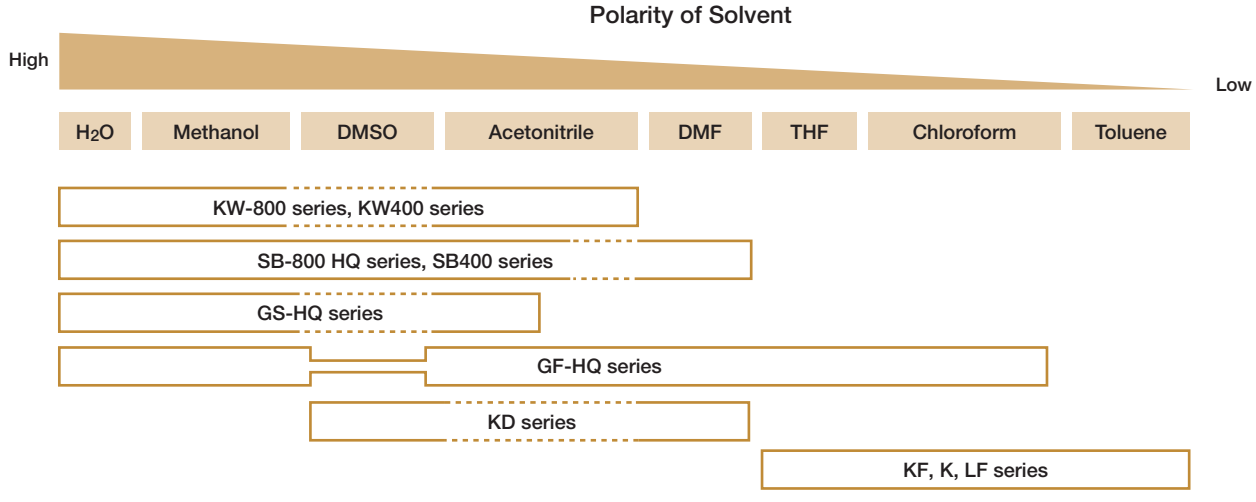
Column Selection for Size Exclusion Chromatography (SEC)

	Application	Solvent	Column		Page
Aqueous SEC (GFC)	Analysis of biological macromolecules (proteins, peptides, nucleic acids, etc.)	buffer etc.	KW-800 series		44
		buffer etc.	KW400 series	High performance (solvent-saving)	44
	Analysis of biological macromolecules (high MW range)	buffer etc.	SB-800 HQ series		46
		buffer etc.	SB400 series	High performance (solvent-saving)	46
	Water-soluble polymers (polyacrylamide, polyethylenimine, etc.)	H_2O, buffer aqueous solution etc.	SB-800 HQ series		46
			SB400 series	High performance (solvent-saving)	46
	Oligosaccharide, polysaccharides	H_2O, aqueous solution	KS-800 series		32
			GS-HQ series		48
Organic SEC (GPC)	Analysis of general polymers	THF	KF-800 series		52
		THF	LF series	High linearity of calibration curve	58
		THF	KF-600 series	Rapid analysis (solvent-saving)	56
		THF	KF-400HQ series	High performance (solvent-saving)	56
		chloroform	K-800 series		52
	Polar polymers (polyimides, polyvinylpyrrolidones etc.)	DMF	KD-800 series		54
		DMF	SB-800 HQ series		46
		DMF	SB400 series		46
	Analysis at high temperature (polyethylene, polypropylene etc.)	ODCB etc.	HT-800 series		58
		ODCB etc.	UT-800 series		58
		ODCB etc.	AT-806MS		58
	Engineering resin analysis at room temperature [polyamide (nylon), polyethylene terephthalate (PET) etc.]	HFIP	HFIP-800 series		60
		HFIP	HFIP-600 series	Rapid analysis (solvent-saving)	60
		HFIP	LF-404	High performance (solvent-saving)	58
Aqueous/Organic SEC			GF-HQ series		50

Guideline of Availability



* See page 62 for the solvent replaceability of organic solvent SEC (GPC) packed columns.

Precautions for polar polymer analysis

Size exclusion chromatography analysis of polar-polymer can be influenced by unexpected interactions in the column. These interactions will result in changing elution patterns and may cause the invalid molecular weight calculations. It is important to reduce them in order to obtain the accurate molecular weight distribution.

Interfering interactions likely to be observed

Interactions between the analyte and the packing materials

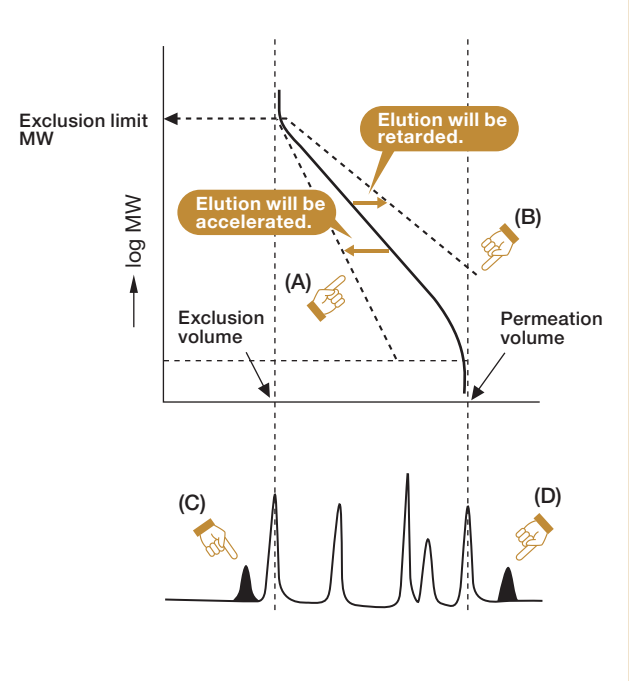
- **Hydrophobic interaction**
  → The analyte is adsorbed into the packing material. This delays the analyte elution, and thus results in underestimation of its molecular weight (Figure B, D).
- **Ionic interaction**
  (1) Ion Exclusion
  →The analyte is repelled from the packing material. This accelerates the analyte elution, and thus results in overestimation of its molecular weight (Figure A, C)
  (2) Ion Exchange
  →The analyte is adsorbed onto the packing material. This delays the analyte elution, and thus results in underestimation of its molecular weight (Figure B, D).

Interaction within and between the analyte

- **Ionic repulsion effects observed within the multivalent macromolecules causes structure expansion**
  → This accelerates the analyte elution, and thus results in overestimation of its molecular weight (Figure A).
- **Association between the molecules**
  → Associated molecule detected as a larger molecule (Figure A).

Interactions between the analyte and the solvent

- **The multivalent ion of the solvent works as a bridge to bind ionic molecules (analyte).**



Methods to reduce interactions

Organic solvent SEC (GPC) columns

Ionic Interaction

- **Add salt**
  (Example) Add LiBr to DMF
  Add CF_3COONa to HFIP

Hydrophobic interaction

- **Lower the polarity of the eluent**
  (Example) Change the eluent from DMF to THF

Hydrophillic interaction

- **Increase the polarity of the eluent**
  (Example) Change the eluent from THF to DMF

Aqueous SEC (GFC)

Ionic Interaction

- **Add salt**

Hydrophobic interaction

- **Increase dissociation of the analyte**
  Cationic polymer → Lower the pH
  Anionic polymer → Higher the pH
- **Lower the eluent polarity**
  (Example) Add acetonitrile or methanol

Aqueous SEC (GFC) columns : Silica-based

Features

KW-800

- Silica-based packed columns for aqueous SEC (GFC) analysis
- Suitable for the analysis of proteins and enzymes

Note book No.7 News No.16 Preparative Columns p.85

KW400

- Reducing particle size of the packing material enhances column performance
- Three- or four-fold higher sensitivity than KW-800 series
- KW405-4F is applicable to samples with a molecular weight above 1 million

Note book No.5, 7 News No.31 Semi-micro Micro Columns p.77

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit		Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
			(Pullulan)	(Protein)				
F6989000	**PROTEIN KW-802.5**	≥ 21,000	60,000	150,000	5	400	**8.0 × 300**	H_2O
F6989103	**PROTEIN KW-803**	≥ 21,000	170,000	700,000	5	1,000	**8.0 × 300**	H_2O
F6989104	**PROTEIN KW-804**	≥ 16,000	500,000	(1,000,000)*	7	1,500	**8.0 × 300**	H_2O
F6700131	**PROTEIN KW-G**	(guard column)	–	–	7	–	**6.0 × 50**	H_2O

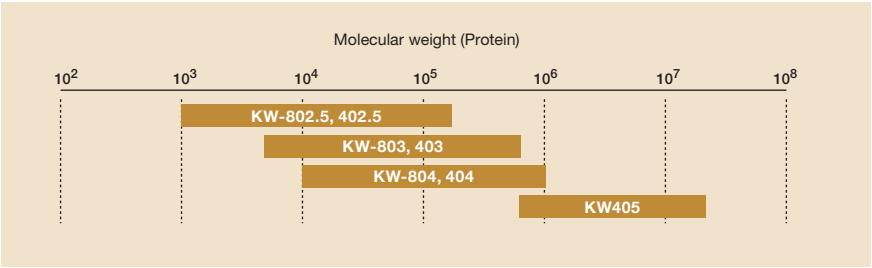
Base Material : Silica
Usable pH range : pH3.0-7.5
The maximum usable concentration is 100% for methanol and acetonitrile.
* Estimated value within parenthesis

High performance semi-micro columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit		Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
			(Pullulan)	(Protein)				
F6989201	**KW402.5-4F**	≥ 35,000	60,000	150,000	3	400	**4.6 × 300**	H_2O
F6989202	**KW403-4F**	≥ 35,000	150,000	600,000	3	800	**4.6 × 300**	H_2O
F6989203	**KW404-4F**	≥ 25,000	500,000	(1,000,000)*	5	1,500	**4.6 × 300**	H_2O
F6989204	**KW405-4F**	≥ 25,000	1,300,000	(20,000,000)*	5	2,000	**4.6 × 300**	H_2O
F6700132	**KW400G-4A**	(guard column)	–	–	5	–	**4.6 × 10**	H_2O

Base Material : Silica
Usable pH range : pH3.0-7.5
The maximum usable concentration is 100% for methanol and acetonitrile.
* Estimated value within parenthesis

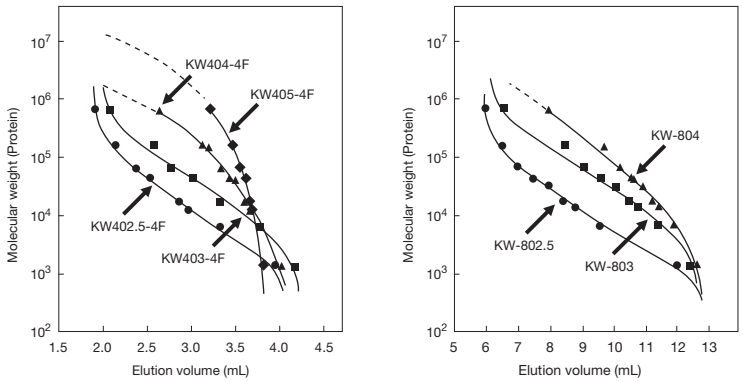
Molecular weight range with protein (eluent : phosphate buffer)



Calibration Standards See page 63 for Calibration Standards

*Contact Shodex or our distributors near you for customized columns.

Calibration curves for KW400 series and KW-800 series



Column : **Shodex KW400-4F series, Shodex PROTEIN KW-800 series**
Eluent : 50mM Sodium phosphate buffer + 0.3M NaCl(pH7.0)
Flow rate : (KW400) 0.33mL/min
(KW-800) 1.0mL/min
Detector : (KW400) UV(280nm) (small cell volume)
(KW-800) UV(280nm) (conventional type)
Column temp. : 25℃

Recovery rate of proteins

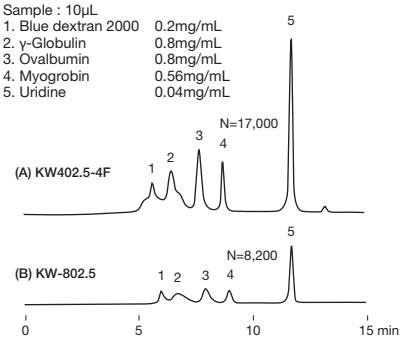
Protein	Recovery (%)	
	KW402.5-4F	KW403-4F
γ- Globulin	98	96
Bovine serum albumin	89	96
Ovalbumin	89	97
Myoglobin	90	89
Cytochrome c	92	92
Lysozyme	87	98
α-Chymotrypsinogen A	95	94

Column : **Shodex KW402.5-4F, KW403-4F**
Eluent : 50mM Sodium phosphate buffer
+ 0.3M NaCl(pH7.0)
Flow rate : 0.33mL/min
Detector : UV(280nm) (small cell volume)
Column temp. : 25℃

Comparison of KW402.5-4F and KW-802.5

KW400 series are high-performance semi-micro columns with theoretical plate number which is approximately 1.5 times larger and a detection sensitivity (peak height) that is 3 to 4 times higher than what KW-800 columns have.

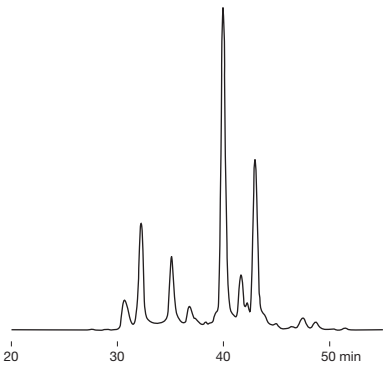
Sample : 10μL
1. Blue dextran 2000 0.2mg/mL
2. γ-Globulin 0.8mg/mL
3. Ovalbumin 0.8mg/mL
4. Myogrobin 0.56mg/mL
5. Uridine 0.04mg/mL



Column : **(A) Shodex KW402.5-4F**
(B) Shodex PROTEIN KW-802.5
Eluent : 50mM Sodium phosphate buffer
+ 0.3M NaCl(pH7.0)
Flow rate : (A) 0.33mL/min, (B) 1.0mL/min
Detector : UV(280nm) (small cell volume)
Column temp. : 25℃

Milk whey in yogurt

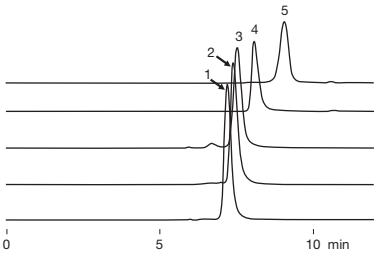
Sample : Whey, 5μL



Column : **Shodex KW402.5-4F + KW403-4F**
Eluent : 50mM Sodium phosphate buffer
+ 0.3M NaCl(pH7.0)
Flow rate : 0.20mL/min
Detector : UV(280nm) (small cell volume)
Column temp. : 30℃

Lectins

Sample : 5μL
1. Lectin from Soybean 0.6mg/mL
2. Lectin from Arachis hypogaea 1.1mg/mL
3. Lectin from Canavalia ensiformis (Con A) 0.9mg/mL
4. Lectin from Lens culinaris (LCA) 0.7mg/mL
5. Lectin from Triticum vulgaris (WGA) 0.8mg/mL

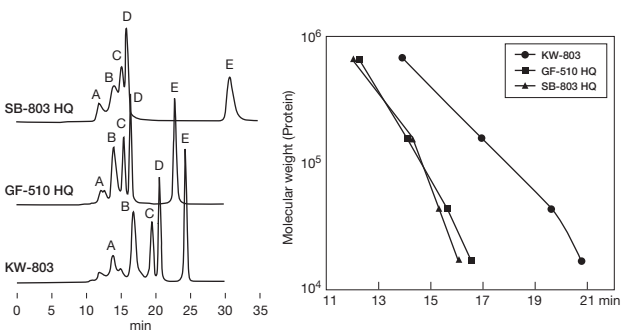


Column : **Shodex KW402.5-4F**
Eluent : 50mM Sodium phosphate buffer
+ 0.3M NaCl(pH7.0)
Flow rate : 0.33mL/min
Detector : UV(220nm) (small cell volume)
Column temp. : 30℃

Comparison of standard protein separation using various GFC columns

Sample :
A : Thyroglobulin (bovine)
B : γ-Globulin (bovine)
C : Ovalbumin (chicken)
D : Nyoglobin (horse)
E : Cyanocobalamin

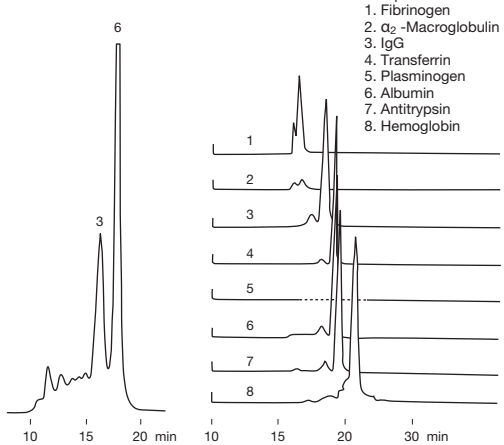
SEC columns for an aqueous system, i.e., SB-803 HQ, GF-510 HQ and KW-803, were compared with each other in terms of the separation of standard proteins. The result demonstrates that the KW-803, a silica-based column, is the most suitable for such an application.



Column : **Shodex OHpak SB-803 HQ, Asahipak GF-510 HQ,**
PROTEIN KW-803
Eluent : 0.2M Phosphate buffer(pH6.9)
Flow rate : 0.5mL/min
Detector : UV(280nm)
Column temp. : 30℃

Proteins in human blood serum

Sample : Human serum 0.1% each
1. Fibrinogen 50μL
2. α_2 -Macroglobulin 50μL
3. IgG 50μL
4. Transferrin 50μL
5. Plasminogen 50μL
6. Albumin 100μL
7. Antitrypsin 100μL
8. Hemoglobin 100μL



Column : **Shodex PROTEIN KW-803 x 2**
Eluent : 50mM Phosphate buffer + 0.3M NaCl(pH7.0)
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

Aqueous SEC (GFC) columns : Polymer-based

Features

SB-800 HQ

- Polymer-based packed columns for aqueous SEC (GFC) analysis
- Supports a wide range of molecular weights
- The eluent can be substituted with DMF (in columns other than SB-802 HQ and SB-807 HQ), enabling the analysis of polar polymers
- SB-804HQ and SB-805HQ are capable of determining the mean molecular weight of the gelatin compliant with PAGI method (ver. 10, Japan)

News No.29, 39
Semi-micro Micro Columns p.78, 79
Preparative Columns p.85

SB-807 HQ

- Columns for the analysis of water-soluble ultra-high molecular polymer
- Packing materials with a large particle size are packed in order to prevent the breakage of molecular chains

SB400

- Three- or four-fold higher sensitivity than the SB-800 HQ series
- SB401-4E can analyze small molecules with MW below 1,000

News No.38, 39

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (Pullulan)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6429100	**OHpak SB-802 HQ**	≥ 12,000	4,000	8	100	**8.0 × 300**	0.02% NaN_3 aq.
F6429101	**OHpak SB-802.5 HQ**	≥ 16,000	10,000	6	200	**8.0 × 300**	0.02% NaN_3 aq.
F6429102	**OHpak SB-803 HQ**	≥ 16,000	100,000	6	800	**8.0 × 300**	0.02% NaN_3 aq.
F6429103	**OHpak SB-804 HQ**	≥ 16,000	1,000,000	10	2,000	**8.0 × 300**	0.02% NaN_3 aq.
F6429104	**OHpak SB-805 HQ**	≥ 12,000	(4,000,000)*	13	7,000	**8.0 × 300**	0.02% NaN_3 aq.
F6429105	**OHpak SB-806 HQ**	≥ 12,000	(20,000,000)*	13	15,000	**8.0 × 300**	0.02% NaN_3 aq.
F6429106	**OHpak SB-806M HQ**	≥ 12,000	(20,000,000)*	13	15,000	**8.0 × 300**	0.02% NaN_3 aq.
F6709430	**OHpak SB-G**	(guard column)	–	10	–	**6.0 × 50**	0.02% NaN_3 aq.

SB-806M HQ is a mixed-gel column capable of analysis of samples over a wide range of molecular weight distribution.

Base Material : Polyhydroxymethacrylate Usable pH range : pH3~10
*( )Estimated value

For water-soluble ultra-high molecular polymer

F6429108	**OHpak SB-807 HQ**	≥ 1,500	(500,000,000)*	35	30,000	**8.0 × 300**	H_2O
F6709431	**OHpak SB-807G**	(guard column)	–	35	–	**8.0 × 50**	H_2O

Base Material : Polyhydroxymethacrylate Usable pH range : pH3~10
*( )Estimated value

High performance semi-micro columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (Pullulan)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6429111	**SB401-4E**	≥ 5,000	1,000	10	40	**4.6 × 250**	H_2O
F6429112	**SB402.5-4E**	≥ 20,000	10,000	6	200	**4.6 × 250**	H_2O
F6429113	**SB403-4E**	≥ 20,000	100,000	6	800	**4.6 × 250**	H_2O
F6429114	**SB404-4E**	≥ 20,000	1,000,000	7	2,000	**4.6 × 250**	H_2O
F6709432	**SB400G-4A**	(guard column)	–	7	–	**4.6 × 10**	H_2O

Base Material : Polyhydroxymethacrylate Usable pH range : pH3~10

Usable concentration of organic solvents

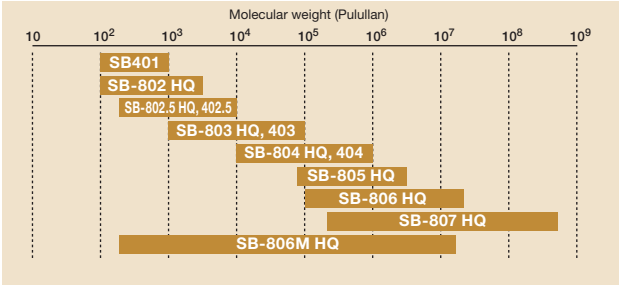
Product Name	The maximum usable concentration (%)		
	Methanol	Acetonitrile	DMF
SB401-4E	0	10	0
SB-802 HQ	0	0	0
SB-802.5 HQ, SB-803 HQ SB402.5-4E, SB403-4E	100	75	100
SB-804 HQ~SB-806M HQ, SB404-4E	75	75	100
SB-G, SB400G-4A	75	75	100
SB-807 HQ, SB-807G	30	30	0

Note :
The maximum solvent tolerance to the SB-800 HQ series preparative columns(SB-2000 series) to methanol, acetonitrile, and DMF is 50%. (SB-2002 is not tolerant to solvents, similar to SB-802 HQ.)

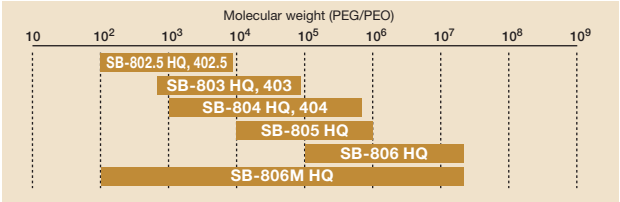
Calibration Standards See page 63 for Calibration Standards

*Contact Shodex or our distributors near you for customized columns.

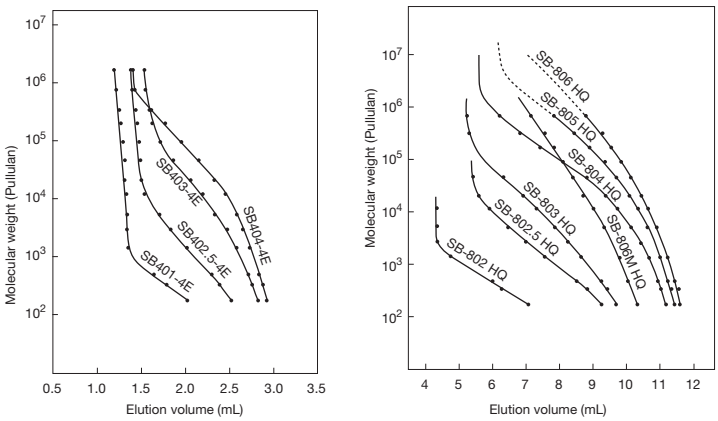
Molecular weight range with pullulan (eluent : ultrapure water)



Molecular weight range with PEG/PEO (eluent : DMF)

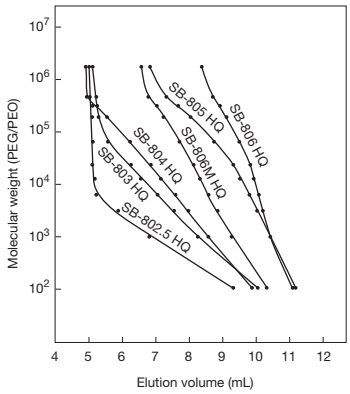


Calibration curves for SB400 series and SB-800 HQ series using pullulan (H_2O)



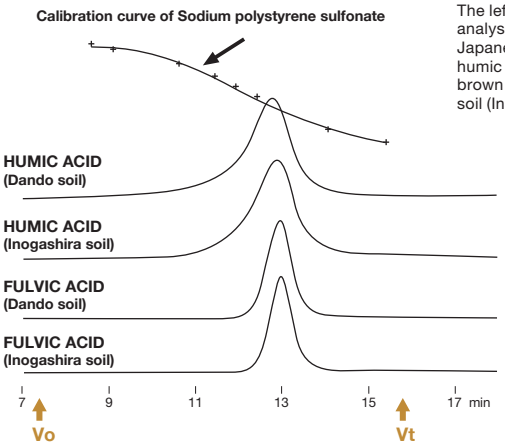
Column : Shodex SB400 series, Shodex OHpak SB-800 HQ series
Eluent : H_2O
Flow rate : 0.3mL/min, 1.0mL/min
Detector : (SB400) RI(small cell volume)
(SB-800 HQ) RI(conventional type)
Column temp. : Room temp.

Calibration curves for SB-800 HQ series using PEG and PEO (DMF)



Column : Shodex OHpak SB-800 HQ series
Eluent : 20mM LiBr in DMF
Flow rate : 0.8mL/min
Detector : RI
Column temp. : 40℃

SEC analysis of humic substance



The left graph shows the results of SEC analysis of reference materials (from the Japanese Humic Substances Society) of humic acid and fulvic acid prepared from brown forest soil (Dando) and kuroboku soil (Inogashira).

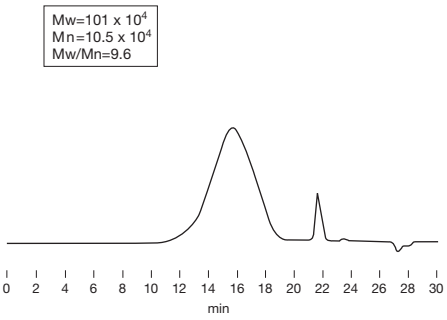
Sample : Humic substances, 30μL
Humic acid 0.02mg/mL
Fulvic acid 0.02mg/mL

Column : Shodex OHpak SB-G + SB-805 HQ
Eluent : 10mM NaH_2PO_4 + 10mM Na_2HPO_4(pH7.0) + 25% CH_3CN
Flow rate : 0.8mL/min
Detector : UV(260nm)
Column temp. : 40℃

Data provided by Nobuhide Fujitake,
Professor of the Graduate School of Agricultural Science, Kobe University

Carboxymethylcellulose

Sample : Carboxymethylcellulose
(Medium viscosity) 0.1%, 200μL

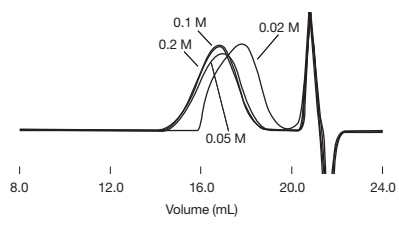


Column : Shodex OHpak SB-806M HQ x 2
Eluent : 0.1M NaCl aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

Effect of sodium nitrate concentration in eluent on the analysis of polyallylamine

In the analysis of cationic polymers such as polyallylamine, the concentration of sodium nitrate in the eluent being 0.02M would allow the column to adsorb the main chain of polyallylamine, resulting in the complete prevention of the elution of polyallylamine. However, if the concentration is 0.1M or higher, adsorption of the sample is suppressed and a favorable chromatogram can be obtained.

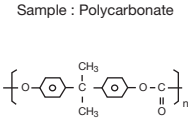
Sample : Polyallylamine 0.2%, 100μL

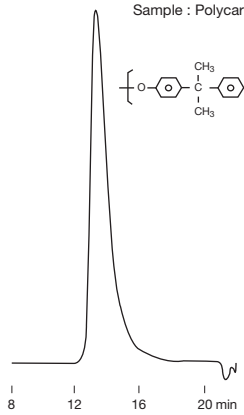


Column : Shodex OHpak SB-806M HQ x 2
Eluent : 0.5M Acetic acid + $NaNO_3$ aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

Polycarbonate

Sample : Polycarbonate

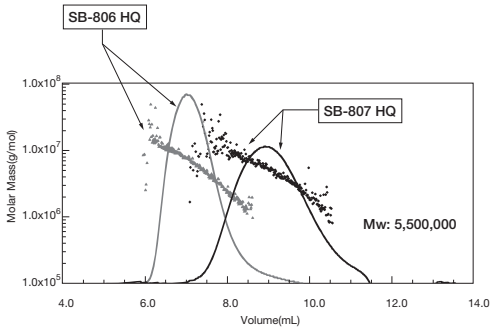




Column : Shodex OHpak SB-805 HQ + SB-802.5 HQ
Eluent : 5mM LiBr in DMF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

Polyacrylamide

Sample : Polyacrylamide, 100μL



Column : Shodex OHpak SB-807 HQ, SB-806 HQ
Eluent : 0.2M NaCl aq.
Flow rate : 0.5mL/min
Detector : RI
MALS(Multi angle laser light scattering)
Column temp. : 30℃

Multimode columns

Features

Asahipak GS-HQ

- SEC mode is the main mode
- Multimode columns for reversed phase, HILIC, and ion exchange modes are available depending on selected eluent conditions
- Suitable for the separation of peptides or nucleic acids with similar molecular weights
- Suitable for desalting samples or substituting buffer in protein analysis

Note book No.3 News No.19, 20 Semi-micro Micro Columns p.80 Preparative Columns p.86

Asahipak GS-320 7E

- For the analysis of nucleic acids as “Umami” and its metabolite with isocratic elution

Asahipak GS-620 7G-P

- Columns to determine mean molecular weight distribution of gelatin compliant with PAGI method (ver. 10, Japan)

MSpak GS-320

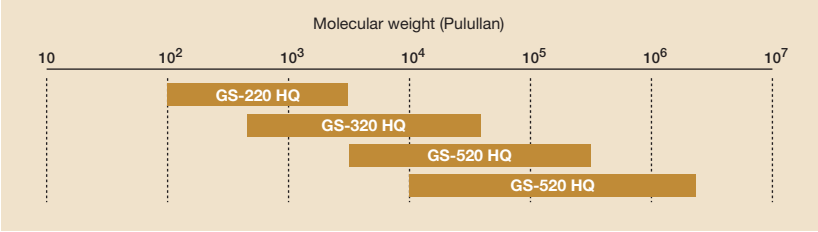
- Semi-micro columns for Asahipak GS-320 HQ
- Effective for the analysis of chemical substances in a biological sample by column switching intended to remove proteins
- Applicable to analysis using LC/MS or ICP-MS

News No.2

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (Pullulan)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7600005	**Asahipak GS-220 HQ**	≥ 19,000	3,000*	6	150	**7.5 × 300**	H_2O/CH_3OH=70/30
F7600006	**Asahipak GS-320 HQ**	≥ 19,000	40,000	6	400	**7.5 × 300**	H_2O/CH_3OH=70/30
F7600007	**Asahipak GS-520 HQ**	≥ 18,000	300,000	7	2,000	**7.5 × 300**	H_2O/CH_3OH=70/30
F7600008	**Asahipak GS-620 HQ**	≥ 18,000	(2,000,000)**	7	7,000	**7.5 × 300**	H_2O/CH_3OH=70/30
F6710019	**Asahipak GS-2G 7B**	(guard column)	–	9	–	**7.5 × 50**	H_2O/CH_3OH=70/30

Molecular weight range with Pullulan (eluent : ultrapure water)



Base Material : Polyvinyl alcohol
Usable pH range : pH2~12
(GS-220 HQ : pH 2~9)
Usable concentration of methanol is up to 100%
(GS-220 HQ up to 30%)
Usable concentration of acetonitrile is up to 50%
* PEG equivalent
**( )Estimated value

Columns for the analysis of nucleic acids as “Umami”

Product Code	Product Name	Scope of application	Column Size (mm) I.D. x L	Shipping Solvent
F7610005	**Asahipak GS-320 7E**	“Umami” (nucleic acids)	**7.5 × 250**	H_2O/CH_3OH=70/30
F6710019	**Asahipak GS-2G 7B**	(guard column)	**7.5 × 50**	H_2O/CH_3OH=70/30

Columns to determine the molecular weight distribution of gelatin

Product Code	Product Name	Scope of application	Column Size (mm) I.D. x L	Shipping Solvent
F7600023	**Asahipak GS-620 7G-P**	Gelatin for photo film	**7.5 × 500**	H_2O/CH_3OH=70/30
F6710019	**Asahipak GS-2G 7B**	(guard column)	**7.5 × 50**	H_2O/CH_3OH=70/30

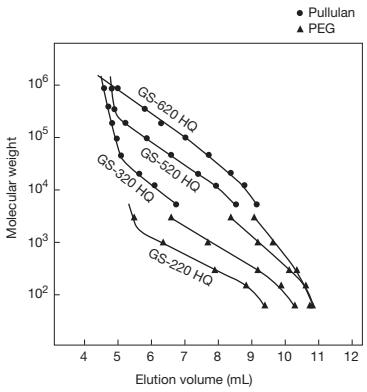
Semi-micro columns

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7600130	**MSpak GS-320 4B**	≥ 2,000	6	400	**4.6 × 50**	H_2O
F7600140	**MSpak GS-320 4D**	≥ 7,000	6	400	**4.6 × 150**	H_2O
F7600150	**MSpak GS-320 2D**	≥ 4,000	6	400	**2.0 ×1 50**	H_2O

Calibration Standards See page 63 for Calibration Standards

*Contact Shodex or our distributors near you for customized columns.

Calibration curves for GS-HQ series using pullulan and PEG



Column : Shodex Asahipak GS-HQ series
Eluent : H_2O
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 30℃

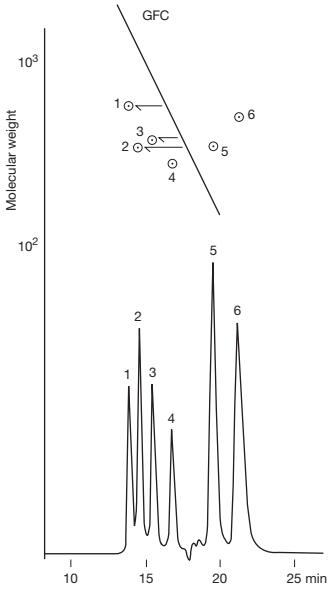
Peptides

GS-HQ columns can be used not only for SEC (GFC) in an aqueous system, but also for multimodal analysis where hydrophobic interaction and ionic interaction are used together as separation criteria, under certain conditions of the eluent. This results in unprecedented separation analysis.
GS-HQ columns are excellent in the performance for separating hydrophilic peptides, in particular, acidic or basic peptides, from each other.

Sample :

No.		MW	Σf	pI
1	Val-Glu-Glu-Ala-Glu	576	1.78	3.02
2	Glu-Ala-Glu	347	0.39	3.12
3	Val-Glu-Ser-Glu	390	0.83	3.12
4	Arg-Asp	289	0.68	6.75
5	Gly-His-Lys	340	0.29	9.95
6	Arg-Pro-Lys-Pro	497	3.24	11.44

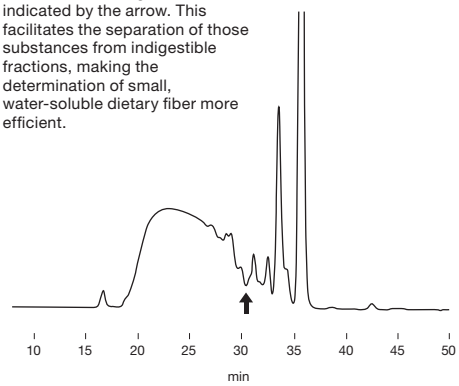
Σf : Hydrophobic parameter
pI : Isoelectric point



Column : Shodex Asahipak GS-320 HQ
Eluent : 50mM Ammonium acetate buffer(pH7.0)
Flow rate : 0.5mL/min
Detector : UV(220nm)
Column temp. : 30℃

Low molecular weight, water-soluble dietary fiber

Monosaccharides, disaccharides, and sugar alcohols are eluted with retention times larger than that indicated by the arrow. This facilitates the separation of those substances from indigestible fractions, making the determination of small, water-soluble dietary fiber more efficient.

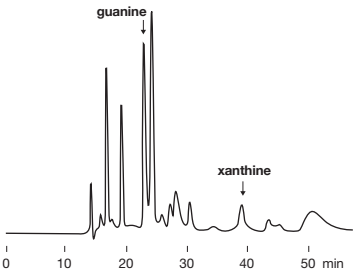


Column : Shodex Asahipak GS-220 HQ x 2
Eluent : H_2O
Flow rate : 0.5mL/min
Detector : RI
Column temp. : 60℃

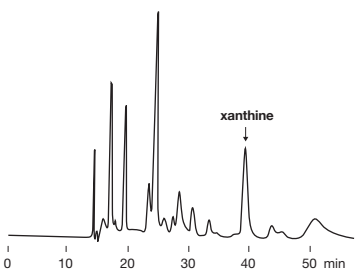
Analysis of the purine base in beers

Purine bodies in food are analyzed after being neutralized to a purine base by hydrolyzing the homogenized and freeze-dried food with a 70% perchloric acid. This section presents an example of analysis of purine base in ordinary beer and purine base in beer treated with guanase (an enzyme that degrades guanine to xanthine). The following data indicates that guanine was decreased and xanthine was increased by guanase.

Normal beer



Guanase treated beer



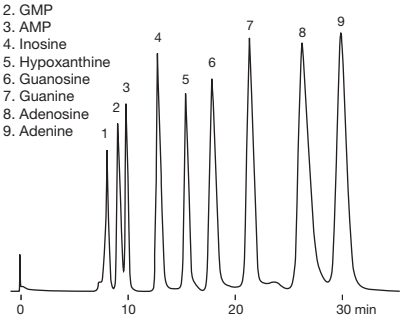
Column : Shodex Asahipak GS-320 HQ
Eluent : 150mM Sodium phosphate buffer(pH2.5)
Flow rate : 0.6mL/min
Detector : UV(260nm)
Column temp. : 35℃

Data provided by Prof. Kiyoko Kaneko,
Faculty of Pharmaceutical Sciences,
Teikyo University

"Umami"

A multimode column GS-320 7E supports an easy and simultaneous analysis of major nucleic acids that are present in taste components, i.e., IMP, GMP, and AMP, and derivatives thereof with isocratic elution.

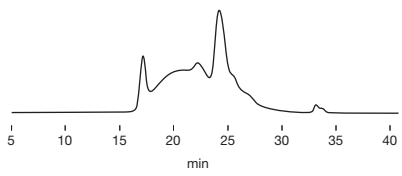
Sample :
1. IMP
2. GMP
3. AMP
4. Inosine
5. Hypoxanthine
6. Guanosine
7. Guanine
8. Adenosine
9. Adenine



Column : Shodex Asahipak GS-320 7E
Eluent : 10mM Sodium phosphate buffer(pH5.0)
Flow rate : 1.0mL/min
Detector : UV(260nm)
Column temp. : 30℃

Gelatin analysis with PAGI method

Sample : 100μL
Gelatin(Koepff 16922), 0.2%



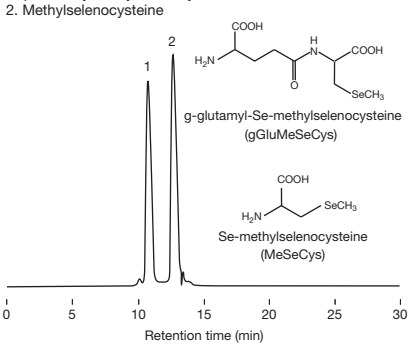
Column : Shodex Asahipak GS-620 7G-P x 2
Eluent : 0.1M KH_2PO_4 aq./0.1M Na_2HPO_4 aq. =50/50
Flow rate : 1.0mL/min
Detector : UV(230nm)
Column temp. : 50℃

High sensitivity analysis of metal-binding amino acids

Sample : 100nL
1. γ-Glutamylmethylselenocysteine
2. Methylselenocysteine

g-glutamyl-Se-methylselenocysteine
(gGluMeSeCys)

Se-methylselenocysteine
(MeSeCys)



Column : Shodex GS320A-M5D
Eluent : 50mM CH_3COONH_4 buffer(pH6.5)
Flow rate : 2.0μL/min
Detector : ICP-MS(Se at m/z=82)

Data provided by Yasumitsu Ogra,
Professor of Showa Pharmaceutical University

Aqueous/Organic SEC columns

Features

Asahipak GF-HQ

- Polymer-based SEC column exhibits solvent durability
- Supports both aqueous and organic solvents

News No.2 Semi-micro Micro Columns p.81 Preparative Columns p.86

MSpak GF-310

- Semi-micro columns for Asahipak GF-310 HQ
- Effective for the analysis of chemical substances in biological samples by column switching intending to remove proteins
- Useful for LC/MS analysis
- Suitable for the analysis of surfactants

News No.2

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (Pullulan)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7600001	**Asahipak GF-310 HQ**	≥ 19,000	40,000	5	400	**7.5 × 300**	H_2O/CH_3OH=70/30
F7600002	**Asahipak GF-510 HQ**	≥ 19,000	300,000	5	2,000	**7.5 × 300**	H_2O/CH_3OH=70/30
F7600003	**Asahipak GF-710 HQ**	≥ 11,000	(10,000,000)*	9	10,000	**7.5 × 300**	H_2O/CH_3OH=70/30
F7600004	**Asahipak GF-7M HQ**	≥ 13,000	(10,000,000)*	9	10,000	**7.5 × 300**	H_2O/CH_3OH=70/30
F6710018	**Asahipak GF-1G 7B**	(guard column)	–	9	–	**7.5 × 50**	H_2O/CH_3OH=70/30

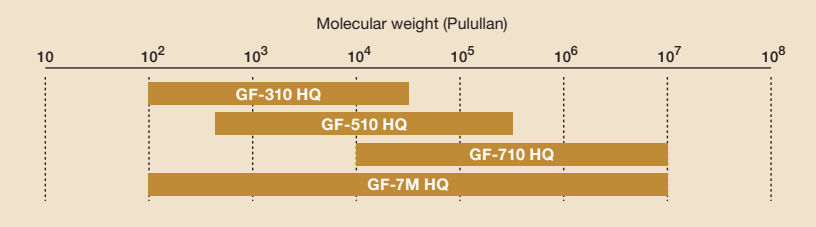
GF-7M HQ is a mixed-gel column capable of analysis of samples over a wide range of molecular weight distribution.

Base Material : Polyvinyl alcohol
Usable pH range : pH2~9
*( )Estimated value

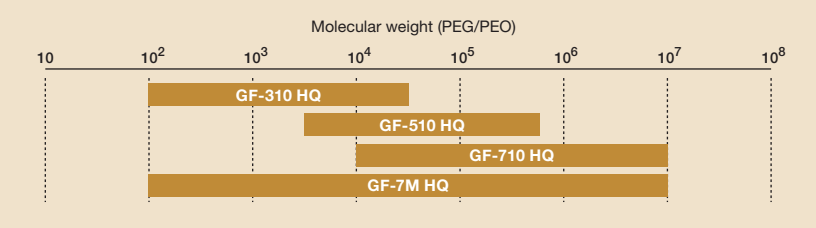
Usable solvents

Water (sodium concentration)	0~0.5M	○
Methanol	0~100%	○
Ethanol	0~100%	○
Acetonitrile	0~100%	○
THF	0~100%	○
DMF	0~100%	○
Acetone	0~100%	○
Chloroform	0~100%	○
Ethylacetate	0~100%	○
DMSO	0~50%	○
DMSO	51~100%	×

Molecular weight range with pullulan (eluent : ultrapure water)



Molecular weight range with PEG/PEO (eluent : DMF)



Note : The solvents used for preparative columns GF-710 HQ (GS-710 20F, 20G) are water and methanol.
Selection of GSM-700 20F or 20G is recommended when other solvents are used for scale-up testing with GF-710 HQ.

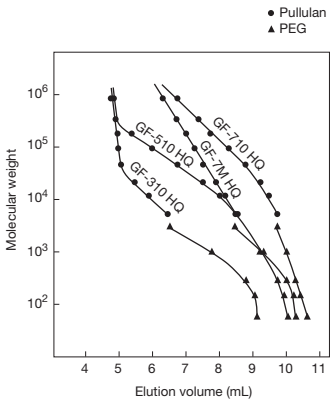
Semi-micro columns

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7600100	**MSpak GF-310 4B**	≥ 3,000	5	400	**4.6 × 50**	H_2O
F7600110	**MSpak GF-310 4D**	≥ 10,000	5	400	**4.6 × 150**	H_2O
F7600024	**MSpak GF-310 4E**	≥ 16,000	5	400	**4.6 × 250**	H_2O
F7600120	**MSpak GF-310 2D**	≥ 5,500	5	400	**2.0 × 150**	H_2O

Calibration Standards See page 63 for Calibration Standards

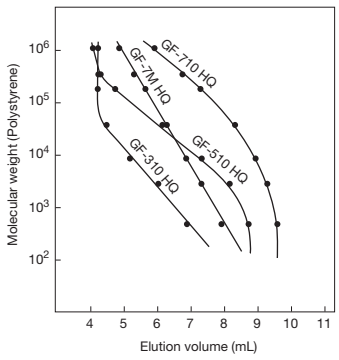
*Contact Shodex or our distributors near you for customized columns.

Calibration curves for GF-HQ series using pullulan and PEG



Column : Shodex Asahipak GF-HQ series
Eluent : H_2O
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 30°C

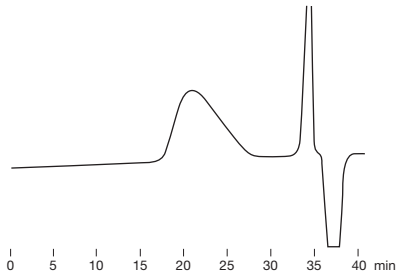
Calibration curves for GF-HQ series using polystyrene



Column : Shodex Asahipak GF-HQ series
Eluent : Chloroform
Flow rate : 0.6mL/min
Detector : UV(254nm)
Column temp. : 30°C

Polyacrylonitrile

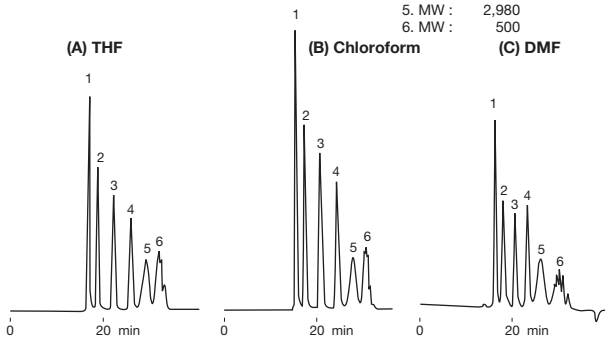
Sample : Polyacrylonitrile 0.1% (w/v), 100µL



Column : Shodex Asahipak GF-710 HQ x 2
Eluent : 20mM LiBr in DMF
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 40°C

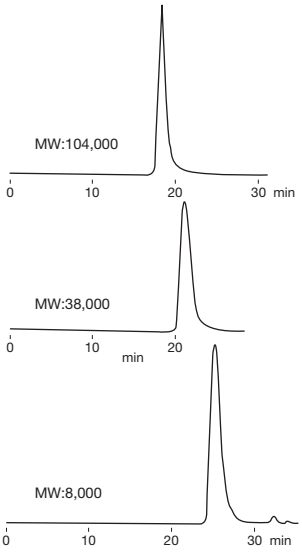
Comparison of standard polystyrene separation using various solvent

Sample : 1mg/mL each, 50µL
Polystyrene
1. MW : 1,090,000
2. MW : 190,000
3. MW : 37,900
4. MW : 9,100
5. MW : 2,980
6. MW : 500



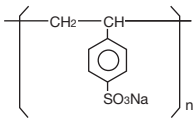
Column : Shodex Asahipak GF-310 HQ + GF-510 HQ
Eluent : (A); THF, (B); Chloroform, (C); DMF
Flow rate : 0.5mL/min
Detector : (A),(B) UV(254nm), (C) UV(270nm)
Column temp. : 30°C

Sodium polystylene sulfonate



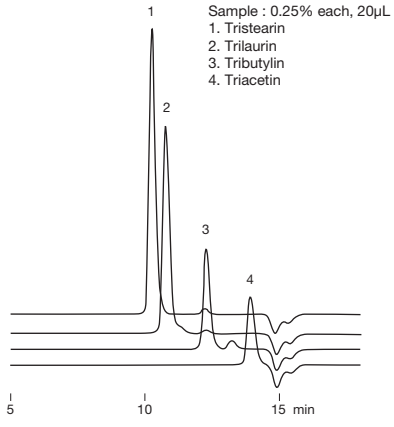
Polymers having both hydrophobic and hydrophilic moieties may exhibit hydrophobic interactions with packing materials. When using such polymers, SEC analysis can be performed by eliminating the hydrophobic interaction through the addition of organic solvents to the eluent.

Sample : 1mg/mL each, 50µL
Sodium polystylene sulfonate



Column : Shodex Asahipak GF-510 HQ
Eluent : 50mM LiCl aq./CH_3CN =60/40
Flow rate : 0.6mL/min
Detector : UV(254nm)
Column temp. : 30°C

Triglycerides



Column : Shodex Asahipak GF-310 HQ
Eluent : THF
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 30°C

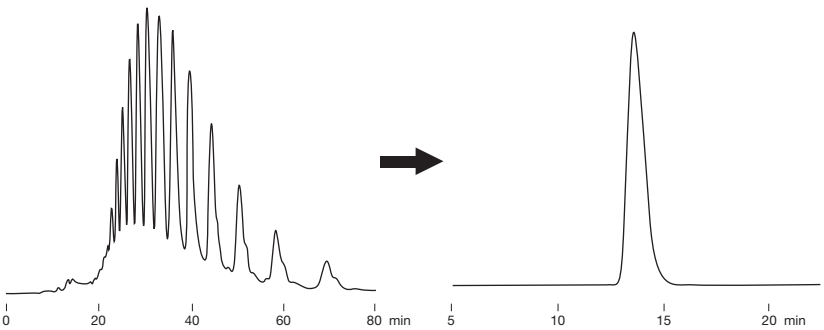
Nonylphenol ethoxylate

GF-310 column is suitable for qualitative analysis and quantitative analysis of surfactants to be performed by adjusting the acetonitrile concentration in the eluent.

Sample :
100mg/L Nonylphenol ethoxylate, 20µL

(A) Eluent : H_2O/CH_3CN=70/30

(B) Eluent : CH_3CN



Column : Shodex Asahipak GF-310 HQ
Eluent : (A); H_2O/CH_3CN=70/30, (B); CH_3CN
Flow rate : 0.6mL/min
Detector : UV(220nm)
Column temp. : 40°C

Organic SEC (GPC) columns (General Analysis) : THF, chloroform

Features

KF-800, K-800

- Standard organic solvent SEC (GPC) column
- Supports a wide range of applications from low to high-molecular-weight compounds

Preparative Columns p.86, 87

Standard columns

KF-800 series : Shipping solvent tetrahydrofuran(THF)

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PS)	Particle Size (µm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028010	GPC KF-801	≥ 18,000	1,500	6	50	8.0 × 300
F6028020	GPC KF-802	≥ 18,000	5,000	6	150	8.0 × 300
F6028025	GPC KF-802.5	≥ 18,000	20,000	6	300	8.0 × 300
F6028030	GPC KF-803	≥ 18,000	70,000	6	500	8.0 × 300
F6027030	GPC KF-803L	≥ 18,000	70,000	6	500	8.0 × 300
F6028040	GPC KF-804	≥ 18,000	400,000	7	1,500	8.0 × 300
F6027040	GPC KF-804L	≥ 18,000	400,000	7	1,500	8.0 × 300
F6028050	GPC KF-805	≥ 11,000	4,000,000	10	5,000	8.0 × 300
F6027050	GPC KF-805L	≥ 11,000	4,000,000	10	5,000	8.0 × 300
F6028060	GPC KF-806	≥ 11,000	(20,000,000)*	10	10,000	8.0 × 300
F6028090	GPC KF-806M	≥ 13,000	(20,000,000)*	10	10,000	8.0 × 300
F6027060	GPC KF-806L	≥ 11,000	(20,000,000)*	10	10,000	8.0 × 300
F6028070	GPC KF-807	≥ 6,000	(200,000,000)*	18	20,000	8.0 × 300
F6027070	GPC KF-807L	≥ 6,000	(200,000,000)*	18	20,000	8.0 × 300
F6700300	GPC KF-G	(guard column)	–	8	–	4.6 × 10
F6709350	GPC KF-800D	(solvent-peak separation column)	–	10	–	8.0 × 100

*( )Estimated value

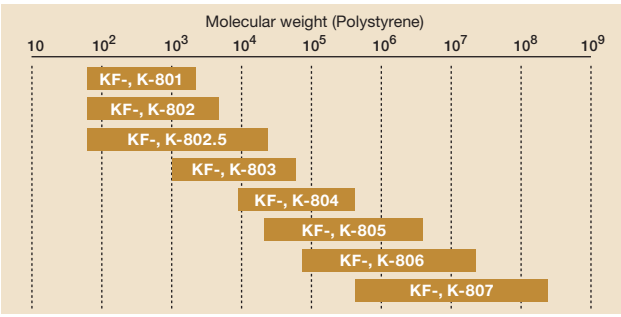
K-800 series : Shipping solvent chloroform

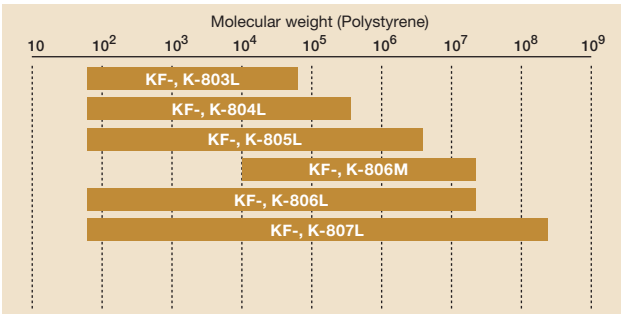
Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PS)	Particle Size (µm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028110	GPC K-801	≥ 18,000	1,500	6	50	8.0 × 300
F6028120	GPC K-802	≥ 18,000	5,000	6	150	8.0 × 300
F6028125	GPC K-802.5	≥ 18,000	20,000	6	300	8.0 × 300
F6028130	GPC K-803	≥ 18,000	70,000	6	500	8.0 × 300
F6028194	GPC K-803L	≥ 18,000	70,000	6	500	8.0 × 300
F6028140	GPC K-804	≥ 18,000	400,000	7	1,500	8.0 × 300
F6028195	GPC K-804L	≥ 18,000	400,000	7	1,500	8.0 × 300
F6028150	GPC K-805	≥ 11,000	4,000,000	10	5,000	8.0 × 300
F6028196	GPC K-805L	≥ 11,000	4,000,000	10	5,000	8.0 × 300
F6028160	GPC K-806	≥ 11,000	(20,000,000)*	10	10,000	8.0 × 300
F6028190	GPC K-806M	≥ 13,000	(20,000,000)*	10	10,000	8.0 × 300
F6028197	GPC K-806L	≥ 11,000	(20,000,000)*	10	10,000	8.0 × 300
F6028170	GPC K-807	≥ 6,000	(200,000,000)*	18	20,000	8.0 × 300
F6028198	GPC K-807L	≥ 6,000	(200,000,000)*	18	20,000	8.0 × 300
F6700401	GPC K-G	(guard column)	–	8	–	4.6 × 10
F6709450	GPC K-800D	(solvent-peak separation column)	–	10	–	8.0 × 100

* See page 54 for details of the solvent-peak separation columns. The columns with 'L'or 'M' at the end of the column name are mixed-gel columns capable of a wide molecular weight distribution range of samples.

*( )Estimated value

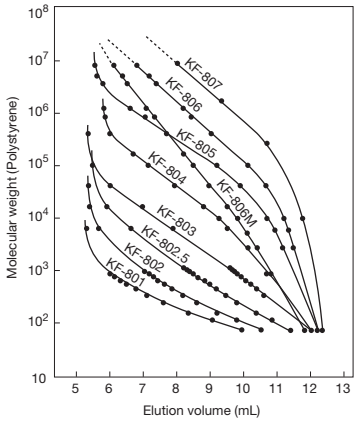
Molecular weight range with polystyrene (eluent KF-800 series : THF, K-800 series : chloroform)





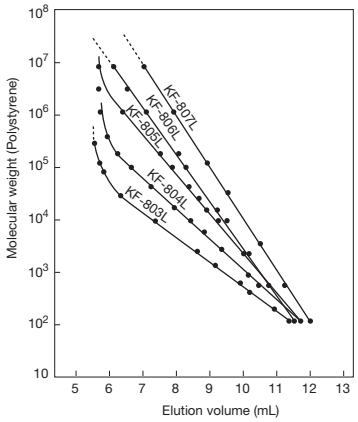
*Contact Shodex or our distributors near you for customized columns.

Calibration curves for KF-800 series using PS standard



Column : Shodex GPC KF-800 series
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : Room temp.

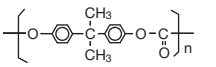
Calibration curves for KF-800L (linear type) series using PS standard

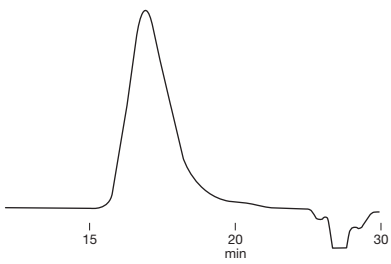


Column : Shodex GPC KF-800L series
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : Room temp.

Polycarbonate resin

Sample : Polycarbonate resin 0.1%, 100µL

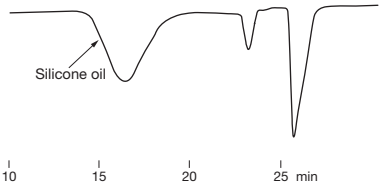




Column : Shodex GPC KF-806L x 2
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Silicon oil

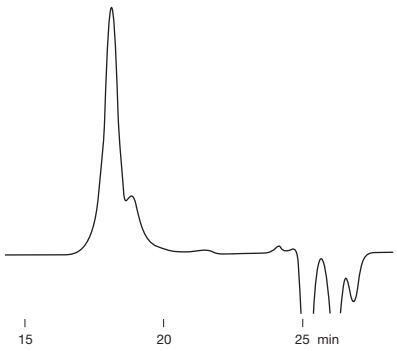
Sample : Silicone oil 0.1%, 200µL



Column : Shodex GPC K-806M x 2
Eluent : Toluene
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 45°C

Styrene isoprene ABA block copolymer

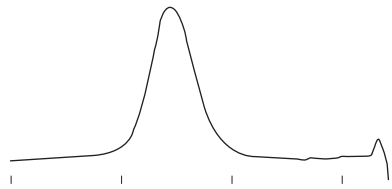
Sample : Styrene isoprene ABA block copolymer



Column : Shodex GPC KF-806M x 2
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 30°C

Bionolle™ (Polybutylene succinate/adipate)

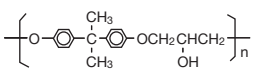
Sample : 100µL
Polybutylene succinate/adipate 0.2%

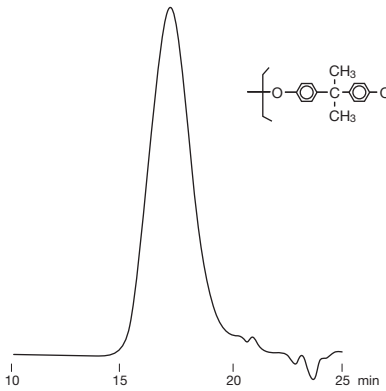


Column : Shodex GPC K-806M x 2 + K-801
Eluent : Chloroform
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Phenoxy resin

Sample : Phenoxy resin 0.1%, 100µL

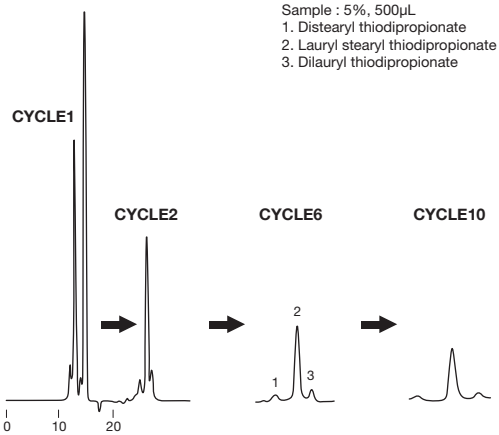




Column : Shodex GPC KF-806L x 2
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Recycling fractionation of lauryl stearyl thiodipropionate

Sample : 5%, 500µL
1. Distearyl thiodipropionate
2. Lauryl stearyl thiodipropionate
3. Dilauryl thiodipropionate



Column : Shodex GPC K-LG + K-2001
Eluent : Chloroform
Flow rate : 3.0mL/min
Detector : RI
Column temp. : 50°C

Organic SEC (GPC) columns (General Analysis) : DMF

Features

KD-800
- Standard organic solvent SEC (GPC) column
- Supports a wide range of applications from low to high-molecular-weight compounds

Standard columns

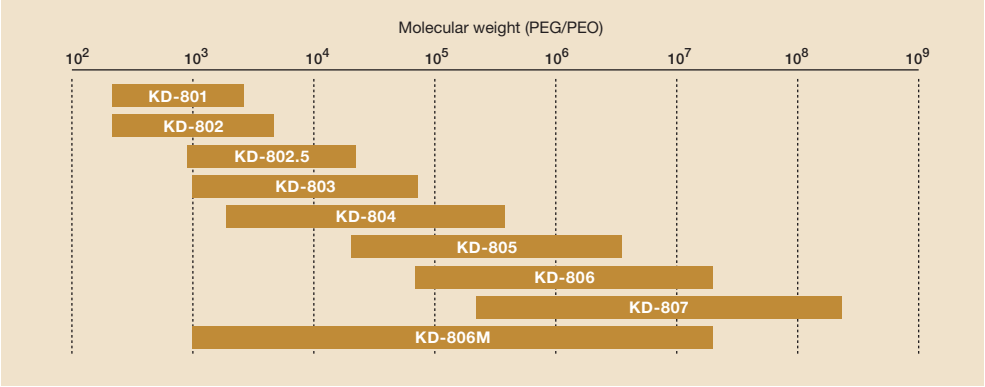
KD-800 series : Shipping solvent dimethylformamide(DMF)

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PEG/PEO)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028210	**GPC KD-801**	≥ 17,000	2,500	6	50	**8.0 × 300**
F6028220	**GPC KD-802**	≥ 17,000	5,000	6	150	**8.0 × 300**
F6028225	**GPC KD-802.5**	≥ 17,000	20,000	6	300	**8.0 × 300**
F6028230	**GPC KD-803**	≥ 17,000	70,000	6	500	**8.0 × 300**
F6028240	**GPC KD-804**	≥ 17,000	400,000	7	1,500	**8.0 × 300**
F6028250	**GPC KD-805**	≥ 11,000	4,000,000	10	5,000	**8.0 × 300**
F6028260	**GPC KD-806**	≥ 11,000	(20,000,000)*	10	10,000	**8.0 × 300**
F6028290	**GPC KD-806M**	≥ 13,000	(20,000,000)*	10	10,000	**8.0 × 300**
F6028270	**GPC KD-807**	≥ 6,000	(200,000,000)*	18	20,000	**8.0 × 300**
F6700411	**GPC KD-G**	(guard column)	–	8	–	**4.6 × 10**

* The columns with 'M' at the end of the column name are mixed-gel columns capable of a wide molecular weight distribution range of samples.

*( )Estimated value

Molecular weight range with PEG/PEO (eluent : DMF)



Solvent-peak separation columns for organic SEC (GPC)

Features

KF-800D, K-800D
- Shifting the elution of monomers, polymer additives and solvent peak in low-molecular-weight region
- Reduces interferences to calculate the molecular weight distribution of polymers or oligomers
- Use this type of column in combination with a linear column

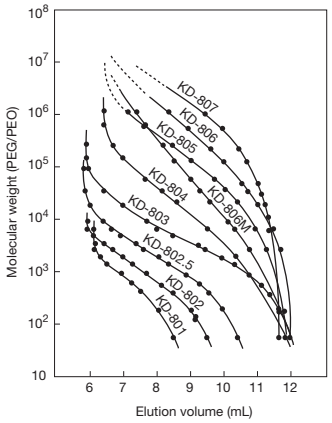
Solvent-peak separation columns

Product Code	Product Name	Column Combination	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6709350	**GPC KF-800D**	KF-805L, 806L, 806M, 807L	10	**8.0 × 100**	THF
F6709450	**GPC K-800D**	K-805L, 806L, 806M, 807L	10	**8.0 × 100**	chloroform

See page 63 for Calibration Standards

*Contact Shodex or our distributors near you for customized columns.

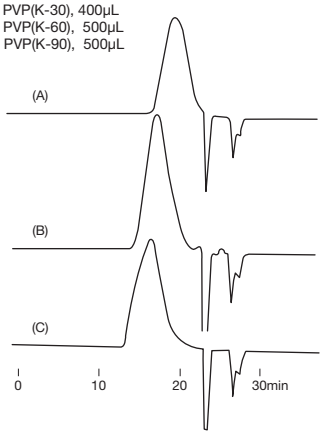
Calibration curves for KD-800 series using PEG/PEO standard



Column : Shodex GPC KD-800 series
Eluent : DMF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 50℃

Polyvinylpyrrolidone

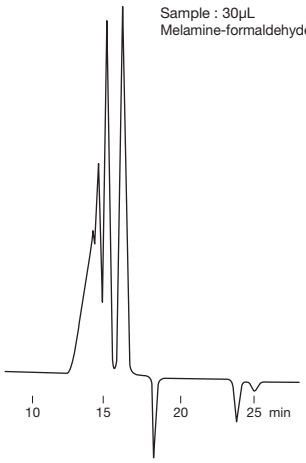
Sample : Polyvinylpyrrolidone(PVP) 0.2% each
(A) PVP(K-30), 400μL
(B) PVP(K-60), 500μL
(C) PVP(K-90), 500μL



Column : Shodex GPC KD-806M x 2
Eluent : 10mM LiBr in DMF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 50℃

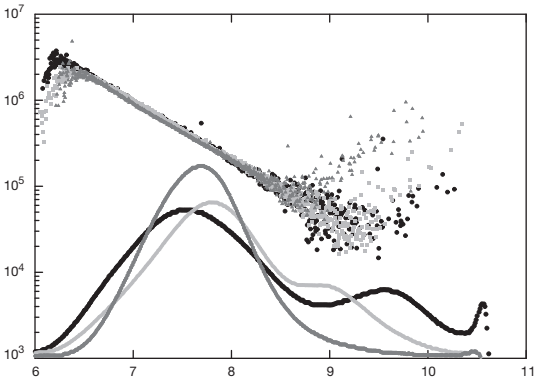
Melamine formaldehyde resin

Sample : 30μL
Melamine-formaldehyde resin 1%



Column : Shodex GPC KD-802 x 2
Eluent : 10mM LiBr in DMF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 50℃

Celluloses



Sample : Cellulose ca. 0.05% each
100μL

Cellulose is known to be difficult to dissolve. A cellulose solution is prepared by repeating solvent replacement. It is reported that the long time required for dissolution (1 to 60 days), which depends on solvent type, the crystallinity and molecular weight of the sample.

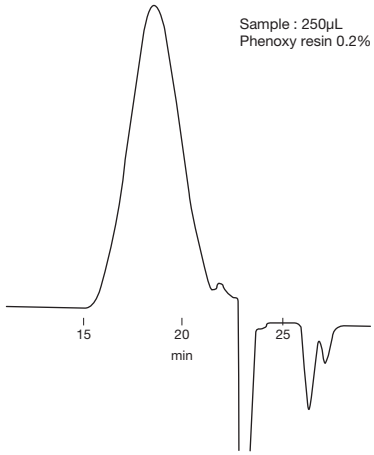
Column : Shodex GPC KD-806M
Eluent : 1% LiCl in DMI
Flow rate : 0.5mL/min
Detector : MALS, RI
Column temp. : 60℃

* DMI 1,3-dimethyl-2-imidazolidinone

**Data provided by Mr. Masahiro Yanagisawa,
Isogai Laboratory,
Graduate School of Agricultural and Life Sciences,
University of Tokyo.**

Phenoxy resin

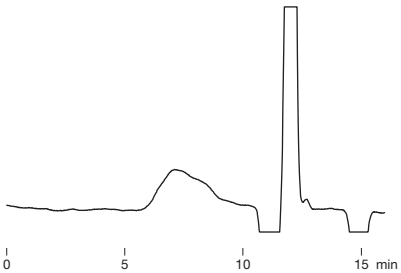
Sample : 250μL
Phenoxy resin 0.2%



Column : Shodex GPC KD-806M x 2
Eluent : 10mM LiBr in DMF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 50℃

Potato starch

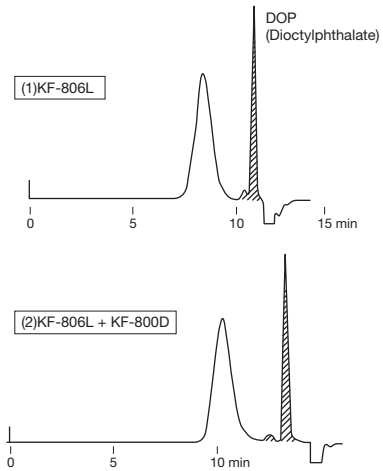
Sample : 100μL
Potato starch in DMSO 0.1%
* solved at 80℃

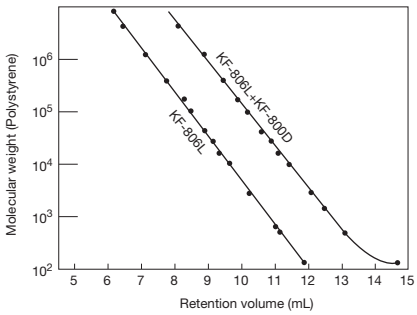


Column : Shodex GPC KD-806M
Eluent : 10mM LiBr in DMSO/DMF=75/25
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 50℃

Effects of solvent-peak separation column

Sample : Polyvinylchloride





Column : (1) Shodex GPC KF-806L
(2) Shodex GPC KF-806L + KF-800D
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI

Organic SEC (GPC) columns : Rapid Analysis, High Performance Analysis

Features

KF-600

- Approximately half of the analysis time required with standard columns
- The amount of solvent used is reduced to about a third
- Improved applicability of solvent replacement

KF-400HQ

- About 1.5-times better separation performance than standard columns, with higher resolution
- About 4-times better sensitivity than that of standard columns, supporting high sensitivity analysis
- The amount of solvent used is reduced to about a third
- Improved applicability of solvent replacement

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Rapid analysis downsized columns

KF-600 series

◎ Use of the KF-600 series with semi-micro type devices is recommended.

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PS)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028091	GPC KF-601	≥ 17,000	1,500	3	50	6.0 × 150
F6028092	GPC KF-602	≥ 17,000	5,000	3	150	6.0 × 150
F6028093	GPC KF-602.5	≥ 17,000	20,000	3	300	6.0 × 150
F6028094	GPC KF-603	≥ 17,000	70,000	3	500	6.0 × 150
F6028095	GPC KF-604	≥ 16,000	400,000	3	1,500	6.0 × 150
F6028096	GPC KF-605	≥ 7,000	4,000,000	10	5,000	6.0 × 150
F6028097	GPC KF-606	≥ 7,000	(20,000,000)*	10	10,000	6.0 × 150
F6028098	GPC KF-606M	≥ 8,000	(20,000,000)*	10	10,000	6.0 × 150
F6028099	GPC KF-607	≥ 5,000	(200,000,000)*	18	20,000	6.0 × 150
F6700300	GPC KF-G	(guard column)	–	8	–	4.6 × 10

* The columns with 'M' at the end of the column names are mixed-gel columns capable of a wide molecular weight distribution range of samples.

Shipping solvent : tetrahydrofuran(THF)
*( )Estimated value

High performance semi-micro columns

KF-400HQ series

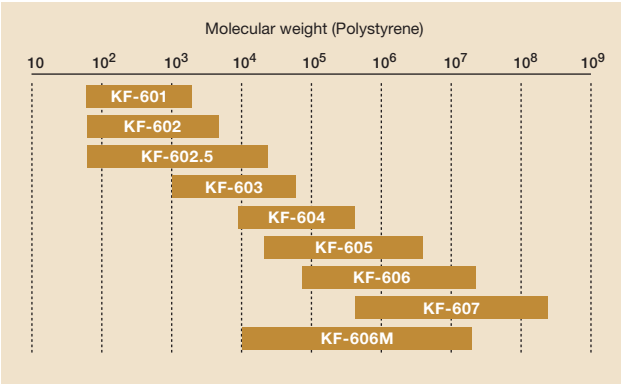
◎ Use of the KF-400HQ series with semi-micro type devices is recommended.

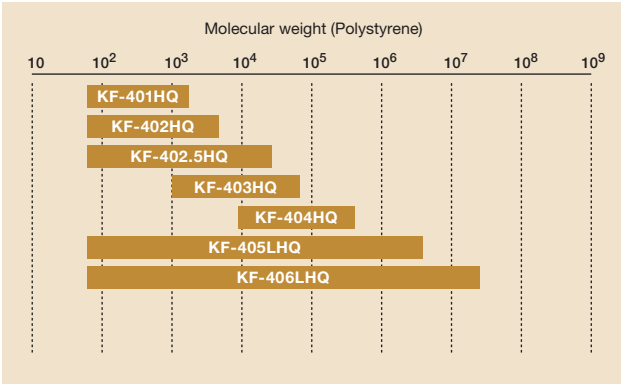
Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PS)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028111	GPC KF-401HQ	≥ 25,000	1,500	3	50	4.6 × 250
F6028112	GPC KF-402HQ	≥ 25,000	5,000	3	150	4.6 × 250
F6028114	GPC KF-402.5HQ	≥ 25,000	20,000	3	300	4.6 × 250
F6028116	GPC KF-403HQ	≥ 25,000	70,000	3	500	4.6 × 250
F6028118	GPC KF-404HQ	≥ 25,000	400,000	3	1,500	4.6 × 250
F6028119	GPC KF-405LHQ	≥ 10,000	4,000,000	10	5,000	4.6 × 250
F6028122	GPC KF-406LHQ	≥ 10,000	(20,000,000)*	10	10,000	4.6 × 250
F6700300	GPC KF-G	(guard column)	–	8	–	4.6 × 10

* The columns with 'L' at the end of the column names are mixed-gel columns capable of a wide molecular weight distribution range of samples.

Shipping solvent : tetrahydrofuran(THF)
*( )Estimated value

Molecular weight range with polystyrene (eluent : THF)

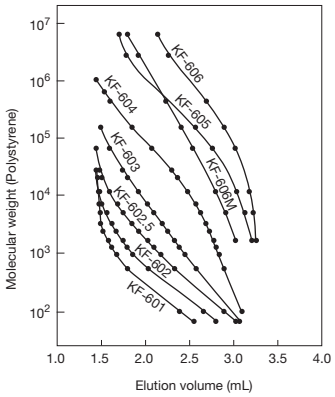




Calibration Standards See page 63 for Calibration Standards

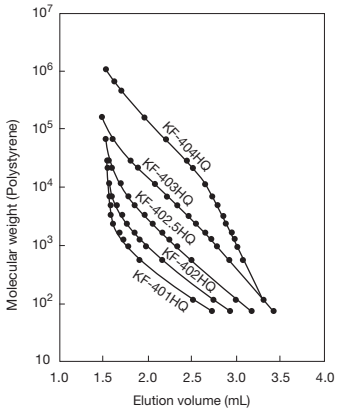
*Contact Shodex or our distributors near you for customized columns.

Calibration curves for KF-600 series using PS standard



Column : Shodex GPC KF-600 series
Eluent : THF
Flow rate : 0.5mL/min
Detector : UV(254nm)
Column temp. : Room temp.

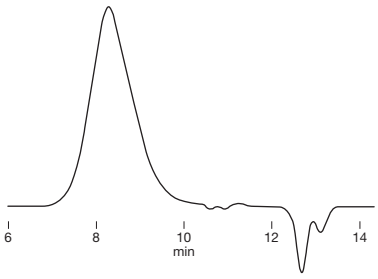
Calibration curves for KF-400HQ series using PS standard



Column : Shodex GPC KF-400HQ series
Eluent : THF
Flow rate : 0.3mL/min
Detector : UV(254nm)
Column temp. : Room temp.

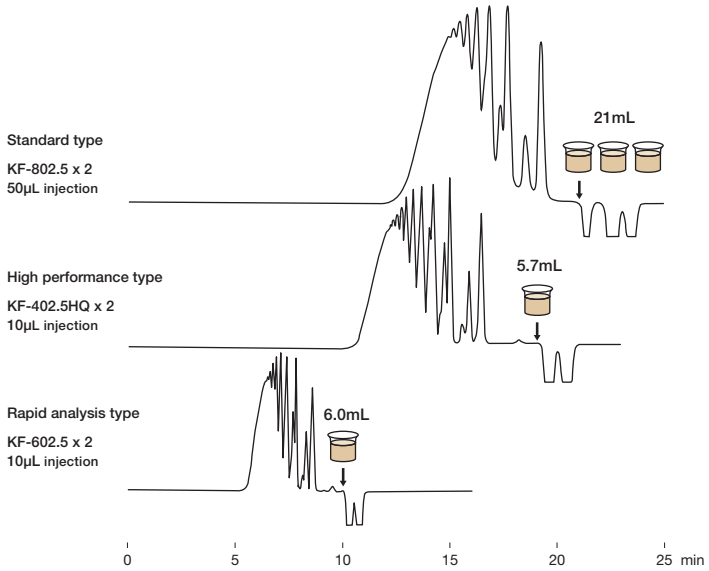
Styrene-Acrylonitrile copolymer

Sample : Styrene-acrylonitrile (30:70) copolymer



Column : Shodex GPC KF-606M x 2
Eluent : 10mM LiBr in DMF
Flow rate : 0.5mL/min
Detector : RI(small cell volume)
Column temp. : 40°C

Comparison of standard, rapid analysis and high performace semi-micro columns



Sample : EPON1001 0.2%

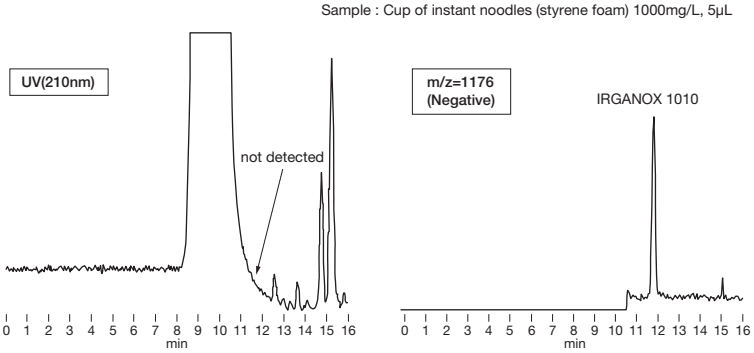
Reducing the analysis time to less than half of that for the standard column (KF-802.5) requires KF-602.5 which enables high-speed analysis. On the other hand, KF-402.5HQ has a number of theoretical plates 1.5 times larger than that of the standard column, thereby improving resolution especially in the analysis of molecules that have a small to medium molecular weight. Both columns spend solvent amounting to only about one third of the quantity spent by the standard column and are eco-friendly.

Column : Shodex GPC KF-802.5 x 2
Shodex GPC KF-402.5HQ x 2
Shodex GPC KF-602.5 x 2
Eluent : THF
Flow rate : (KF-802.5) 1.0mL/min
(KF-402.5HQ) 0.3mL/min
(KF-602.5) 0.6mL/min
Detector : (KF-802.5) RI(conventional type)
(KF-402.5HQ, KF-602.5) RI(small cell volume)
Column temp. : 40°C

LC/MS analysis of additives (Irganox1010) in polymer

The analysis of the additives that are present in polymer usually includes a pretreatment step. However, our SEC columns can separate the additives from the polymer and introduce only the low-molecular-weight fraction containing the additives into MS, thus enabling easy and highly sensitive analysis without any pretreatment step.

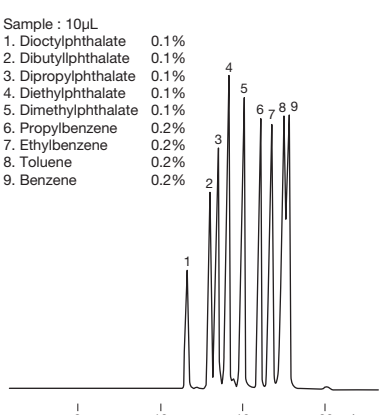
Sample : Cup of instant noodles (styrene foam) 1000mg/L, 5µL



Column : Shodex GPC KF-402HQ x 2
Eluent : THF
Flow rate : 0.3mL/min
Detector : UV(210nm), APCI-MS(SIM)
Column temp. : 40°C

Phthalates

Sample : 10µL
1. Dioctylphthalate 0.1%
2. Dibutyllphthalate 0.1%
3. Dipropylphthalate 0.1%
4. Diethylphthalate 0.1%
5. Dimethylphthalate 0.1%
6. Propylbenzene 0.2%
7. Ethylbenzene 0.2%
8. Toluene 0.2%
9. Benzene 0.2%



Column : Shodex GPC KF-401HQ x 2
Eluent : THF
Flow rate : 0.3mL/min
Detector : UV(254nm) (small cell volume)
Column temp. : 40°C

Organic SEC (GPC) columns : Linear calibration type

Features

LF

- Employs a special packing material with a wide pore size distribution (multi pore type)
- Enables analysis over a broad range of molecular weights (1 to 2 million)
- Highly linear calibration curve without inflection points
- Molecular weight distribution can be determined with high precision
- Columns for rapid analysis (LF-604) and columns for high performance analysis (LF-404) enabling reduction in solvent use are also available

Note book No.1 News No.4, 40

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PS)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6021041	**GPC LF-804**	≥ 17,000	2,000,000	6	3,000	**8.0 × 300**
F6709621	**GPC LF-G**	(guard column)	–	6	–	**4.6 × 10**

Shipping solvent : tetrahydrofuran(THF)

Rapid analysis downsized columns

◎ Use of the LF-604 series with semi-micro type devices is recommended.

F6021042	**GPC LF-604**	≥ 9,000	2,000,000	6	3,000	**6.0 × 150**
F6709621	**GPC LF-G**	(guard column)	–	6	–	**4.6 × 10**

Shipping solvent : tetrahydrofuran(THF)

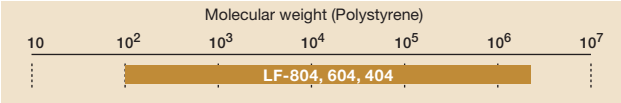
High-performance semi-micro column

◎ Use of the LF-404 series with semi-micro type devices is recommended.

F6021043	**GPC LF-404**	≥ 14,000	2,000,000	6	3,000	**4.6 × 250**
F6709621	**GPC LF-G**	(guard column)	–	6	–	**4.6 × 10**

Shipping solvent : tetrahydrofuran(THF)

Molecular weight range with polystyrene (eluent :THF)



High temperature/Ultra high temperature analysis SEC (GPC) columns

Features

HT-800

- Varied product lineup to support a wide range of molecular weights

UT-800

- Dedicated to SEC analysis at high/ultra high temperatures with a maximum usable temperature of 210˚C
- Suitable for the analysis of supermolecule-containing samples

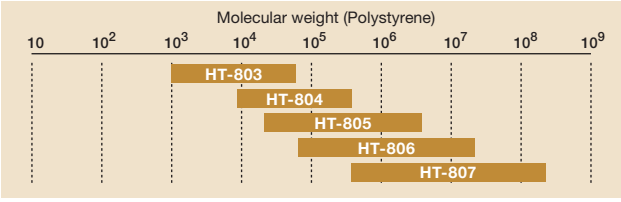
Standard columns

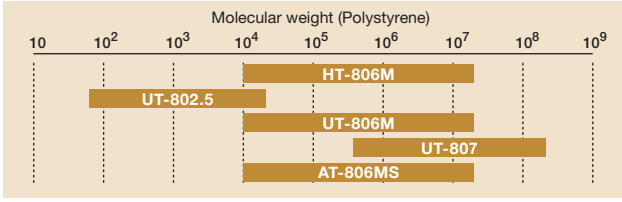
Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit * (PS)	Usable Temperature (˚C)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6208700	**GPC HT-803**	≥ 7,000	70,000	100–150	13	500	**8.0 × 300**
F6208710	**GPC HT-804**	≥ 7,000	400,000	100–150	13	1,500	**8.0 × 300**
F6208720	**GPC HT-805**	≥ 7,000	4,000,000	100–150	13	5,000	**8.0 × 300**
F6208730	**GPC HT-806**	≥ 7,000	(20,000,000)**	100–150	13	10,000	**8.0 × 300**
F6208740	**GPC HT-806M**	≥ 7,000	(20,000,000)**	100–150	13	10,000	**8.0 × 300**
F6208770	**GPC HT-807**	≥ 4,000	(200,000,000)**	100–150	18	20,000	**8.0 × 300**
F6709410	**GPC HT-G**	(guard column)	–	100–150	13	–	**8.0 × 50**
F6208600	**GPC UT-802.5**	≥ 4,400	20,000	100–210	30	300	**8.0 × 300**
F6208610	**GPC UT-806M**	≥ 4,400	(20,000,000)**	100–210	30	10,000	**8.0 × 300**
F6208620	**GPC UT-807**	≥ 3,300	(200,000,000)**	100–210	30	20,000	**8.0 × 300**
F6709400	**GPC UT-G**	(guard column)	–	100–210	30	–	**8.0 × 50**
F6208390	**GPC AT-806MS**	≥ 6,000	(20,000,000)**	Ta–150***	12	10,000	**8.0 × 250**
F6700280	**GPC AT-G**	(guard column)	–	Ta–150***	15	–	**8.0 × 50**

* The columns with 'M' at the end of the column name are mixed-gel columns capable of a wide molecular weight distribution range of samples.

Shipping solvent : toluene
*Exclusion limit was measured with THF
**( )Estimated value
*** Ta : ambient temperature

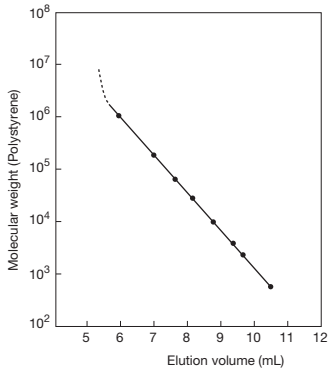
Molecular weight range with polystyrene (eluent :THF)





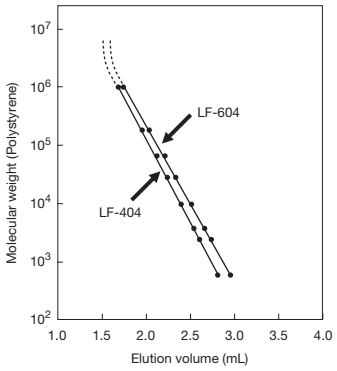
*Contact Shodex or our distributors near you for customized columns.

Calibration curve for LF-804 using PS standard



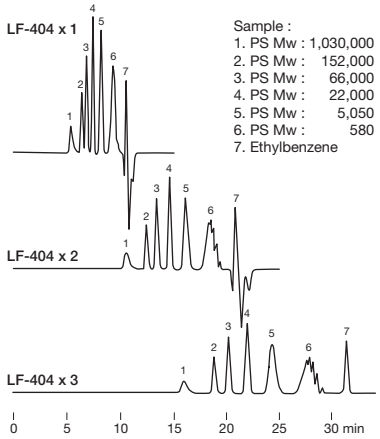
Column : Shodex GPC LF-804
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

Calibration curves for LF-604 and LF-404 using PS standard



Column : Shodex GPC LF-604, LF-404
Eluent : THF
Flow rate : (LF-604) 0.5mL/min
(LF-404) 0.3mL/min
Detector : RI(small cell volume)
Column temp. : 40℃

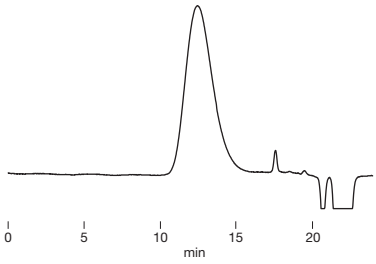
Comparison of polystyrene separation with different numbers of LF-404



Column : Shodex GPC LF-404 x n
Eluent : THF
Flow rate : 0.3mL/min
Detector : RI(small cell volume)
Column temp. : 40℃

Polyurethane

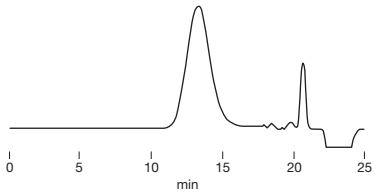
Sample : Polyurethane 0.1%, 20µL



Column : Shodex GPC LF-404 x 2
Eluent : THF
Flow rate : 0.3mL/min
Detector : RI(small cell volume)
Column temp. : 40℃

Polyamide (Nylon6/6)

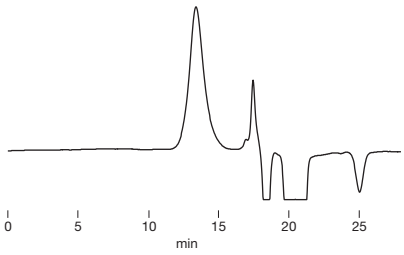
Sample : Nylon™ 6/6 0.1%, 20µL



Column : Shodex GPC LF-404
Eluent : 5mM CF_3COONa in HFIP
Flow rate : 0.15mL/min
Detector : RI(small cell volume)
Column temp. : 40℃

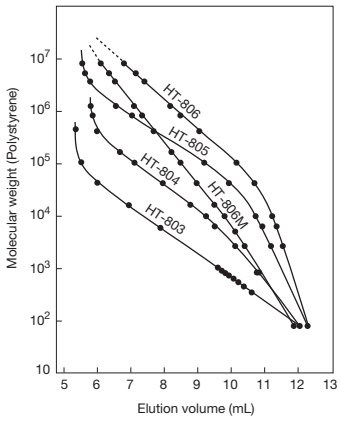
Xylan

Sample : Xylan 0.1%, 100µL



Column : Shodex GPC LF-804
Eluent : 20mM H_3PO_4 + 20mM LiBr in (DMSO/DMF=80/20)
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 50℃

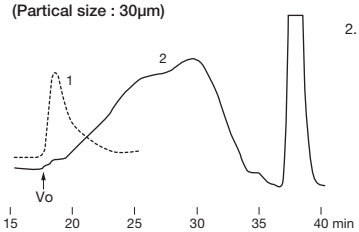
Calibration curves for HT-800 series using PS



Column : Shodex GPC HT-800 series
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : Room temp.

Effect of the particle size of material packed in high temperature SEC columns

Column : UT-806M x 3
(Partical size : 30µm)

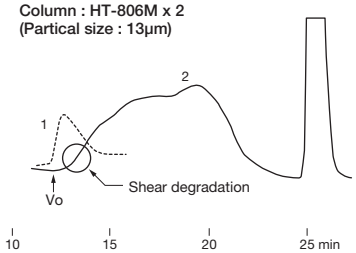


Sample :
1. Polystyrene
(MW : 20,000,000)
2. HDPE-A

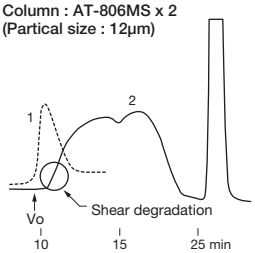
For the analysis of samples containing macromolecules, GPC UT columns are recommended because of their ability to prevent the breakage of molecular chains. High temperature SEC columns are suitable for the analysis of insoluble polymers, such as polyethylene and polypropylene.

Column : Shodex GPC UT-806M
HT-806M, AT-806MS
Eluent : 0.1% BHT in ODCB
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 140℃

Column : HT-806M x 2
(Partical size : 13µm)



Column : AT-806MS x 2
(Partical size : 12µm)



Organic SEC (GPC) columns : HFIP solvent type

Features

HFIP-800 ● Columns exclusively for use with hexafluoroisopropanol (HFIP)

HFIP-600 ● Rapid analysis, solvent-saving type

● Standard columns

HFIP-800 series

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PMMA)*	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028530	**GPC HFIP-803**	≥ 12,000	30,000	10	500	**8.0 × 300**
F6028540	**GPC HFIP-804**	≥ 12,000	100,000	7	1,500	**8.0 × 300**
F6028550	**GPC HFIP-805**	≥ 10,000	1,000,000	10	5,000	**8.0 × 300**
F6028560	**GPC HFIP-806**	≥ 10,000	(10,000,000)**	10	10,000	**8.0 × 300**
F6028590	**GPC HFIP-806M**	≥ 10,000	(10,000,000)**	10	10,000	**8.0 × 300**
F6028570	**GPC HFIP-807**	≥ 4,000	(100,000,000)**	18	20,000	**8.0 × 300**
F6700500	**GPC HFIP-LG**	(guard column)	–	15	–	**8.0 × 50**

* The columns with 'M' at the end of the column name are mixed-gel columns capable of a wide molecular weight distribution range of samples.

Shipping solvent : hexafluoroisopropanol (HFIP)
*PMMA : polymethylmethacrylate
**( )Estimated value

● Rapid analysis downsized columns

HFIP-600 series

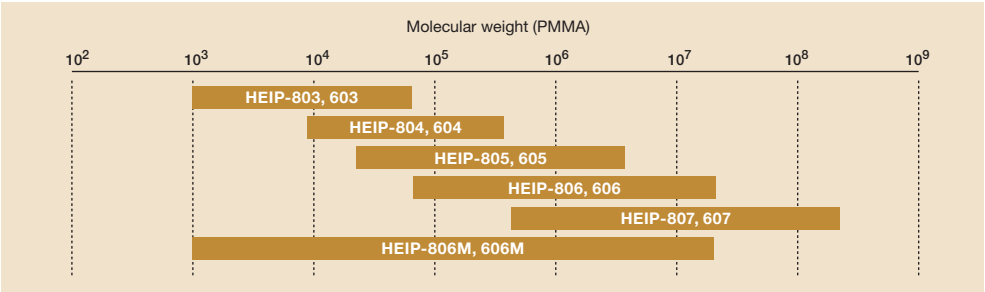
◎ Use of the HFIP-600 series with semi-micro type devices is recommended.

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PMMA)*	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6021030	**GPC HFIP-603**	≥ 12,000	30,000	3	500	**6.0 × 150**
F6021040	**GPC HFIP-604**	≥ 12,000	100,000	3	1,500	**6.0 × 150**
F6021050	**GPC HFIP-605**	≥ 5,000	1,000,000	10	5,000	**6.0 × 150**
F6021060	**GPC HFIP-606**	≥ 5,000	(10,000,000)**	10	10,000	**6.0 × 150**
F6021080	**GPC HFIP-606M**	≥ 6,000	(10,000,000)**	10	10,000	**6.0 × 150**
F6021070	**GPC HFIP-607**	≥ 3,000	(100,000,000)**	18	20,000	**6.0 × 150**
F6700511	**GPC HFIP-G**	(guard column)	–	8	–	**4.6 × 10**

* The columns with 'M' at the end of the column name are mixed-gel columns capable of a wide molecular weight distribution range of samples.

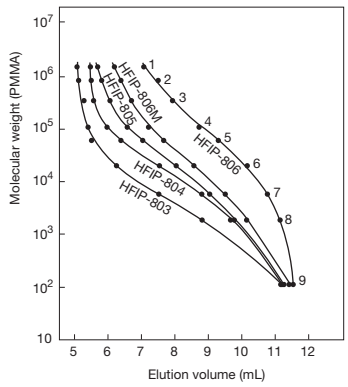
Shipping solvent : hexafluoroisopropanol (HFIP)
*PMMA : polymethylmethacrylate
**( )Estimated value

Molecular weight range with PMMA (eluent : HFIP)



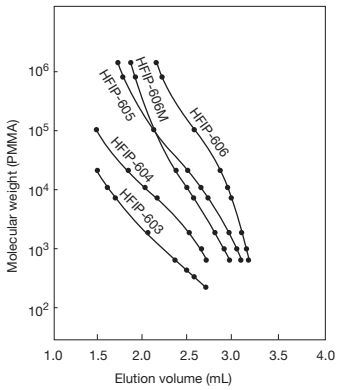
*Contact Shodex or our distributors near you for customized columns.

Calibration curves for HFIP-800 series using polymethylmethacrylate (PMMA)



Column : Shodex GPC HFIP-800 series
Eluent : HFIP
Flow rate : 1.0mL/min
Detector : RI
Column temp. : Room temp.

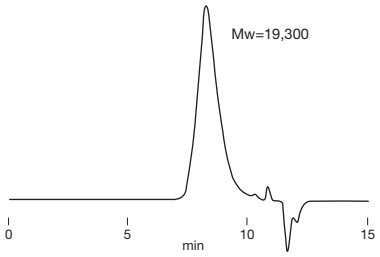
Calibration curves for HFIP-600 series using polymethylmethacrylate (PMMA)



Column : Shodex GPC HFIP-600 series
Eluent : 5mM CF_3COONa in HFIP
Detector : RI(small cell volume)
Column temp. : 40°C

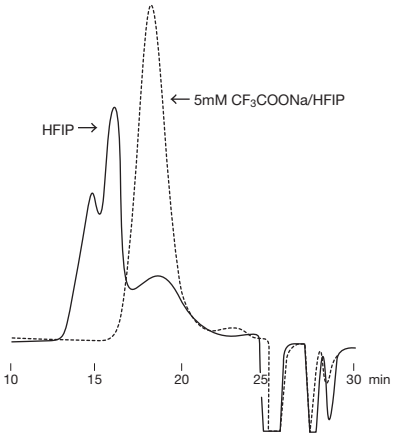
Polyethylene terephthalate (PET)

Sample : PET 0.2%, 20μL



Column : Shodex GPC HFIP-606M x 2
Eluent : 5mM CF_3COONa in HFIP
Flow rate : 0.6mL/min
Detector : RI(small cell volume)
Column temp. : 40°C

Polyamide (effect of salt addition)



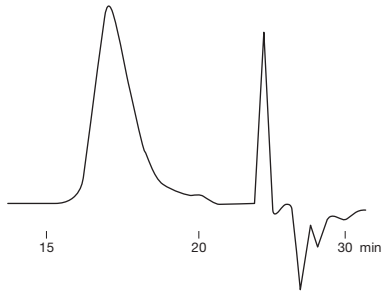
Sample : Polycaprolactum (Nylon™ 6)

In SEC analysis using HFIP some samples may yield abnormal peaks as a result of electrostatic interaction. In this case, the impact of electrostatic interaction can be removed by adding sodium trifluoroacetate to HFIP.

Column : Shodex GPC HFIP-806M x 2
Eluent : HFIP(solid line), 5mM CF_3COONa in HFIP(broken line)
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Polybutylene terephthalate (PBT)

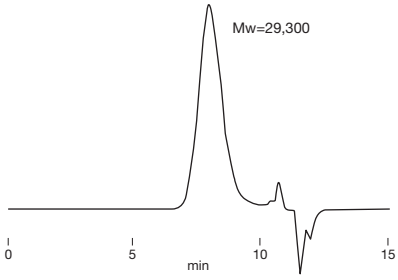
Sample : PBT 0.05%, 500μL



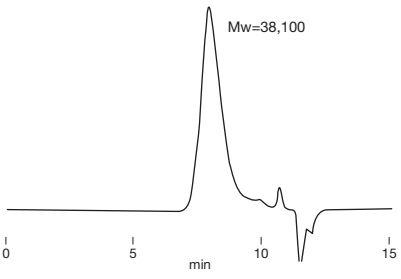
Column : Shodex GPC HFIP-805 + HFIP-803
Eluent : 5mM CF_3COONa in HFIP
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Polyamides (Nylon 6/10 and Nylon 6)

Sample : Nylon™ 6/10 0.2%, 20μL



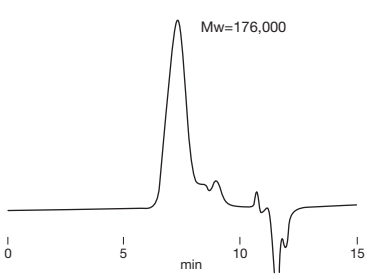
Sample : Nylon™ 6 0.2%, 20μL



Column : Shodex GPC HFIP-606M x 2
Eluent : 5mM CF_3COONa in HFIP
Flow rate : 0.6mL/min
Detector : RI(small cell volume)
Column temp. : 40°C

Polyacetal

Sample : Polyacetal 0.2%, 20μL



Column : Shodex GPC HFIP-606M x 2
Eluent : 5mM CF_3COONa in HFIP
Flow rate : 0.6mL/min
Detector : RI(small cell volume)
Column temp. : 40°C

Applicability of SEC (GPC) columns to solvent replacement

Solvent	Column Name									
	Shipping Solvent : THF							Shipping Solvent : DMF		
	KF-801	KF-802 KF-802.5 KF-803L KF-804L	KF-803	KF-804 KF-805 KF-806 KF-807 KF-806M KF-805L KF-806L KF-807L	KF-601 KF-602 KF-602.5	KF-603 KF-604 KF-605 KF-606 KF-607 KF-606M	LF-804 LF-604 LF-404	KD-801 KD-802 KD-802.5	KD-803	KD-804 KD-805 KD-806 KD-807 KD-806M
	Shipping Solvent : Chloroform				Shipping Solvent : THF					
	K-801	K-802 K-802.5 K-803L K-804L	K-803	K-804 K-805 K-806 K-807 K-806M K-805L K-806L K-807L	KF-401HQ KF-402HQ KF-402.5HQ	KF-403HQ KF-404HQ KF-405LHQ KF-406LHQ				
THF	○	○	○	○	○	○	○	×	×	○
Chloroform	○	○	○	○	○	○	○	×	×	○
Carbon tetrachloride	×	○	○	○			○	×	×	○
Benzene	○	○	○	○	○	○		×	○	○
Toluene	○	○	○	○	○	○	○	×	○	○
p-Xylene	×	○	○	○	○	○		×	○	○
o-Dichlorobenzene(ODCB)	×	×	○	○	○	○		×	○	○
Trichlorobenzene(TCB)	×	×	○	○	○	○		×	○	○
Dioxane	×	○	○	○				×	○	○
Diethyl ether	×	×	○	○				×	○	○
Ethyl acetate	×	×	○	○				×	×	○
Acetone	×	×	○	○	○	○		×	○	○
Methyl ethyl ketone	×	×	○	○	○	○	○	×	○	○
Dimethylformamide(DMF)	×	×	○	○	○ *1	○ *1	○ *1	○	○	○
Dimethylacetamide(DMAc)	×	×	○	○	○ *1	○ *1	○ *1	×	○	○
Hexafluoroisopropanol(HFIP)	×	×	×	○	×	△ *1	○ *1	×	○	○
m-Cresol	×	×	○	○				×	○	○
o-Chlorophenol	×	×	○	○				×	○	○
Quinolin	×	×	○	○				×	○	○
N-Methylpyrrolidone(NMP)	×	×	○	○	○ *1	○ *1	○ *1	×	○	○
Dimethylsulfoxide(DMSO)	×	×	×	△	△ *1	○ *1	○ *1	×	○	○
30% m-Cresol/Chloroform	×	○	○	○			○	×	○	○
30% o-Chlorophenol/Chloroform	×	○	○	○			○	×	○	○
30% HFIP/Chloroform	×	○	○	○				×	○	○
Hexane	×	×	×	×	×	×	×	×	×	×
Acetonitrile	×	×	×	×	×	×	×	×	×	×
Methanol	×	×	×	×	×	×	×	×	×	×
Water	×	×	×	×	×	×	×	×	×	×

○ : Solvent replacement possible
△ : Solvent replacement possible, but this may cause column performance to slightly deteriorate
*1 : Usable at 40°C or higher
× : Solvent replacement not possible

Calibration Standards for SEC

[Polystyrene (PS)]

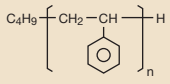
Features

- For organic solvent SEC (GPC)
- Less branched polystyrene with anionic polymerization
- Easily soluble in tetrahydrofuran (THF), chloroform, toluene, and o-dichlorobenzene

Kit type

Product Code	Product Name	Contents	MW Range
F8601105	**STANDARD SL-105**	0.5g x 10 kinds	500~22,000
F8602105	**STANDARD SM-105**	0.5g x 10 kinds	1,200~3,800,000
F8603075	**STANDARD SH-75**	0.5g x 7 kinds	590,000~7,500,000

Structural formula of S series



■ **SL-105**

Std. No.	Mp	Mw/Mn
S-20	19,800	1.02
S-11	10,700	1.02
S-6.9	6,930	1.03
S-5.0	5,030	1.03
S-4.4	4,430	1.03
S-2.9	2,900	1.03
S-1.9	1,930	1.05
S-1.2	1,200	1.07
S-1.0	1,050	1.07
S-0.5	580	1.12

■ **SM-105**

Std. No.	Mp	Mw/Mn
S-3730	3,730,000	1.04
S-2480	2,480,000	1.05
S-1230	1,230,000	1.05
S-579	579,000	1.02
S-197	197,000	1.02
S-55.1	55,100	1.03
S-31.4	31,400	1.02
S-12.8	12,800	1.02
S-3.95	3,950	1.03
S-1.20	1,200	1.07

■ **SH-105**

Std. No.	Mp	Mw/Mn
S-7450	7,450,000	1.07
S-3790	3,790,000	1.05
S-3250	3,250,000	1.04
S-2220	2,220,000	1.03
S-1820	1,820,000	1.04
S-1060	1,060,000	1.03
S-591	591,000	1.03

(Note)
Molecular weights (Mp, Mw/Mn) of each kit may vary depending on production lots.

[Polymethylmethacrylate (PMMA)]

Features

- For organic solvent SEC (GPC)
- Narrow molecular weight distribution range
- Easily soluble in hexafluoroisopropanol (HFIP) and dimethylformamide (DMF)

Kit type

Product Code	Product Name	Contents	MW Range
F8604075	**STANDARD M-75**	0.5g x 7 kinds	1,800~950,000

(Note)
Molecular weights (Mp, Mw/Mn) of each kit may vary depending on production lots.

Std. No.	Mp	Mw/Mn
M-949	949,000	1.05
M-451	451,000	1.02
M-139	139,000	1.05
M-53	52,600	1.02
M-21	20,800	1.03
M-7.1	7,100	1.08
M-1.9	1,890	1.10

[Pullulan]

Features

- For aqueous SEC (GFC)
- Unbranched pullulan standard
- High solubility in water eliminates the possibility of recrystallization

Kit type

Product Code	Product Name	Contents	MW Range
F8400000	**STANDARD P-82**	0.2g x 8 kinds	5,000~800,000

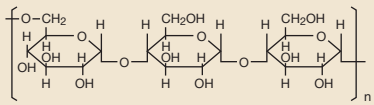
Single type

Product Code	Product Name	Contents	Mp	Mw/Mn
F8402500	NEW **STD P-2500**	0.2g	2,350,000	1.49
F8401300	NEW **STD P-1300**	0.2g	1,220,000	1.37
F8400800	**STD P-800**	0.5g	708,000	1.23
F8400400	**STD P-400**	0.5g	375,000	1.13
F8400200	**STD P-200**	0.5g	200,000	1.13
F8400100	**STD P-100**	0.5g	107,000	1.12
F8400050	**STD P-50**	0.5g	47,100	1.06
F8400020	**STD P-20**	0.5g	21,100	1.07
F8400010	**STD P-10**	0.5g	11,100	1.10
F8400005	**STD P-5**	0.5g	5,900	1.09
F8400003	**STD P-3**	0.2g	2,890	1.12
F8400002	**STD P-2**	0.2g	2,150	1.11
F8400001	**STD P-1**	0.2g	1,420	1.18

Std. No.
P-800
P-400
P-200
P-100
P-50
P-20
P-10
P-5

(Note)
Molecular weights (Mp, Mw/Mn) of each kit may vary depending on production lots.

Structural formula of P series



Column list for Pharmaceuticals and Cosmetics analysis

Pharmaceuticals, Metabolites

Product Name	Separation mode	Page
ODP2 HP	RPC	11
ET-RP1	RPC	11
RSpak DE series	RPC	11
RSpak DS series	RPC	11
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Asahipak C8P-50	RPC	10
Asahipak C4P-50	RPC	10
Silica C18M	RPC	20
Silica C18P	RPC	20
ODSpak F-411	RPC	20
Asahipak NH2P series	HILIC	13
RSpak NN series	IEC+RPC	12
USPpak MN-431	LEX+SEC	32

[Substances in bio-fluid]

Product Name	Separation mode	Page
ODP2 HP	RPC	11
Asahipak GF-310 HQ	SEC+RPC	50
MSpak GF-310	SEC+RPC	50
Asahipak GS-320 HQ	SEC+RPC	48
MSpak GS-320	SEC+RPC	48
MSpak PK	SEC+RPC	6

Moisturizers

[Polyalcohols]

Product Name	Separation mode	Page
SUGAR SC1211	LEX+HILIC	33
SUGAR SC1011	LEX+SEC	32
OHpak SB-802.5 HQ	SEC	46
SB402.5	SEC	46
Asahipak GF-310 HQ	SEC	50
MSpak GF-310	SEC	50
RSpak DE series	RPC	11

[Protein hydrolysates]

Product Name	Separation mode	Page
PROTEIN KW-802.5	SEC	44
KW402.5	SEC	44
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10

[Mucopolysaccharides]

Product Name	Separation mode	Page
OHpak SB-800 HQ series	SEC	46
SB400 series	SEC	46

Emulsifiers

Product Name	Separation mode	Page
Asahipak GF-310 HQ	SEC+RPC	50
MSpak GF-310	SEC+RPC	50
GPC KF-802	SEC	52
GPC KF-402HQ	SEC	56

Preservatives

Product Name	Separation mode	Page
RSpak DE series	RPC	11
RSpak DS series	RPC	11
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Silica C18M	RPC	20
Silica C18P	RPC	20
ODSpak F-411	RPC	20

Optical active materials

Product Name	Separation mode	Page
ORpak CDA-453 HQ	CS	22
ORpak CDB-453 HQ	CS	22
ORpak CDC-453 HQ	CS	22
ORpak CDBS-453	CS	22
ORpak CRX-853	CS	22
AFpak ABA-894	CS	22, 28

Separation Mode

RPC : Reversed phase chromatography
HILIC : Hydrophilic interaction chromatography
IEC : Ion exchange chromatography
LEX : Ligand exchange chromatography
SEC : Size exclusion chromatography
CS : Chiral Separation

Column list for Foods analysis

Nutritional ingredients

[Monosaccharides, Disaccharides, Sugar alcohols]

Product Name	Separation mode	Page
SUGAR SC1011	LEX+SEC	32
SUGAR SC1821	LEX+SEC	32
SUGAR SP0810	LEX+SEC	32
SUGAR KS-801	LEX+SEC	32
SUGAR KS-802	LEX+SEC	32
SUGAR SC1211	LEX+HILIC	33
SUGAR SZ5532	LEX+HILIC	33
RSpak DC-613	LEX+HILIC	33
Asahipak NH2P series	HILIC	13

[Oligosaccharides]

Product Name	Separation mode	Page
Asahipak GS-220 HQ	SEC	48
OHpak SB-802 HQ	SEC	46
OHpak SB-802 5HQ	SEC	46
SUGAR KS-802	SEC	32
RSpak DC-613	LEX+HILIC	33
Asahipak NH2P series	HILIC	13

[Low-molecular water-soluble fiber]

Product Name	Separation mode	Page
Asahipak GS-220 HQ	SEC	48

[Polysaccharides]

Product Name	Separation mode	Page
OHpak SB-800 HQ series	SEC	46
SUGAR KS-800 series	SEC	32

[Organic acids]

Product Name	Separation mode	Page
SUGAR SH1011	IEX+RPC	36
SUGAR SH1821	IEX+RPC	36
RSpak KC-811	IEX+RPC	36
RSpak NN series	IEX+RPC	12
IC SI-90 4E	IC	38
IC SI-50 4E	IC	38
IC SI-52 4E	IC	38
ODP2 HP	RPC	11
RSpak DE series	RPC	11

[Water soluble vitamins]

Product Name	Separation mode	Page
ODP2 HP	RPC	11
RSpak DE series	RPC	11
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Asahipak NH2P series	HILIC	13
RSpak NN series	IEC+RPC	12

[Fat-soluble vitamins]

Product Name	Separation mode	Page
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Silica 5SIL	NPC	20
GPC KF-801	SEC	52
GPC KF-401HQ	SEC	56

[Fatty acids]

Product Name	Separation mode	Page
RSpak DE series	RPC	11
RSpak RP18 series	RPC	11
Silica C18M	RPC	20
Silica C18P	RPC	20
Silica 5SIL	RPC	20
Asaipak GF-310 HQ	SEC	50
MSpak GF-310	SEC	50
GPC KF-802	SEC	52
GPC KF-402HQ	SEC	56

["Umami", Nucleic acids]

Product Name	Separation mode	Page
Asahipak GS-320 7E	IEC+SEC	48

[Amino acids]

Product Name	Separation mode	Page
CXpak P-421S	IEC	26
RSpak NN series	IEC+IEX+RPC	12

Food safety

[Food additives]

Product Name	Separation mode	Page
ET-RP1	RPC	11
RSpak DE series	RPC	11
RSpak DS series	RPC	11
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Asahipak NH2P series	HILIC	13

[Pesticides]

Product Name	Separation mode	Page
RSpak GOLF-413	RPC	12
RSpak CARB series	RPC	12
RSpak DE-413	RPC	11
IC SI-90 4E	IC	38
RSpak NN series	IEC+RPC	12

[Pretreatment of residual pesticides]

Product Name	Separation mode	Page
CLNpak EV series	SEC (GPC clean-up)	6

Separation Mode

RPC : Reversed phase chromatography
NPC : Normal phase chromatography
HILIC : Hydrophilic interaction chromatography
IEC : Ion exchange chromatography
LEX : Ligand exchange chromatography
IEX : Ion exclusion chromatography
IC : Ion chromatography
SEC : Size exclusion chromatography

Column list for Biotechnology analysis

Genomics

[Nucleobases, Nucleotides, Nucleosides]

Product Name	Separation mode	Page
Asahipak GS-320 HQ	IEC+SEC	48
MSpak GS-320	IEC+SEC	48
RSpak NN series	IEC+RPC	12
AXpak WA-624	IEC	24
RSpak DE series	RPC	11
AFpak AED-894	AFC	28
AFpak AIA-894	AFC	28
AFpak APB-894	AFC	28

[Oligo nucleic acids]

Product Name	Separation mode	Page
Asahipak GS-320 HQ	IEC+SEC	48
MSpak GS-320	IEC+SEC	48
Asahipak ES-502N 7C	IEC	24
IEC DEAE3N-4T	IEC	24
RSpak DE series	RPC	11

[DNA, RNA]

Product Name	Separation mode	Page
OHpak SB-800 HQ series	SEC	46
SB400 series	SEC	46
Asahipak GF series	SEC	50
AFpak AAF-894	AFC	28
AFpak ALS-894	AFC	28

Hormones

[Amines]

Product Name	Separation mode	Page
ODP2 HP	RPC	11
RSpak DE series	RPC	11
RSpak DS series	RPC	11
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Asahipak C8P-50	RPC	10
Asahipak C4P-50	RPC	10
Asahipak ES-502C 7C	IEC	26

[Steroids]

Product Name	Separation mode	Page
Asahipak ODP-40	RPC	11
Asahipak ODP-50	RPC	11
Asahipak NH2P series	HILIC	13
OHpak SB-802.5 HQ	SEC	46
SB402.5	SEC	46
Asahipak GF-310 HQ	SEC	50
MSpak GF-310	SEC	50

Proteomics

[Amino acids]

Product Name	Separation mode	Page
CXpak P-421S	IEC	26
ICYS-50	IEC	40
RSpak NN series	IEC+IEX+RPC	12
Asahipak GS-320 HQ	IEC+SEC	48
MSpak GS-320	IEC+SEC	48
Asahipak ODP-50	RPC	10

[Peptides, Proteins]

Product Name	Separation mode	Page
PROTEIN KW-800 series	SEC	40
KW400 series	SEC	44
Asahipak GF-HQ series	SEC	50
Asahipak GS-HQ series	SEC	48
IEC SP-825	IEC	26
IEC CM-825	IEC	26
IEC QA-825	IEC	24
IEC DEAE-825	IEC	24
Asahipak ES-502C 7C	IEC	26
Asahipak ES-502N 7C	IEC	24
IEC SP-420N	IEC	26
IEC DEAE3N-4T	IEC	24
PIKESS SP-2B	IEC	26
PIKESS DEAE-2B	IEC	24
RSpak RP18-415	RPC	11
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Asahipak C8P-50	RPC	10
Asahipak C4P-50	RPC	10
HIC PH-814	HIC	26
AFpak APH-894	AFC	28
AFpak AAB-894	AFC	28
AFpak AAP-894	AFC	28
AFpak ALS-894	AFC	28
AFpak AST-894	AFC	28

Separation Mode

RPC : Reversed phase chromatography
NPC : Normal phase chromatography
HILIC : Hydrophilic interaction chromatography
IEC : Ion exchange chromatography
HIC : Hydrophobic interaction chromatography
AFC : Affinity chromatography
LEX : Ligand exchange chromatography
IEX : Ion exclusion chromatography
SEC : Size exclusion chromatography

Column list for Biotechnology analysis

Glycomics

[Glycoproteins]

Product Name	Separation mode	Page
PROTEIN KW-800 series	SEC	44
KW400 series	SEC	44
Asahipak GF-HQ series	SEC	50
Asahipak GS-HQ series	SEC	48
IEC SP-825	IEC	26
IEC CM-825	IEC	26
IEC QA-825	IEC	24
IEC DEAE-825	IEC	24
Asahipak ES-502C 7C	IEC	26
Asahipak ES-502N 7C	IEC	24
IEC SP-420N	IEC	26
IEC DEAE3N-4T	IEC	24
PIKESS SP-2B	IEC	26
PIKESS DEAE-2B	IEC	24
RSpak RP18-415	RPC	11
Asahipak ODP-40	RPC	10
Asahipak ODP-50	RPC	10
Asahipak C8P-50	RPC	10
Asahipak C4P-50	RPC	10
HIC PH-814	HIC	26
AFpak ACA-894	AFC	28
AFpak AGA-894	AFC	28
AFpak ALC-894	AFC	28
AFpak ARC-894	AFC	28

[Sugar chains]

Product Name	Separation mode	Page
Asahipak NH2P series	HILIC	13
AFpak series	AFC	28

[Monosaccharides, Disaccharides, Sugar alcohols]

Product Name	Separation mode	Page
SUGAR SC1011	LEX+SEC	32
SUGAR SC1821	LEX+SEC	32
SUGAR SP0810	LEX+SEC	32
SUGAR KS-801	LEX+SEC	32
SUGAR KS-802	LEX+SEC	32
SUGAR SC1211	LEX+HILIC	33
SUGAR SZ5532	LEX+HILIC	33
RSpak DC-613	LEX+HILIC	33
Asahipak NH2P series	HILIC	13

[Sialic acid, Uronic acid, Aldonic acid]

Product Name	Separation mode	Page
SUGAR SH1011	IEX+SEC	36
SUGAR SH1821	IEX+SEC	36

Lipids

[Phospholipids]

Product Name	Separation mode	Page
Silica 5SIL	NPC	20
Asahipak GF-310 HQ	SEC	50
MSpak GF-310	SEC	50
GPC KF-802	SEC	52
GPC KF-402HQ	SEC	56

[Lipoproteins]

Product Name	Separation mode	Page
OHpak SB-805 HQ	SEC	46
SB405	SEC	46
AFpak AHR-894	AFC	28
AFpak ADS-894	AFC	28

Separation Mode

RPC : Reversed phase chromatography
NPC : Normal phase chromatography
HILIC : Hydrophilic interaction chromatography
IEC : Ion exchange chromatography
HIC : Hydrophobic interaction chromatography
AFC : Affinity chromatography
LEX : Ligand exchange chromatography
IEX : Ion exclusion chromatography
SEC : Size exclusion chromatography

Column list for Environment analysis

Water quality

[Anions]

Product Name	Separation mode	Page
IC SI series	IC	38
IC I-524A	IC	38
IC NI-424	IC	38

[Oxyhalides]

Product Name	Separation mode	Page
IC SI-91 4C	IC	38
IC SI-52 4E	IC	38

[Cyanide, Cyanogen chloride]

Product Name	Separation mode	Page
RSpak KC-811 6E	IEX	36

[Cations]

Product Name	Separation mode	Page
ICYS-50	IC	40
ICYK-421	IC	40

[Surfactants]

Product Name	Separation mode	Page
Asahipak GF-310 HQ	SEC+RPC	50
MSpak GF-310	SEC+RPC	50
Silica C18M	RPC	20

[Pesticides]

Product Name	Separation mode	Page
RSpak GOLF-413	RPC	12
RSpak CARB series	RPC	12
IC SI-90 4E	IC	38
RSpak NN series	IEC+RPC	12

Environmental hormones

[Pretreatment of phthalates, PCBs, Benzo [a] pyrene]

Product Name	Separation mode	Page
CLNpak PAE series	SEC (GPC clean-up)	6

Biodiesel

[Cations]

Product Name	Separation mode	Page
ICYS-50	IC	40

[Fatty acid glycerides]

Product Name	Separation mode	Page
Asahipak GF-310 HQ	SEC	50
MSpak GF-310	SEC	50

[Fatty acid methyl esters]

Product Name	Separation mode	Page
RSpak DS series	RPC	11

[Organic acids]

Product Name	Separation mode	Page
IC SI-52 4E	IC	38

Soil

[Anions]

Product Name	Separation mode	Page
IC SI series	IC	38
IC I-524A	IC	38
IC NI-424	IC	38

[Heavy metals]

Product Name	Separation mode	Page
ICT-521	IC	40
ICY-421	IC	40

[Rare earth elements]

Product Name	Separation mode	Page
IC R-621	IC	40

[Humic substances]

Product Name	Separation mode	Page
OHpak SB-805 HQ	SEC	46
SB405	SEC	46

[Organic arsenics]

Product Name	Separation mode	Page
RSpak NN series	IEC+RPC	12

[Pesticides]

Product Name	Separation mode	Page
RSpak GOLF-413	RPC	12
RSpak CARB series	RPC	12
IC SI-90 4E	IC	38
RSpak NN series	IEC+RPC	12

Bioethanol

[Monosaccharides, Oligosaccharides]

Product Name	Separation mode	Page
SUGAR SP0810	LEX+SEC	32
Asahipak NH2P series	HILIC	13

[Oligosaccharides, Alcohols]

Product Name	Separation mode	Page
SUGAR KS-802	LEX+SEC	32
SUGAR SC1821	LEX+SEC	32

[Saccharides, Organic acids, Alcohols]

Product Name	Separation mode	Page
SUGAR SH1011	IEX+RPC+SEC	36
SUGAR SH1821	IEX+RPC+SEC	38

[Hemicellulose, Cellulose]

Product Name	Separation mode	Page
GPC LF-804	SEC	58
GPC KD-800 series	SEC	54

Separation Mode

RPC : Reversed phase chromatography
HILIC : Hydrophilic interaction chromatography
IEC : Ion exchange chromatography
LEX : Ligand exchange chromatography
IEX : Ion exclusion chromatography
IC : Ion chromatography
SEC : Size exclusion chromatography

USP(United States Pharmacopeia) Column List

No.	Packing material	Recommended Column	Page
L1	Octadecyl silane chemically bonded to porous silica or ceramic micro-particles, 1.5 to 10μm in diameter, or a monolithic rod	Silica C18M	20
		Silica C18P	20
		ODSpak F-411	20
		C18	20
L3	Porous silica particles, 1.5 to 10μm in diameter, or a monolithic silica rod	Silica 5SIL	20
L7	Octylsilane chemically bonded to totally porous silica particles, 1.5 to 10μm in diameter, or a monolithic silica rod	Silica 5C8	20
L8	An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support, 3 to 10μm in diameter	Silica 5NH	20
L10	Nitrile groups chemically bonded to porous silica particles, 3 to 10μm in diameter	Silica 5CN	20
L11	Phenyl groups chemically bonded to porous silica particles, 1.5 to 10μm in diameter	Silica 5NPE	20
L17	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 7 to 11μm in diameter	SUGAR SH1011	36
		SUGAR SH1821	36
		RSpak KC-811	36
		IC Y-521	40
L19	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the calcium form, about 9μm in diameter	SUGAR SC1011	32
		SUGAR SC1821	32
		SUGAR SC1211	33
		USPpak MN-431	32
L20	Dihydroxypropane groups chemically bonded to porous silica particles, 3 to 10μm in diameter	PROTEIN KW-800 series	44
		KW400 series	44
L21	A rigid, spherical styrene-divinylbenzene copolymer, 3 to 10μm in diameter	GPC KF,K,KD,HFIP,LF,AT,UT series	52,54,56,58,60
		RSpak DS-613	11
		RSpak DS-413	11
		RSpak RP18-415	11
		RSpak RP18-413	11
		RSpak RP18-613	11
L22	A cation-exchange resin made of porous polystyrene gel with sulfonic acid groups, about 10μm in size	CXpak P-421S	26
		SUGAR SP0810	32
		SUGAR SC1011	32
		SUGAR SC1821	32
		SUGAR KS-800 series	32
		SUGAR SC1211	33
		SUGAR SZ5532	33
		USPpak MN-431	32
		RSpak DC-613	33
		SUGAR SH1011	36
		SUGAR SH1821	36
		RSpak KC-811	36
		IC Y-521	40
L23	An anion-exchange resin made of porous polymethacrylate or polyacrylate gel with quartenary ammonium groups, about 10μm in size	IEC QA-825	24
L25	Packing having the capacity to separate compounds with a molecular weight range from 100-5000 (as determined by polyethylene oxide), applied to neutral, anionic, and cationic water-soluble polymers. A polymethacrylate resin base, cross-linked with polyhydroxylated ether (surface contained some residual carboxyl functional groups) was found suitable	OHpak SB-802 HQ	46
		OHpak SB-802.5 HQ	46
		SB402.5	46
L26	Butyl silane chemically bonded to totally porous silica particles, 1.5 to 10μm in diameter	Silica 5C4	20
L33	Packing having the capacity to separate dextrans by molecular size over a range of 4,000 to 500,000 Da. It is spherical, silica-based, and processed to provide pH stability	PROTEIN KW-800 series	44
		KW400 series	44
L34	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the lead form, about 9μm in diameter	SUGAR SP0810	32
L37	Packing having the capacity to separate proteins by molecular size over a range of 2,000 to 40,000 Da. It is a polymethacrylate gel	OHpak SB-803 HQ	46
		SB403	46
L38	A methacrylate-based size-exclusion packing for water-soluble samples	OHpak SB-800 HQ series	46
		SB400 series	46
L39	A hydrophilic polyhydroxymethacrylate gel of totally porous spherical resin	OHpak SB-800 HQ series	46
		SB400 series	46
		ODP2 HP	11
		RSpak DM-614	11
L45	Beta cyclodextrin bonded to porous silica particles, 5 to 10μm in diameter	ORpak CDBS-453	22
L58	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 6 to 30μm diameter	CXpak P-421S	26
		SUGAR KS-800 series	32
		RSpak DC-613	33
L59	Packing having the capacity to separate proteins by molecular weight over the range of 5 to 7000kDa. It is spherical (5 - 10μm), silica-based, and processed to provide hydrophilic characteristics and pH stability	PROTEIN KW-800 series	44
		KW400 series	44
L67	Porous vinyl alcohol copolymer with a C18 alkyl group attached to the hydroxyl group of the polymer, 2 to 10μm in diameter	Asahipak ODP-40	10
		Asahipak ODP-50	10
		ET-RP1	11
L71	A rigid, spherical polymetacrylate, 4 to 6μm in diameter	RSpak DE-613	11
		RSpak DE-413	11
		RSpak DE-213	11

Semi-micro and micro columns

Polymer-based Packed Columns for Reversed Phase and Hydrophilic Interaction Chromatography (HILIC)

Asahipak ODP semi-micro and micro type

Base Material : Polyvinyl alcohol
Functional Group : Octadecyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	250	ODP40-2E	F7838021
	150	ODP40-2D	F7838022
	50	ODP40-2B	F7838023
	35	ODP40-2T	F7838024
1.0mm	250	ODP40-1E	F7838031
	150	ODP40-1D	F7838032
	50	ODP40-1B	F7838033
	35	ODP40-1T	F7838034
0.8mm	250	ODP40-M8E	F7838041
	150	ODP40-M8D	F7838042
	50	ODP40-M8B	F7838043
	35	ODP40-M8T	F7838044
0.5mm	250	ODP40-M5E	F7838051
	150	ODP40-M5D	F7838052
	50	ODP40-M5B	F7838053
	35	ODP40-M5T	F7838054
0.3mm	250	ODP40-M3E	F7838061
	150	ODP40-M3D	F7838062
	50	ODP40-M3B	F7838063
	35	ODP40-M3T	F7838064

* See page 10 for Asahipak ODP-40.
* See page 82 for preparative columns.

RSpak DE semi-micro and micro type

Base Material : Polymethacrylate

I.D.	Length (mm)	Product Name	Product Code
2.0mm	250	DE413-2E	F7840121
	150	DE413-2D	F7840122
	50	DE413-2B	F7840123
	35	DE413-2T	F7840124
1.0mm	250	DE413-1E	F7840131
	150	DE413-1D	F7840132
	50	DE413-1B	F7840133
	35	DE413-1T	F7840134
0.8mm	150	DE413-M8D	F7840142
	50	DE413-M8B	F7840143
	35	DE413-M8T	F7840144
0.5mm	150	DE413-M5D	F7840152
	50	DE413-M5B	F7840153
	35	DE413-M5T	F7840154
0.3mm	150	DE413-M3D	F7840162
	50	DE413-M3B	F7840163
	35	DE413-M3T	F7840164

* See page 11 for RSpak DE-413 series.
* See page 82 for preparative columns.

RSpak NN semi-micro and micro type

Base Material : Polyhydroxymethacrylate
Functional Group : Sulfo

I.D.	Length (mm)	Product Name	Product Code
2.0mm	150	NN414-2D	F7860122
	50	NN414-2B	F7860123
	35	NN414-2T	F7860124
1.0mm	150	NN414-1D	F7860132
	50	NN414-1B	F7860133
	35	NN414-1T	F7860134
0.8mm	150	NN414-M8D	F7860142
	50	NN414-M8B	F7860143
	35	NN414-M8T	F7860144
0.5mm	150	NN414-M5D	F7860152
	50	NN414-M5B	F7860153
	35	NN414-M5T	F7860154
0.3mm	150	NN414-M3D	F7860162
	50	NN414-M3B	F7860163
	35	NN414-M3T	F7860164

* See page 12 for RSpak NN-414.

Asahipak NH2P semi-micro and micro type

Base Material : Polyvinyl alcohol
Functional Group : Amino

I.D.	Length (mm)	Product Name	Product Code
2.0mm	250	NH2P40-2E	F7858021
	150	NH2P40-2D	F7858022
	50	NH2P40-2B	F7858023
	35	NH2P40-2T	F7858024
1.0mm	250	NH2P40-1E	F7858031
	150	NH2P40-1D	F7858032
	50	NH2P40-1B	F7805033
	35	NH2P40-1T	F7805034
0.8mm	250	NH2P40-M8E	F7858041
	150	NH2P40-M8D	F7858042
	50	NH2P40-M8B	F7858043
	35	NH2P40-M8T	F7858044
0.5mm	250	NH2P40-M5E	F7858051
	150	NH2P40-M5D	F7858052
	50	NH2P40-M5B	F7858053
	35	NH2P40-M5T	F7858054
0.3mm	250	NH2P40-M3E	F7858061
	150	NH2P40-M3D	F7858062
	50	NH2P40-M3B	F7858063
	35	NH2P40-M3T	F7858064

* See page 13 for Asahipak NH2P-40 series.
* See page 83 for preparative columns.

Semi-micro and micro columns

Columns for Anion Exchange Chromatography

IEC QA-825 semi-micro and micro type

Base Material : Polyhydroxymethacrylate
Functional Group : Quaternary ammonium

I.D.	Length (mm)	Product Name	Product Code
2.0mm	150	QA8-2D	F7940322
	50	QA8-2B	F7940323
	35	QA8-2T	F7940324
1.0mm	150	QA8-1D	F7940332
	50	QA8-1B	F7940333
	35	QA8-1T	F7940334
0.8mm	150	QA8-M8D	F7940342
	50	QA8-M8B	F7940343
	35	QA8-M8T	F7940344
0.5mm	150	QA8-M5D	F7940352
	50	QA8-M5B	F7940353
	35	QA8-M5T	F7940354
0.3mm	150	QA8-M3D	F7940362
	50	QA8-M3B	F7940363
	35	QA8-M3T	F7940364

* See page 24 for IEC QA-825.
* See page 84 for preparative columns.

IEC DEAE-825 semi-micro and micro type

Base Material : Polyhydroxymethacrylate
Functional Group : Diethylaminoethyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	150	DEAE8-2D	F7940422
	50	DEAE8-2B	F7940423
	35	DEAE8-2T	F7940424
1.0mm	150	DEAE8-1D	F7940432
	50	DEAE8-1B	F7940433
	35	DEAE8-1T	F7940434
0.8mm	150	DEAE8-M8D	F7940442
	50	DEAE8-M8B	F7940443
	35	DEAE8-M8T	F7940444
0.5mm	150	DEAE8-M5D	F7940452
	50	DEAE8-M5B	F7940453
	35	DEAE8-M5T	F7940454
0.3mm	150	DEAE8-M3D	F7940462
	50	DEAE8-M3B	F7940463
	35	DEAE8-M3T	F7940464

* See page 24 for IEC DEAE-825.
* See page 84 for preparative columns.

IEC DEAE3N semi-micro and micro type

Base Material : Polyhydroxymethacrylate
Functional Group : Diethylaminoethyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	DEAE3N-2B	F7950223
	35	DEAE3N-2T	F7950224
1.0mm	50	DEAE3N-1B	F7950233
	35	DEAE3N-1T	F7950234
0.8mm	50	DEAE3N-M8B	F7950243
	35	DEAE3N-M8T	F7950244
0.5mm	50	DEAE3N-M5B	F7950253
	35	DEAE3N-M5T	F7950254
0.3mm	50	DEAE3N-M3B	F7950263
	35	DEAE3N-M3T	F7950264

* See page 24 for IEC DEAE3N-4T.

Asahipak ES-502N semi-micro and micro type

Base Material : Polyvinyl alcohol
Functional Group : Diethylaminoethyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	150	DEAE9A-2D	F7960122
	50	DEAE9A-2B	F7960123
	35	DEAE9A-2T	F7960124
1.0mm	150	DEAE9A-1D	F7960132
	50	DEAE9A-1B	F7960133
	35	DEAE9A-1T	F7960134
0.8mm	150	DEAE9A-M8D	F7960142
	50	DEAE9A-M8B	F7960143
	35	DEAE9A-M8T	F7960144
0.5mm	150	DEAE9A-M5D	F7960152
	50	DEAE9A-M5B	F7960153
	35	DEAE9A-M5T	F7960154
0.3mm	150	DEAE9A-M3D	F7960162
	50	DEAE9A-M3B	F7960163
	35	DEAE9A-M3T	F7960164

* See page 24 for Asahipak ES-502N 7C.
* See page 84 for preparative columns.

Semi-micro and micro columns

Columns for Cation Exchange Chromatography

IEC SP-825 semi-micro and micro type

Base Material : Polyhydroxymethacrylate
Functional Group : Sulfopropyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	150	SP8-2D	F7940122
	50	SP8-2B	F7940123
	35	SP8-2T	F7940124
1.0mm	150	SP8-1D	F7940132
	50	SP8-1B	F7940133
	35	SP8-1T	F7940134
0.8mm	150	SP8-M8D	F7940142
	50	SP8-M8B	F7940143
	35	SP8-M8T	F7940144
0.5mm	150	SP8-M5D	F7940152
	50	SP8-M5B	F7940153
	35	SP8-M5T	F7940154
0.3mm	150	SP8-M3D	F7940162
	50	SP8-M3B	F7940163
	35	SP8-M3T	F7940164

* See page 26 for IECSP-825.
* See page 84 for preparative columns.

IEC SP-420N semi-micro and micro type

Base Material : Polyhydroxymethacrylate
Functional Group : Sulfopropyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	SP3N-2B	F7950123
	35	SP3N-2T	F7950124
1.0mm	50	SP3N-1B	F7950133
	35	SP3N-1T	F7950134
0.8mm	50	SP3N-M8B	F7950143
	35	SP3N-M8T	F7950144
0.5mm	50	SP3N-M5B	F7950153
	35	SP3N-M5T	F7950154
0.3mm	50	SP3N-M3B	F7950163
	35	SP3N-M3T	F7950164

* See page 26 for IEC SP-420N.

IEC CM-825 semi-micro and micro type

Base Material : Polyhydroxymethacrylate
Functional Group : Carboxymethyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	150	CM8-2D	F7940222
	50	CM8-2B	F7940223
	35	CM8-2T	F7940224
1.0mm	150	CM8-1D	F7940232
	50	CM8-1B	F7940233
	35	CM8-1T	F7940234
0.8mm	150	CM8-M8D	F7940242
	50	CM8-M8B	F7940243
	35	CM8-M8T	F7940244
0.5mm	150	CM8-M5D	F7940252
	50	CM8-M5B	F7940253
	35	CM8-M5T	F7940254
0.3mm	150	CM8-M3D	F7940262
	50	CM8-M3B	F7940263
	35	CM8-M3T	F7940264

* See page 26 for IEC CM-825.
* See page 84 for preparative columns.

Asahipak ES-502C semi-micro and micro type

Base Material : Polyvinyl alcohol
Functional Group : Carboxymethyl

I.D.	Length (mm)	Product Name	Product Code
2.0mm	150	CM9A-2D	F7960222
	50	CM9A-2B	F7960223
	35	CM9A-2T	F7960224
1.0mm	150	CM9A-1D	F7960232
	50	CM9A-1B	F7960233
	35	CM9A-1T	F7960234
0.8mm	150	CM9A-M8D	F7960242
	50	CM9A-M8B	F7960243
	35	CM9A-M8T	F7960244
0.5mm	150	CM9A-M5D	F7960252
	50	CM9A-M5B	F7960253
	35	CM9A-M5T	F7960254
0.3mm	150	CM9A-M3D	F7960262
	50	CM9A-M3B	F7960263
	35	CM9A-M3T	F7960264

* See page 26 for Asahipak ES-502C 7C.
* See page 84 for preparative columns.

Base Material : Polyhydroxymethacrylate

Columns for Affinity Chromotography

AFpak AAB-894 semi-micro and micro type

Ligand : Aminobezamidine

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AAB-2B	F7970123
	35	AAB-2T	F7970124
1.0mm	50	AAB-1B	F7970133
	35	AAB-1T	F7970134
0.8mm	50	AAB-M8B	F7970143
	35	AAB-M8T	F7970144
0.5mm	50	AAB-M5B	F7970153
	35	AAB-M5T	F7970154
0.3mm	50	AAB-M3B	F7970163
	35	AAB-M3T	F7970164

* See page 28 for AFpak AAB-894.

AFpak AAF-894 semi-micro and micro type

Ligand : Acriflavine

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AAF-2B	F7970223
	35	AAF-2T	F7970224
1.0mm	50	AAF-1B	F7970233
	35	AAF-1T	F7970234
0.8mm	50	AAF-M8B	F7970243
	35	AAF-M8T	F7970244
0.5mm	50	AAF-M5B	F7970253
	35	AAF-M5T	F7970254
0.3mm	50	AAF-M3B	F7970263
	35	AAF-M3T	F7970264

* See page 28 for AFpak AAF-894.

AFpak AAM-894 semi-micro and micro type

Ligand : 5'AMP

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AAM-2B	F7970323
	35	AAM-2T	F7970324
1.0mm	50	AAM-1B	F7970333
	35	AAM-1T	F7970334
0.8mm	50	AAM-M8B	F7970343
	35	AAM-M8T	F7970344
0.5mm	50	AAM-M5B	F7970353
	35	AAM-M5T	F7970354
0.3mm	50	AAM-M3B	F7970363
	35	AAM-M3T	F7970364

* See page 28 for AFpak AAM-894.

AFpak AAP-894 semi-micro and micro type

Ligand : Aprotinin

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AAP-2B	F7970423
	35	AAP-2T	F7970424
1.0mm	50	AAP-1B	F7970433
	35	AAP-1T	F7970434
0.8mm	50	AAP-M8B	F7970443
	35	AAP-M8T	F7970444
0.5mm	50	AAP-M5B	F7970453
	35	AAP-M5T	F7970454
0.3mm	50	AAP-M3B	F7970463
	35	AAP-M3T	F7970464

* See page 28 for AFpak AAP-894.

AFpak AAV-894 semi-micro and micro type

Ligand : Avidin

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AAV-2B	F7970523
	35	AAV-2T	F7970524
1.0mm	50	AAV-1B	F7970533
	35	AAV-1T	F7970534
0.8mm	50	AAV-M8B	F7970543
	35	AAV-M8T	F7970544
0.5mm	50	AAV-M5B	F7970553
	35	AAV-M5T	F7970554
0.3mm	50	AAV-M3B	F7970563
	35	AAV-M3T	F7970564

* See page 28 for AFpak AAV-894.

AFpak ABA-894 semi-micro and micro type

Ligand : Bovine serum albumin

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ABA-2B	F7970623
	35	ABA-2T	F7970624
1.0mm	50	ABA-1B	F7970633
	35	ABA-1T	F7970634
0.8mm	50	ABA-M8B	F7970643
	35	ABA-M8T	F7970644
0.5mm	50	ABA-M5B	F7970653
	35	ABA-M5T	F7970654
0.3mm	50	ABA-M3B	F7970663
	35	ABA-M3T	F7970664

* See page 22,28 for AFpak ABA-894.

AFpak ABT-894 semi-micro and micro type

Ligand : Biotin

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ABT-2B	F7970723
	35	ABT-2T	F7970724
1.0mm	50	ABT-1B	F7970733
	35	ABT-1T	F7970734
0.8mm	50	ABT-M8B	F7970743
	35	ABT-M8T	F7970744
0.5mm	50	ABT-M5B	F7970753
	35	ABT-M5T	F7970754
0.3mm	50	ABT-M3B	F7970763
	35	ABT-M3T	F7970764

* See page 28 for AFpak ABT-894.

AFpak ACA-894 semi-micro and micro type

Ligand : Concanavalin A

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ACA-2B	F7970823
	35	ACA-2T	F7970824
1.0mm	50	ACA-1B	F7970833
	35	ACA-1T	F7970834
0.8mm	50	ACA-M8B	F7970843
	35	ACA-M8T	F7970844
0.5mm	50	ACA-M5B	F7970853
	35	ACA-M5T	F7970854
0.3mm	50	ACA-M3B	F7970863
	35	ACA-M3T	F7970864

* See page 28 for AFpak ACA-894.

Semi-micro and micro columns

Base Material : Polyhydroxymethacrylate

Columns for Affinity Chromotography

AFpak ACB-894 semi-micro and micro type

Ligand : Cibacron blue

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ACB-2B	F7970923
	35	ACB-2T	F7970924
1.0mm	50	ACB-1B	F7970933
	35	ACB-1T	F7970934
0.8mm	50	ACB-M8B	F7970943
	35	ACB-M8T	F7970944
0.5mm	50	ACB-M5B	F7970953
	35	ACB-M5T	F7970954
0.3mm	50	ACB-M3B	F7970963
	35	ACB-M3T	F7970964

* See page 28 for AFpak ACB-894.

AFpak ADS-894 semi-micro and micro type

Ligand : Dextran sulfate

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ADS-2B	F7971023
	35	ADS-2T	F7971024
1.0mm	50	ADS-1B	F7971033
	35	ADS-1T	F7971034
0.8mm	50	ADS-M8B	F7971043
	35	ADS-M8T	F7971044
0.5mm	50	ADS-M5B	F7971053
	35	ADS-M5T	F7971054
0.3mm	50	ADS-M3B	F7971063
	35	ADS-M3T	F7971064

* See page 28 for AFpak ADS-894.

AFpak AED-894 semi-micro and micro type

Ligand : Ethylenediaminediacetic acid

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AED-2B	F7971123
	35	AED-2T	F7971124
1.0mm	50	AED-1B	F7971133
	35	AED-1T	F7971134
0.8mm	50	AED-M8B	F7971143
	35	AED-M8T	F7971144
0.5mm	50	AED-M5B	F7971153
	35	AED-M5T	F7971154
0.3mm	50	AED-M3B	F7971163
	35	AED-M3T	F7971164

* See page 28 for AFpak AED-894.

AFpak AGA-894 semi-micro and micro type

Ligand : N-acetylglucosamine

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AGA-2B	F7971223
	35	AGA-2T	F7971224
1.0mm	50	AGA-1B	F7971233
	35	AGA-1T	F7971234
0.8mm	50	AGA-M8B	F7971243
	35	AGA-M8T	F7971244
0.5mm	50	AGA-M5B	F7971253
	35	AGA-M5T	F7971254
0.3mm	50	AGA-M3B	F7971263
	35	AGA-M3T	F7971264

* See page 28 for AFpak AGA-894.

AFpak AGE-894 semi-micro and micro type

Ligand : Gelatin

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AGE-2B	F7971323
	35	AGE-2T	F7971324
1.0mm	50	AGE-1B	F7971333
	35	AGE-1T	F7971334
0.8mm	50	AGE-M8B	F7971343
	35	AGE-M8T	F7971344
0.5mm	50	AGE-M5B	F7971353
	35	AGE-M5T	F7971354
0.3mm	50	AGE-M3B	F7971363
	35	AGE-M3T	F7971364

* See page 28 for AFpak AGE-894.

AFpak AGT-894 semi-micro and micro type

Ligand : Glutathione

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AGT-2B	F7971423
	35	AGT-2T	F7971424
1.0mm	50	AGT-1B	F7971433
	35	AGT-1T	F7971434
0.8mm	50	AGT-M8B	F7971443
	35	AGT-M8T	F7971444
0.5mm	50	AGT-M5B	F7971453
	35	AGT-M5T	F7971454
0.3mm	50	AGT-M3B	F7971463
	35	AGT-M3T	F7971464

* See page 28 for AFpak AGT-894.

AFpak AHR-894 semi-micro and micro type

Ligand : Heparin

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AHR-2B	F7971523
	35	AHR-2T	F7971524
1.0mm	50	AHR-1B	F7971533
	35	AHR-1T	F7971534
0.8mm	50	AHR-M8B	F7971543
	35	AHR-M8T	F7971544
0.5mm	50	AHR-M5B	F7971553
	35	AHR-M5T	F7971554
0.3mm	50	AHR-M3B	F7971563
	35	AHR-M3T	F7971564

* See page 28 for AFpak AHR-894.

AFpak AIA-894 semi-micro and micro type

Ligand : Iminodiacetic acid

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AIA-2B	F7971623
	35	AIA-2T	F7971624
1.0mm	50	AIA-1B	F7971633
	35	AIA-1T	F7971634
0.8mm	50	AIA-M8B	F7971643
	35	AIA-M8T	F7971644
0.5mm	50	AIA-M5B	F7971653
	35	AIA-M5T	F7971654
0.3mm	50	AIA-M3B	F7971663
	35	AIA-M3T	F7971664

* See page 28 for AFpak AIA-894.

Semi-micro and micro columns

Base Material : Polyhydroxymethacrylate

Columns for Affinity Chromotography

AFpak ALC-894 semi-micro and micro type

Ligand : Lentil lectin

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ALC-2B	F7971723
	35	ALC-2T	F7971724
1.0mm	50	ALC-1B	F7971733
	35	ALC-1T	F7971734
0.8mm	50	ALC-M8B	F7971743
	35	ALC-M8T	F7971744
0.5mm	50	ALC-M5B	F7971753
	35	ALC-M5T	F7971754
0.3mm	50	ALC-M3B	F7971763
	35	ALC-M3T	F7971764

* See page 28 for AFpak ALC-894.

AFpak ALS-894 semi-micro and micro type

Ligand : Lysine

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ALS-2B	F7971823
	35	ALS-2T	F7971824
1.0mm	50	ALS-1B	F7971833
	35	ALS-1T	F7971834
0.8mm	50	ALS-M8B	F7971843
	35	ALS-M8T	F7971844
0.5mm	50	ALS-M5B	F7971853
	35	ALS-M5T	F7971854
0.3mm	50	ALS-M3B	F7971863
	35	ALS-M3T	F7971864

* See page 28 for AFpak ALS-894.

AFpak ANA-894 semi-micro and micro type

Ligand : Nicotinamide Adenine Dinucleotide (NAD)

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ANA-2B	F7971923
	35	ANA-2T	F7971924
1.0mm	50	ANA-1B	F7971933
	35	ANA-1T	F7971934
0.8mm	50	ANA-M8B	F7971943
	35	ANA-M8T	F7971944
0.5mm	50	ANA-M5B	F7971953
	35	ANA-M5T	F7971954
0.3mm	50	ANA-M3B	F7971963
	35	ANA-M3T	F7971964

* See page 28 for AFpak ANA-894.

AFpak AOV-894 semi-micro and micro type

Ligand : Ovomucoid

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AOV-2B	F7972023
	35	AOV-2T	F7972024
1.0mm	50	AOV-1B	F7972033
	35	AOV-1T	F7972034
0.8mm	50	AOV-M8B	F7972043
	35	AOV-M8T	F7972044
0.5mm	50	AOV-M5B	F7972053
	35	AOV-M5T	F7972054
0.3mm	50	AOV-M3B	F7972063
	35	AOV-M3T	F7972064

* See page 28 for AFpak AOV-894.

AFpak APA-894 semi-micro and micro type

Ligand : Protein A

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	APA-2B	F7972123
	35	APA-2T	F7972124
1.0mm	50	APA-1B	F7972133
	35	APA-1T	F7972134
0.8mm	50	APA-M8B	F7972143
	35	APA-M8T	F7972144
0.5mm	50	APA-M5B	F7972153
	35	APA-M5T	F7972154
0.3mm	50	APA-M3B	F7972163
	35	APA-M3T	F7972164

* See page 28 for AFpak APA-894.

AFpak APB-894 semi-micro and micro type

Ligand : Aminophenylboronic acid

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	APB-2B	F7972223
	35	APB-2T	F7972224
1.0mm	50	APB-1B	F7972233
	35	APB-1T	F7972234
0.8mm	50	APB-M8B	F7972243
	35	APB-M8T	F7972244
0.5mm	50	APB-M5B	F7972253
	35	APB-M5T	F7972254
0.3mm	50	APB-M3B	F7972263
	35	APB-M3T	F7972264

* See page 28 for AFpak APB-894.

AFpak APD-894 semi-micro and micro type

Ligand : Procion red

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	APD-2B	F7972323
	35	APD-2T	F7972324
1.0mm	50	APD-1B	F7972333
	35	APD-1T	F7972334
0.8mm	50	APD-M8B	F7972343
	35	APD-M8T	F7972344
0.5mm	50	APD-M5B	F7972353
	35	APD-M5T	F7972354
0.3mm	50	APD-M3B	F7972363
	35	APD-M3T	F7972364

* See page 28 for AFpak APD-894.

AFpak APE-894 semi-micro and micro type

Ligand : Phosphorylethanolamine

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	APE-2B	F7972423
	35	APE-2T	F7972424
1.0mm	50	APE-1B	F7972433
	35	APE-1T	F7972434
0.8mm	50	APE-M8B	F7972443
	35	APE-M8T	F7972444
0.5mm	50	APE-M5B	F7972453
	35	APE-M5T	F7972454
0.3mm	50	APE-M3B	F7972463
	35	APE-M3T	F7972464

* See page 28 for AFpak APE-894.

Semi-micro and micro columns

Base Material : Polyhydroxymethacrylate

Columns for Affinity Chromotography

AFpak APG-894 semi-micro and micro type

Ligand : Protein G

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	APG-2B	F7972523
	35	APG-2T	F7972524
1.0mm	50	APG-1B	F7972533
	35	APG-1T	F7972534
0.8mm	50	APG-M8B	F7972543
	35	APG-M8T	F7972544
0.5mm	50	APG-M5B	F7972553
	35	APG-M5T	F7972554
0.3mm	50	APG-M3B	F7972563
	35	APG-M3T	F7972564

* See page 28 for AFpak APG-894.

AFpak APH-894 semi-micro and micro type

Ligand : Phenylalanine

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	APH-2B	F7972623
	35	APH-2T	F7972624
1.0mm	50	APH-1B	F7972633
	35	APH-1T	F7972634
0.8mm	50	APH-M8B	F7972643
	35	APH-M8T	F7972644
0.5mm	50	APH-M5B	F7972653
	35	APH-M5T	F7972654
0.3mm	50	APH-M3B	F7972663
	35	APH-M3T	F7972664

* See page 28 for AFpak APH-894.

AFpak APR-894 semi-micro and micro type

Ligand : Protamine

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	APR-2B	F7972723
	35	APR-2T	F7972724
1.0mm	50	APR-1B	F7972733
	35	APR-1T	F7972734
0.8mm	50	APR-M8B	F7972743
	35	APR-M8T	F7972744
0.5mm	50	APR-M5B	F7972753
	35	APR-M5T	F7972754
0.3mm	50	APR-M3B	F7972763
	35	APR-M3T	F7972764

* See page 28 for AFpak APR-894.

AFpak ARC-894 semi-micro and micro type

Ligand : Ricinus communis agglutinin I (RCA-I)

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	ARC-2B	F7972823
	35	ARC-2T	F7972824
1.0mm	50	ARC-1B	F7972833
	35	ARC-1T	F7972834
0.8mm	50	ARC-M8B	F7972843
	35	ARC-M8T	F7972844
0.5mm	50	ARC-M5B	F7972853
	35	ARC-M5T	F7972854
0.3mm	50	ARC-M3B	F7972863
	35	ARC-M3T	F7972864

* See page 28 for AFpak ARC-894.

AFpak AST-894 semi-micro and micro type

Ligand : Soybean trypsin inhibitor

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AST-2B	F7972923
	35	AST-2T	F7972924
1.0mm	50	AST-1B	F7972933
	35	AST-1T	F7972934
0.8mm	50	AST-M8B	F7972943
	35	AST-M8T	F7972944
0.5mm	50	AST-M5B	F7972953
	35	AST-M5T	F7972954
0.3mm	50	AST-M3B	F7972963
	35	AST-M3T	F7972964

* See page 28 for AFpak AST-894.

AFpak AWG-894 semi-micro and micro type

Ligand : Wheat germ agglutinin (WGA)

I.D.	Length (mm)	Product Name	Product Code
2.0mm	50	AWG-2B	F7973023
	35	AWG-2T	F7973024
1.0mm	50	AWG-1B	F7973033
	35	AWG-1T	F7973034
0.8mm	50	AWG-M8B	F7973043
	35	AWG-M8T	F7973044
0.5mm	50	AWG-M5B	F7973053
	35	AWG-M5T	F7973054
0.3mm	50	AWG-M3B	F7973063
	35	AWG-M3T	F7973064

* See page 28 for AFpak AWG-894.

Semi-micro and micro columns

Aqueous SEC(GFC) column : Silica-based

KW402.5 semi-micro and micro type

Base Material : Silica

I.D.	Length (mm)	Product Name	Product Code
4.6mm	150	KW402.5-4D	F7781212
	50	KW402.5-4B	F7781213
2.0mm	250	KW402.5-2E	F7781221
	150	KW402.5-2D	F7781222
	50	KW402.5-2B	F7781223
1.0mm	250	KW402.5-1E	F7781231
	150	KW402.5-1D	F7781232
	50	KW402.5-1B	F7781233
0.8mm	250	KW402.5-M8E	F7781241
	150	KW402.5-M8D	F7781242
	50	KW402.5-M8B	F7781243
0.5mm	250	KW402.5-M5E	F7781251
	150	KW402.5-M5D	F7781252
	50	KW402.5-M5B	F7781253
0.3mm	250	KW402.5-M3E	F7781261
	150	KW402.5-M3D	F7781262
	50	KW402.5-M3B	F7781263

* See page 44 for KW402.5-4F.
* See page 85 for preparative columns.

KW403 semi-micro and micro type

Base Material : Silica

I.D.	Length (mm)	Product Name	Product Code
4.6mm	150	KW403-4D	F7781312
	50	KW403-4B	F7781313
2.0mm	250	KW403-2E	F7781321
	150	KW403-2D	F7781322
	50	KW403-2B	F7781323
1.0mm	250	KW403-1E	F7781331
	150	KW403-1D	F7781332
	50	KW403-1B	F7781333
0.8mm	250	KW403-M8E	F7781341
	150	KW403-M8D	F7781342
	50	KW403-M8B	F7781343
0.5mm	250	KW403-M5E	F7781351
	150	KW403-M5D	F7781352
	50	KW403-M5B	F7781353
0.3mm	250	KW403-M3E	F7781361
	150	KW403-M3D	F7781362
	50	KW403-M3B	F7781363

* See page 44 for KW403-4F.
* See page 85 for preparative columns.

KW404 semi-micro and micro type

Base Material : Silica

I.D.	Length (mm)	Product Name	Product Code
4.6mm	150	KW404-4D	F7781412
	50	KW404-4B	F7781413
2.0mm	250	KW404-2E	F7781421
	150	KW404-2D	F7781422
	50	KW404-2B	F7781423
1.0mm	250	KW404-1E	F7781431
	150	KW404-1D	F7781432
	50	KW404-1B	F7781433
0.8mm	250	KW404-M8E	F7781441
	150	KW404-M8D	F7781442
	50	KW404-M8B	F7781443
0.5mm	250	KW404-M5E	F7781451
	150	KW404-M5D	F7781452
	50	KW404-M5B	F7781453
0.3mm	250	KW404-M3E	F7781461
	150	KW404-M3D	F7781462
	50	KW404-M3B	F7781463

* See page 44 for KW404-4F.
* See page 85 for preparative columns.

KW405 semi-micro and micro type

Base Material : Silica

I.D.	Length (mm)	Product Name	Product Code
4.6mm	150	KW405-4D	F7781512
	50	KW405-4B	F7781513
2.0mm	250	KW405-2E	F7781521
	150	KW405-2D	F7781522
	50	KW405-2B	F7781523
1.0mm	250	KW405-1E	F7781531
	150	KW405-1D	F7781532
	50	KW405-1B	F7781533
0.8mm	250	KW405-M8E	F7781541
	150	KW405-M8D	F7781542
	50	KW405-M8B	F7781543
0.5mm	250	KW405-M5E	F7781551
	150	KW405-M5D	F7781552
	50	KW405-M5B	F7781553
0.3mm	250	KW405-M3E	F7781561
	150	KW405-M3D	F7781562
	50	KW405-M3B	F7781563

* See page 44 for KW405-4F.
* See page 85 for preparative columns.

Semi-micro and micro columns

Aqueous SEC(GFC) columns : Polymer-based

OHpak SB-802 HQ semi-micro and micro type

Base Material : Polyhydroxymethacrylate

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	SB802-4E	F7770111
	150	SB802-4D	F7770112
	50	SB802-4B	F7770113
2.0mm	250	SB802-2E	F7770121
	150	SB802-2D	F7770122
	50	SB802-2B	F7770123
1.0mm	250	SB802-1E	F7770131
	150	SB802-1D	F7770132
	50	SB802-1B	F7770133
0.8mm	250	SB802-M8E	F7770141
	150	SB802-M8D	F7770142
	50	SB802-M8B	F7770143
0.5mm	250	SB802-M5E	F7770151
	150	SB802-M5D	F7770152
	50	SB802-M5B	F7770153
0.3mm	250	SB802-M3E	F7770161
	150	SB802-M3D	F7770162
	50	SB802-M3B	F7770163

* See page 46 for OHpak SB-802 HQ.
* See page 85 for preparative columns.

OHpak SB-802.5 HQ semi-micro and micro type

Base Material : Polyhydroxymethacrylate

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	SB802.5-4E	F7770211
	150	SB802.5-4D	F7770212
	50	SB802.5-4B	F7770213
2.0mm	250	SB802.5-2E	F7770221
	150	SB802.5-2D	F7770222
	50	SB802.5-2B	F7770223
1.0mm	250	SB802.5-1E	F7770231
	150	SB802.5-1D	F7770232
	50	SB802.5-1B	F7770233
0.8mm	250	SB802.5-M8E	F7770241
	150	SB802.5-M8D	F7770242
	50	SB802.5-M8B	F7770243
0.5mm	250	SB802.5-M5E	F7770251
	150	SB802.5-M5D	F7770252
	50	SB802.5-M5B	F7770253
0.3mm	250	SB802.5-M3E	F7770261
	150	SB802.5-M3D	F7770262
	50	SB802.5-M3B	F7770263

* See page 46 for OHpak SB-802.5 HQ.
* See page 85 for preparative columns.

OHpak SB-803 HQ semi-micro and micro type

Base Material : Polyhydroxymethacrylate

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	SB803-4E	F7770311
	150	SB803-4D	F7770312
	50	SB803-4B	F7770313
2.0mm	250	SB803-2E	F7770321
	150	SB803-2D	F7770322
	50	SB803-2B	F7770323
1.0mm	250	SB803-1E	F7770331
	150	SB803-1D	F7770332
	50	SB803-1B	F7770333
0.8mm	250	SB803-M8E	F7770341
	150	SB803-M8D	F7770342
	50	SB803-M8B	F7770343
0.5mm	250	SB803-M5E	F7770351
	150	SB803-M5D	F7770352
	50	SB803-M5B	F7770353
0.3mm	250	SB803-M3E	F7770361
	150	SB803-M3D	F7770362
	50	SB803-M3B	F7770363

* See page 46 for OHpak SB-803 HQ.
* See page 85 for preparative columns.

OHpak SB-804 HQ semi-micro and micro type

Base Material : Polyhydroxymethacrylate

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	SB804-4E	F7770411
	150	SB804-4D	F7770412
	50	SB804-4B	F7770413
2.0mm	250	SB804-2E	F7770421
	150	SB804-2D	F7770422
	50	SB804-2B	F7770423
1.0mm	250	SB804-1E	F7770431
	150	SB804-1D	F7770432
	50	SB804-1B	F7770433
0.8mm	250	SB804-M8E	F7770441
	150	SB804-M8D	F7770442
	50	SB804-M8B	F7770443
0.5mm	250	SB804-M5E	F7770451
	150	SB804-M5D	F7770452
	50	SB804-M5B	F7770453
0.3mm	250	SB804-M3E	F7770461
	150	SB804-M3D	F7770462
	50	SB804-M3B	F7770463

* See page 46 for OHpak SB-804 HQ.
* See page 85 for preparative columns.

Semi-micro and micro columns

Aqueous SEC(GFC) columns : Polymer-based

OHpak SB-805 HQ semi-micro and micro type

Base Material : Polyhydroxymethacrylate

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	SB805-4E	F7770511
	150	SB805-4D	F7770512
	50	SB805-4B	F7770513
2.0mm	250	SB805-2E	F7770521
	150	SB805-2D	F7770522
	50	SB805-2B	F7770523
1.0mm	250	SB805-1E	F7770531
	150	SB805-1D	F7770532
	50	SB805-1B	F7770533
0.8mm	250	SB805-M8E	F7770541
	150	SB805-M8D	F7770542
	50	SB805-M8B	F7770543
0.5mm	250	SB805-M5E	F7770551
	150	SB805-M5D	F7770552
	50	SB805-M5B	F7770553
0.3mm	250	SB805-M3E	F7770561
	150	SB805-M3D	F7770562
	50	SB805-M3B	F7770563

* See page 46 for OHpak SB-805 HQ.
* See page 85 for preparative columns.

OHpak SB-806 HQ semi-micro and micro type

Base Material : Polyhydroxymethacrylate

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	SB806-4E	F7770611
	150	SB806-4D	F7770612
	50	SB806-4B	F7770613
2.0mm	250	SB806-2E	F7770621
	150	SB806-2D	F7770622
	50	SB806-2B	F7770623
1.0mm	250	SB806-1E	F7770631
	150	SB806-1D	F7770632
	50	SB806-1B	F7770633
0.8mm	250	SB806-M8E	F7770641
	150	SB806-M8D	F7770642
	50	SB806-M8B	F7770643
0.5mm	250	SB806-M5E	F7770651
	150	SB806-M5D	F7770652
	50	SB806-M5B	F7770653
0.3mm	250	SB806-M3E	F7770661
	150	SB806-M3D	F7770662
	50	SB806-M3B	F7770663

* See page 46 for OHpak SB-806 HQ.
* See page 85 for preparative columns.

Semi-micro and micro columns

Multimode Columns

Asahipak GS-220 HQ semi-micro and micro type

Base Material : Polyvinyl alcohol

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	GS220A-4E	F7750211
	150	GS220A-4D	F7750212
	50	GS220A-4B	F7750213
2.0mm	250	GS220A-2E	F7750221
	150	GS220A-2D	F7750222
	50	GS220A-2B	F7750223
1.0mm	250	GS220A-1E	F7750231
	150	GS220A-1D	F7750232
	50	GS220A-1B	F7750233
0.8mm	250	GS220A-M8E	F7750241
	150	GS220A-M8D	F7750242
	50	GS220A-M8B	F7750243
0.5mm	250	GS220A-M5E	F7750251
	150	GS220A-M5D	F7750252
	50	GS220A-M5B	F7750253
0.3mm	250	GS220A-M3E	F7750261
	150	GS220A-M3D	F7750262
	50	GS220A-M3B	F7750263

* See page 48 for Asahipak GS-220 HQ.
* See page 86 for preparative columns.

Asahipak GS-320 HQ semi-micro and micro type

Base Material : Polyvinyl alcohol

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	GS320A-4E	F7750311
	150	GS320A-4D	F7750312
	50	GS320A-4B	F7750313
2.0mm	250	GS320A-2E	F7750321
	150	GS320A-2D	F7750322
	50	GS320A-2B	F7750323
1.0mm	250	GS320A-1E	F7750331
	150	GS320A-1D	F7750332
	50	GS320A-1B	F7750333
0.8mm	250	GS320A-M8E	F7750341
	150	GS320A-M8D	F7750342
	50	GS320A-M8B	F7750343
0.5mm	250	GS320A-M5E	F7750351
	150	GS320A-M5D	F7750352
	50	GS320A-M5B	F7750353
0.3mm	250	GS320A-M3E	F7750361
	150	GS320A-M3D	F7750362
	50	GS320A-M3B	F7750363

* See page 48 for Asahipak GS-320 HQ.
* See page 86 for preparative columns.

Asahipak GS-520 HQ semi-micro and micro type

Base Material : Polyvinyl alcohol

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	GS520A-4E	F7750511
	150	GS520A-4D	F7750512
	50	GS520A-4B	F7750513
2.0mm	250	GS520A-2E	F7750521
	150	GS520A-2D	F7750522
	50	GS520A-2B	F7750523
1.0mm	250	GS520A-1E	F7750531
	150	GS520A-1D	F7750532
	50	GS520A-1B	F7750533
0.8mm	250	GS520A-M8E	F7750541
	150	GS520A-M8D	F7750542
	50	GS520A-M8B	F7750543
0.5mm	250	GS520A-M5E	F7750551
	150	GS520A-M5D	F7750552
	50	GS520A-M5B	F7750553
0.3mm	250	GS520A-M3E	F7750561
	150	GS520A-M3D	F7750562
	50	GS520A-M3B	F7750563

* See page 48 for Asahipak GS-520 HQ.
* See page 86 for preparative columns.

Asahipak GS-620 HQ semi-micro and micro type

Base Material : Polyvinyl alcohol

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	GS620A-4E	F7750611
	150	GS620A-4D	F7750612
	50	GS620A-4B	F7750613
2.0mm	250	GS620A-2E	F7750621
	150	GS620A-2D	F7750622
	50	GS620A-2B	F7750623
1.0mm	250	GS620A-1E	F7750631
	150	GS620A-1D	F7750632
	50	GS620A-1B	F7750633
0.8mm	250	GS620A-M8E	F7750641
	150	GS620A-M8D	F7750642
	50	GS620A-M8B	F7750643
0.5mm	250	GS620A-M5E	F7750651
	150	GS620A-M5D	F7750652
	50	GS620A-M5B	F7750653
0.3mm	250	GS620A-M3E	F7750661
	150	GS620A-M3D	F7750662
	50	GS620A-M3B	F7750663

* See page 48 for Asahipak GS-620 HQ.
* See page 86 for preparative columns.

Semi-micro and micro columns

Aqueous/Organic SEC Columns

Asahipak GF-310 HQ semi-micro and micro type

Base Material : Polyvinyl alcohol

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	GF310A-4E	F7760311
	150	GF310A-4D	F7760312
	50	GF310A-4B	F7760313
2.0mm	250	GF310A-2E	F7760321
	150	GF310A-2D	F7760322
	50	GF310A-2B	F7760323
1.0mm	250	GF310A-1E	F7760331
	150	GF310A-1D	F7760332
	50	GF310A-1B	F7760333
0.8mm	250	GF310A-M8E	F7760341
	150	GF310A-M8D	F7760342
	50	GF310A-M8B	F7760343
0.5mm	250	GF310A-M5E	F7760351
	150	GF310A-M5D	F7760352
	50	GF310A-M5B	F7760353
0.3mm	250	GF310A-M3E	F7760361
	150	GF310A-M3D	F7760362
	50	GF310A-M3B	F7760363

* See page 50 for Asahipak GF-310 HQ.
* See page 86 for preparative columns.

Asahipak GF-510 HQ semi-micro and micro type

Base Material : Polyvinyl alcohol

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	GF510A-4E	F7760511
	150	GF510A-4D	F7760512
	50	GF510A-4B	F7760513
2.0mm	250	GF510A-2E	F7760521
	150	GF510A-2D	F7760522
	50	GF510A-2B	F7760523
1.0mm	250	GF510A-1E	F7760531
	150	GF510A-1D	F7760532
	50	GF510A-1B	F7760533
0.8mm	250	GF510A-M8E	F7760541
	150	GF510A-M8D	F7760542
	50	GF510A-M8B	F7760543
0.5mm	250	GF510A-M5E	F7760551
	150	GF510A-M5D	F7760552
	50	GF510A-M5B	F7760553
0.3mm	250	GF510A-M3E	F7760561
	150	GF510A-M3D	F7760562
	50	GF510A-M3B	F7760563

* See page 50 for Asahipak GF-510 HQ.
* See page 86 for preparative columns.

Asahipak GF-710 HQ semi-micro and micro type

Base Material : Polyvinyl alcohol

I.D.	Length (mm)	Product Name	Product Code
4.6mm	250	GF710A-4E	F7760711
	150	GF710A-4D	F7760712
	50	GF710A-4B	F7760713
2.0mm	250	GF710A-2E	F7760721
	150	GF710A-2D	F7760722
	50	GF710A-2B	F7760723
1.0mm	250	GF710A-1E	F7760731
	150	GF710A-1D	F7760732
	50	GF710A-1B	F7760733
0.8mm	250	GF710A-M8E	F7760741
	150	GF710A-M8D	F7760742
	50	GF710A-M8B	F7760743
0.5mm	250	GF710A-M5E	F7760751
	150	GF710A-M5D	F7760752
	50	GF710A-M5B	F7760753
0.3mm	250	GF710A-M3E	F7760761
	150	GF710A-M3D	F7760762
	50	GF710A-M3B	F7760763

* See page 50 for Asahipak GF-710 HQ.
* See page 86 for preparative columns.