

The TSK-GEL line of columns includes a variety of ion exchange columns for laboratory-scale sample purification and analyses of proteins, peptides, and small molecular weight organic ions. TSK-GEL columns are highly efficient and combine sample purification with excellent recovery rates. Anion- and cation-exchangers are available on porous polymer-based and silica-based matrices, and in nonporous resin (NPR) columns. The various column types are described in the tables included here.

TSK-GEL 5PW and TSK-GEL NPR columns are stable between pH 2-12; TSK-GEL SW columns can be used from pH 2-7.5. TSK-GEL 2SW columns (125Å pores in the packing particles) are best suited for small molecular weight solutes, such as nucleotides. Larger biomolecules, including peptides and small proteins, can be analyzed on TSK-GEL 3SW ion exchange columns (250Å pores). The wide-pore (1000Å), polymer-based TSK-GEL 5PW columns are suitable for analyses and purifica-

tions of large proteins and nucleic acids (see Figure A, next page). Sample capacity for a 7.5cm x 7.5mm TSK-GEL 5PW ion exchange column is approximately 1mg.

Proteins and nucleic acids can be analyzed in 3-5 times shorter analysis times on the nonporous TSK-GEL NPR columns (see Figure B). The sample capacity of these columns for proteins is, however, 50-100 times smaller. TSKgel DEAE-NPR columns are commonly used to separate DNA fragments. TSKgel SP-NPR columns can provide fast results in hemoglobin A1c screening. (For more detailed information about NPR columns, request Bulletin 862). Due to their small particle size (2.5µm), TSK-GEL NPR columns must be protected by using a pre-column filter containing a 0.5µm frit Rheodyne® in-line filter or Sigma-Aldrich® Precolumn filter.

**Table 1. Characteristics of TSK-GEL Ion Exchange Columns<sup>a</sup>**

<b>Anion Exchange Columns</b>					
Characteristic	DEAE-5PW	DEAE-3SW	TSK-GEL Column		DEAE-NPR
			DEAE-2SW		
Matrix	hydrophilic resin	silica	silica		hydrophilic resin
Particle Size (µm)	10	10	5		2.5
Pore Size (Å)	1000	250	125		nonporous
Functional Group	-CH <sub>2</sub> CH <sub>2</sub> N <sup>+</sup> (C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub>	-CH <sub>2</sub> CH <sub>2</sub> N <sup>+</sup> (C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub>	-CH <sub>2</sub> CH <sub>2</sub> N <sup>+</sup> (C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub>		-CH <sub>2</sub> CH <sub>2</sub> N <sup>+</sup> (C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub>
Counter Ion	Cl <sup>-</sup>	Cl <sup>-</sup>	Cl <sup>-</sup>		Cl <sup>-</sup>
pH Range	2 - 12	2 - 7.5	2 - 7.5		2 - 12
Exclusion Limit (PEG, daltons)	1,000,000	30,000	10,000		500
Capacity (mg BSA/mL)	30	120	not avail.		5
Small Ion Capacity	>0.1meq/mL	>0.3meq/g	>0.3meq/mL		>0.15meq/mL
pKa	11.2	11.2	11.2		11.2

<b>Cation Exchange Columns</b>					
Characteristic	SP-5PW	SP-NPR	TSK-GEL Column		CM-3SW
			CM-5PW	CM-2SW	
Matrix	hydrophilic resin	hydrophilic resin	hydrophilic resin	silica	silica
Particle Size (µm)	10	2.5	10	5	10
Pore Size (Å)	1000	nonporous	1000	125	250
Functional Group	-CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> SO <sub>3</sub> <sup>-</sup>	-CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> SO <sub>3</sub> <sup>-</sup>	-CH <sub>2</sub> COO <sup>-</sup>	-CH <sub>2</sub> COO <sup>-</sup>	-CH <sub>2</sub> COO <sup>-</sup>
Counter Ion	Na <sup>+</sup>	Na <sup>+</sup>	Na <sup>+</sup>	Na <sup>+</sup>	Na <sup>+</sup>
pH Range	2 - 12	2 - 12	2 - 12	2 - 7.5	2 - 7.5
Exclusion Limit (PEG, daltons)	1,000,000	500	1,000,000	10,000	30,000
Capacity (mg Hb/mL)	40	5	45	—	110
Small Ion Capacity	>0.1meq/mL	>0.1meq/g	>0.1meq/mL	>0.3meq/mL	>0.3meq/mL
pKa	2.3	2.3	4.2	4.2	4.2

<sup>a</sup> TSK-GEL applications on 5PW resins can be scaled up using Toyopearl bulk packing material (see Toyopearl® Ion Exchange Packings in our catalog).

**Technical Information:**

Bulletin 862 — TSK-GEL Nonporous Resin Columns.  
 Stocchi, V., et al., Preparative Biochemistry, 22 (1992) 11-40 and 41-55.

To Order, Call: 800-247-6628 or 814-359-3441

**Figure A. Selectivity of TSK-GEL Strong and Weak Cation Exchangers**

Column: **SP-5PW, 7.5cm x 7.5mm, 10µm particles**  
 Cat. No.: **8-07161**

Column: **CM-5PW, 7.5cm x 7.5mm, 10µm particles**  
 Cat. No.: **8-13068**

Mobile Phase: 0M to 0.5M NaCl in 0.02M phosphate buffer, pH 7, 60 min linear gradient

Flow Rate: 1.0mL/min  
 Det.: UV, 280nm

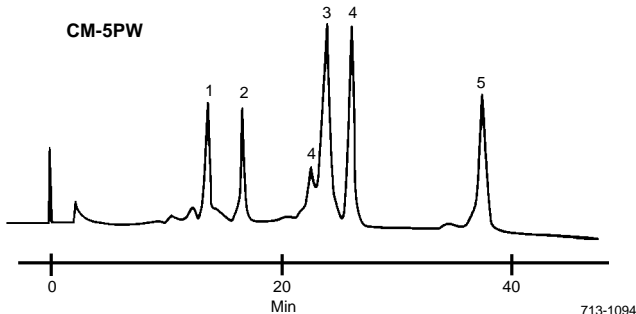
1. Trypsinogen
2. Ribonuclease
3. α-Chymotrypsinogen
4. Cytochrome c
5. Lysozyme

**SP-5PW**



713-1093

**CM-5PW**



713-1094

**Trademarks**

Rheodyne — Rheodyne, Inc.  
 Sigma-Aldrich — Sigma-Aldrich Corp.  
 Toyopearl, TSK-GEL — Tosoh Corp.

**Figure B. Faster Analysis and Greater Resolution on a Nonporous Resin Column**

Column: **DEAE-NPR**  
**3.5cm x 4.6mm, 2.5µm particles**

Cat. No.: **8-13075**

Mobile Phase: 0M to 0.5M NaCl in 20mM Tris-HCl buffer, pH 8.0, 10 min linear gradient

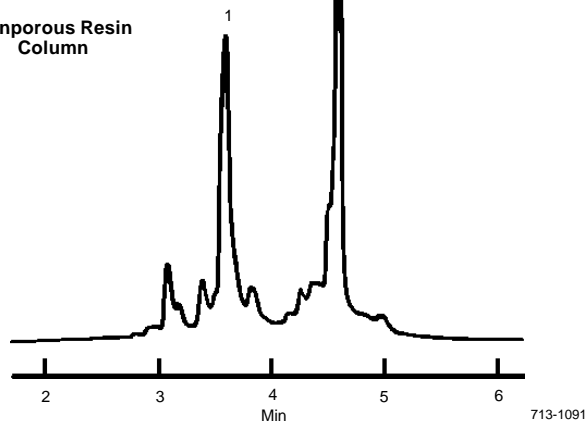
Flow Rate: 1.5mL/min

Temp.: 25°C

Det.: UV, 280nm

1. Ovalbumin
2. Trypsin inhibitor

**Nonporous Resin Column**



713-1091

Column: **DEAE-5PW**  
**7.5cm x 7.5mm, 10µm particles**

Cat. No.: **8-07164**

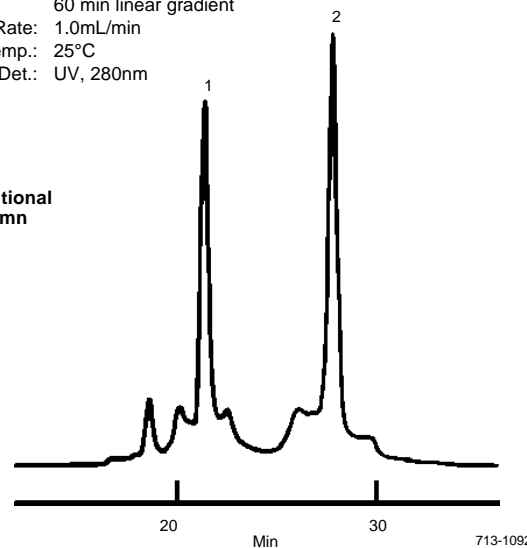
Mobile Phase: 0M to 0.5M NaCl in 20mM Tris-HCl buffer, pH 8.0, 60 min linear gradient

Flow Rate: 1.0mL/min

Temp.: 25°C

Det.: UV, 280nm

**Conventional Column**



713-1092

FAX: 800-447-3044 or 814-359-3044

### Anion Exchange, Polymer-Based Columns

Column	Packing Particle Size (µm)	Column Dimensions		Cat. No.
		Length (cm)	Diameter (mm)	
TSKgel DEAE-NPR	2.5	3.5	4.6	8-13075
TSKgel DEAE-NPR guard column	5	0.5	4.6	8-17088
TSKgel DEAE-5PW	10	7.5	7.5	8-07164
TSKgel DEAE-5PW guard column kit	20	—	—	8-07210
TSKgel DEAE-5PW packing (5mL)	20	—	—	8-07207

### Anion Exchange, Silica-Based Columns

Column	Packing Particle Size (µm)	Column Dimensions		Cat. No.
		Length (cm)	Diameter (mm)	
TSKgel DEAE-2SW	5	25	4.6	8-07168
TSKgel DEAE-3SW	10	7.5	7.5	8-07163
TSKgel DEAE-SW guard column kit	10	—	—	8-07648
TSKgel DEAE-SW packing (5mL)	10	—	—	8-07647

### Cation Exchange, Polymer-Based Columns

Column	Packing Particle Size (µm)	Column Dimensions		Cat. No.
		Length (cm)	Diameter (mm)	
TSKgel CM-5PW	10	7.5	7.5	8-13068
TSKgel CM-5PW guard column kit	20	—	—	8-13069
TSKgel CM-5PW packing (5mL)	20	—	—	8-13070
TSKgel SP-NPR	2.5	3.5	4.6	8-13076
TSKgel SP-5PW	10	7.5	7.5	8-07161
TSKgel SP-5PW guard column kit	20	—	—	8-07211
TSKgel SP-5PW packing (5mL)	20	—	—	8-07208

### Cation Exchange, Silica-Based Columns

Column	Packing Particle Size (µm)	Column Dimensions		Cat. No.
		Length (cm)	Diameter (mm)	
TSKgel CM-2SW	5	25	4.6	8-07167
TSKgel CM-3SW	10	7.5	7.5	8-07162
TSKgel CM-SW guard column kit	10	—	—	8-07650
TSKgel CM-SW packing (5mL)	10	—	—	8-07649

Guard column kits include 1cm x 6.0mm column, column holder, 5mL packing, 2 frits, 2 nuts and ferrules for 1/16" tubing, 5cm of 1/16" tubing.

For more information, or current prices, contact your nearest Supelco subsidiary listed below. If your country is not listed, see the Supelco catalog for a complete list of all Supelco representatives, or contact Supelco, Bellefonte, PA 16823-0048 USA.

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