particles of which the surface consists of an open access network of multi-layered anion exchange groups. The innovative bonding chemistry, combined with a relatively large particle size, results in a respectable loading capacity, low operating pressure and rapid analysis.

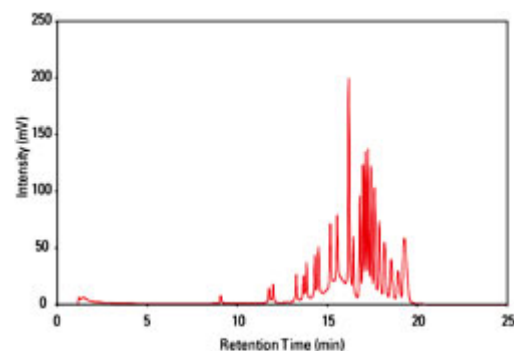
Applications for the TSK-GEL DNA-STAT columns include the separation of: DNA fragments, nucleic acids and nucleotides.

Product Attributes:

Matrix:	hydrophilic polymer
Particle size (mean):	5µm
Pore size (mean):	non-porous
Functional group:	quarternary ammonium
Counter ion:	Cl
pH range:	3.0 - 10.0
Static binding capacity(mg BSA/mg dry gel):	ca. 35 (5µm)
Small ion capacity:	270ueg/g dry gel
pKa:	10.5

Applications

Large DNA fragments containing more than 10kb were successfully separated on a TSKgel DNA-STAT column.



Column: TSKgel DNA-STAT, 5µm, 4.6mm ID x10cm
 Eluent: A) 20mmol/L Tris-HCl (pH 8.5)
 B) 1.0mol/L NaCl (pH 8.5)
 Flow-rate: 0.5mL/min
 Gradient: B) 75 to 100% (20 min.)
 Detection: UV@260nm
 Sample: 1kb Ladder

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
21962	TSKgel DNA-STAT	5µm	Stainless Steel	4.6	10	900

Ion Exchange Chromatography

TSK-GEL QAE-2SW

TSK-GEL QAE-2SW columns are packed with 5µm porous spherical silica beads which are surface modified with a strong anion exchanger. They are used for the separation and analysis of peptides, nucleotides, nucleosides and other biologically active molecules.

Product Attributes:

Matrix:	Silica
Particle size (mean):	5µm
Pore size (mean):	125Å
Functional group:	trimethylamino
Counter ion:	H ₂ PO ₄ ⁻
pH range:	2.0 - 7.5
Capacity (mg BSA/mL):	ND
Small ion capacity:	>0.3
pKa:	11.2

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
07166	TSKgel QAE-2SW	5µm	Stainless Steel	4.6	25	1,179
07646	Guardgel Kit for P/N 07166		Stainless Steel			496

Ion Exchange Chromatography

TSK-GEL Q-STAT

TSK-GEL Q-STAT columns are packed with 7 and 10 μ m hydrophilic non-porous resin particles of which the surface consists of an open access network of multi-layered anion exchange groups. The innovative bonding chemistry, combined with a relatively large particle size, results in a respectable loading capacity and a low operating pressure, making these columns suitable for all HPLC and FPLC systems.

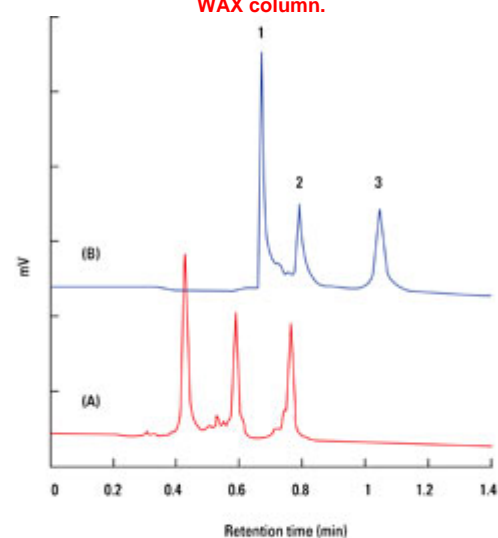
Applications for the TSK-GEL Q-STAT columns include the separation of: proteins, peptides, low molecular weight nucleic acids, aggregates and charge isomers of monoclonal antibodies, PEGylated proteins, oligo DNA, and siRNA.

Product Attributes:

Matrix:	hydrophilic polymer
Particle size (mean):	7 and 10 μ m
Pore size (mean):	non-porous
Functional group:	quaternary ammonium
Counter ion:	Cl
pH range:	3.0 - 10.0
Static binding capacity (mg BSA/ mg dry gel):	ca. 25 (7 μ m) ca. 20 (10 μ m)
Small ion capacity:	270 μ eq/g dry gel
pKa:	10.5

Applications

The protein mixture was completely separated within 1 minute and with higher resolution on the TSKgel Q-STAT column in comparison to the monolithic WAX column.



Columns: A: TSKgel Q-STAT, 10 μ m, 3mm ID x 3.5cm
B: ProSwift WAX-1S Monolith, 4mm ID x 5cm
Eluent: A: 20mmol/L Tris-HCl (pH8.5)
B: 0.5mol/L NaCl in buffer A
Gradient: 0% B (0min), 100% B (1min)
Flow rate: 2.0mL/min
Detection: UV@280nm
Samples: 1. conalbumin
2. ovalbumin
3. trypsin inhibitor

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
21960	TSKgel Q-STAT	10 μ m	Stainless Steel	3	3.5	850
21961	TSKgel Q-STAT	7 μ m	Stainless Steel	4.6	10	900

Ion Exchange Chromatography

TSK-GEL SAX

TSK-GEL SAX columns are packed with 5 μ m porous spherical polymer beads which are surface modified with a strong anion exchanger. They are used for the separation of isomerized sugars, alcohols, and low molecular weight organic acids.

Product Attributes:

Matrix:	PS-DVB polymer
Particle size (mean):	5 μ m
Pore size (mean):	60Å
Functional group:	trimethylamine
Counter ion:	Cl ⁻
pH range:	1.0 -14.0
Capacity :	ND
Small ion capacity:	>1.0meq/mL
pKa:	12.5

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
07157	TSKgel SAX	5 μ m	Stainless Steel	6	15	900

Ion Exchange Chromatography

TSK-GEL Sugar AXG

TSK-GEL Sugar AXG columns are packed with 10µm porous spherical polymer beads which are surface modified with a strong anion exchanger. They are used for the gradient separation and analysis of monosaccharides, disaccharides, and sugar alcohols.

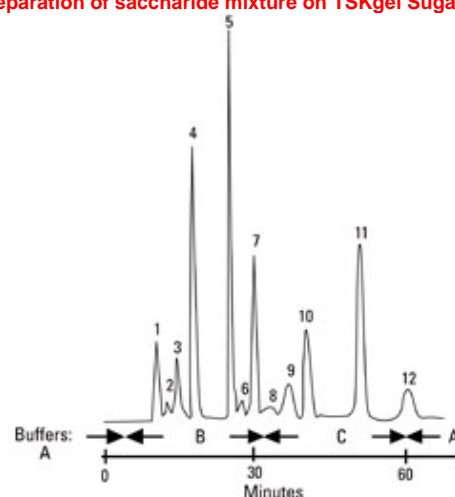
For isocratic separation of carbohydrates where lower and constant back pressures may be generated, please see the TSKgel Sugar AXI which is packed with 8µm particles.

Product Attributes:

Matrix:	PS-DVB polymer
Particle size (mean):	10µm
Pore size (mean):	60Å
Functional group:	trimethylamino
Counter ion:	HBO ₃ ⁻
pH range:	1 - 14
Capacity :	NA
Small ion capacity:	>1.2 meq/mL
pKa:	12.5

Applications

Separation of saccharide mixture on TSKgel Sugar AXG



Column: TSKgel Sugar AXG, 4.6mm x 15cm
 Sample: disaccharides, 25nM; monosaccharides, 50nM: 1. cellobiose, 2. maltose, 3. lactose, 4. rhamnose, 5. lyxose, 6. ribose, 7. mannose, 8. fructose, 9. arabinose, 10. galactose, 11. xylose, 12. glucose
 Elution: step gradient: 6min buffer A, 0.6M boric acid, pH 7.7; then 27min buffer B, 0.7M boric acid, pH 7.25; then 30min buffer C, 0.7M boric acid, pH 8.7
 Flow Rate: 0.4mL/min (column and post column reagent solution)
 Pressure: 16kg/cm²
 Temp: 70°C (column), 100°C (post column reactor)
 Detection: fluorescence excitation @ 331nm, emission @ 383nm
 PC reagent: 2.5% 2-cyanoacetamide solution

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08640	TSKgel Sugar AXG	10µm	Stainless Steel	4.6	15	1,079

Ion Exchange Chromatography

TSK-GEL Sugar AXI

TSK-GEL Sugar AXI columns are packed with 8µm porous spherical polymer beads which are modified with a strong anion exchanger. They are used for the isocratic separation and analysis of monosaccharides, disaccharides, and sugar alcohols.

For gradient separation of carbohydrates where higher back pressures may be generated, please see the [TSKgel Sugar AXG](#) which is packed with 10µm particles.

Product Attributes:

Matrix:	PS-DVB polymer
Particle size (mean):	8µm
Pore size (mean):	60Å
Functional group:	trimethylamino
Counter ion:	HBO ₃ ⁻
pH range:	1.0 - 14.0
Capacity :	ND
Small ion capacity:	>1.2meq/mL
pKa:	12.5

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P/N	Description	Particle size	Housing material	ID (mm)	Length (cm)	Price (\$)
08639	TSKgel Sugar AXI	8µm	Stainless Steel	4.6	15	1,079

Ion Exchange Chromatography

TSK-GEL SuperQ-5PW columns are packed with porous hydrophilic polymer beads which are modified with a strong anion exchanger. The resulting product exhibits very high protein capacities. TSKgel SuperQ-5PW is used for the separation and analysis of proteins, oligonucleotides and other biologically active molecules.

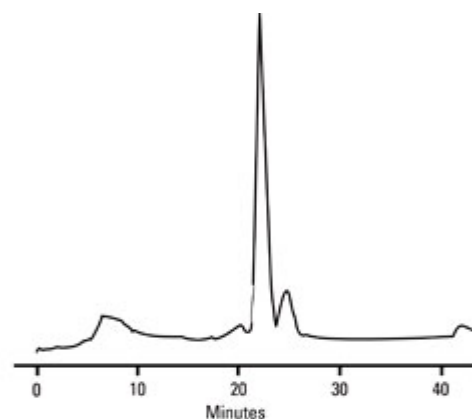
TSK-GEL SuperQ-5PW columns have the same backbone chemistry and selectivity as the bulk process scale resins TSK-GEL SuperQ-5PW and Toyopearl SuperQ-650.

Product Attributes:

Matrix:	polymethacrylate
Particle size (mean):	10 and 13µm
Pore size (mean):	1000Å
Functional group:	trimethylamino
Counter ion:	Cl ⁻
pH range:	2.0 - 12.0
Capacity:	100mg BSA/mL
Small ion capacity:	>0.13meq/mL
pKa:	12.2

Applications

Analysis of synthetic oligonucleotide on TSKgel SuperQ-5PW



Column: TSKgel SuperQ-5PW, 7.5mm x 7.5cm
Sample: 16-mer morpholine oligonucleotide, AAG AAG AAG AGG GGA G
Sample load: 0.5 O.D. (optical density)
Mobile phase: A: 10mM NaOH
 B: 10mM NaOH with 1M NaCl
Gradient: Initial: 0% B
 40min: 50% B
 41min: 100% B
 46min: 100% B
Flow Rate: 1mL/min
Detection: UV @ 254nm

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 (\$)
18386	TSKgel SuperQ-5PW	10µm	Glass	8	7.5	1,200
18257	TSKgel SuperQ-5PW	10µm	Stainless Steel	7.5	7.5	1,148
18388	Guardgel Kit for P/N 18257		Stainless Steel			711
18387	TSKgel SuperQ-5PW	13µm	Stainless Steel	21.5	15	4,088