Capture the Essence

Shodex™

HPLC Columns and Instruments 2011 – 2012

SHOWA DENKO K.K.

Shodex™

We provide a wide range of products to meet your analytical needs, from pretreatment and separation columns to HPLC-related instruments.
Please visit the Shodex website to see application data and uses.

Shodex website
http://www.shodex.net

[Caution]

1. Please read the operating manual included on the product carefully before use.
2. For improvement purposes, some specifications are subject to change without notice.
3. The figures included in this catalogue are not guaranteed and should be used only as references.
4. It is essential to take normal precautions when handling reagents and other chemical products even if the safety information is not included on the operating manual.
5. Products described in this brochure are not intended for medical use or medical applications including medical diagnosis.

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Reversed & HILIC (Silica-based)	ODSpak	F	Silica	Octadecyl	20
	Silica	C18M, C18P	Silica	Octadecyl	20
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	Silica	5SIL	Silica	—	20
	Silica	5C8	Silica	Octyl	20
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	Silica	5CN	Silica	Cyanopropyl	20
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	PIKESS	SP-2B	Polyhydroxymethacrylate	Sulfopropyl	26
	IEC	CM-825	Polyhydroxymethacrylate	Carboxymethyl	26
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	SUGAR	SP0810	Styrene divinylbenzene copolymer	Sulfo(Pb^{2+})	32
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	USPpak	MN-431	Styrene divinylbenzene copolymer	Sulfo(Ca^{2+})	32
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Ion Chromatography	IC	NI-424, I-524A	Polyhydroxymethacrylate	Quaternary ammonium	38
	IC	SI	Polyvinyl alcohol	Quaternary ammonium	38
	WINE	VH-anion	Polyvinyl alcohol	Quaternary ammonium	38
	IC	YS-50	Polyvinyl alcohol	Carboxyl	40
	IC	YK-421	Silica	Carboxyl	40
	IC	Y-521, T-521, R-621	Styrene divinylbenzene copolymer	Sulfo	40
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Organic SEC (GPC)	GPC	KF-800, KF-600, KF-400HQ, K-800, KD-800, HFIP-800, HFIP-600, LF, HT-800, UT-800, AT-806MS	Styrene divinylbenzene copolymer	—	52, 54, 56, 58, 60

HPLC Separation Modes

Liquid chromatography (LC) uses liquid as mobile phase (eluent). It is an analytical method that separates a mixture of compounds based on their physical and chemical differences. High-performance liquid chromatography (HPLC) is a method that introduces the mobile phase under high-pressure conditions that results in rapid and high-performance separations. The various interactions between the analyte, stationary phase (packing material), and mobile phase are the key factors for the separation. A wide variety of separation mechanism can be obtained by using particular combinations of stationary and mobile phases.

Separation mode	Characteristics
Reversed Phase Chromatography (RPC)	• Separation is based on the partition equilibrium between stationary phase and mobile phase. • The polarity of the stationary phase is lower than the mobile phase. • Typically used mobile phase contains a mixture of organic solvents (methanol, acetonitrile, or THF) and aqueous solvents (water or buffer). • Using the lower polarity mobile phase trigers a faster elution.
Normal Phase Chromatography (NPC)	• Separation is based on the partition equilibrium between the stationary phase and the mobile phase. • The polarity of the stationary phase is higher than that of the mobile phase. • Typically used mobile phase contains a mixture of organic solvents with different polarities such as hexane and isopropanol. • Using the higher polarity mobile phase trigers a faster elution.
Hydrophilic Interaction Chromatography (HILIC)	• Separation is based on hydrophilic interaction. • A high polarity stationary phase is used. • Typically the mobile phase contains a mixture of organic solvent such as acetonitrile and aqueous solvents (water or buffer). • Using the higher polarity mobile phase trigers a faster elution. • Applicable for the analysis of high polar substances.
Ion Exchange Chromatography (IEC)	• Separation is based on electrostatic interactions between the ion exchanger and ionic solutes. • The mobile phase of choice should have a sufficient buffering capacity at the pH that produces the largest charge differences between the analyte of interest. • The elution position is optimized by varying the pH, salt concentration, and/or ionic strength of the mobile phase.
Hydrophobic Interaction Chromatography (HIC)	• Separation is based on hydrophobic interaction. • Hydrophobic functional group is modified on the stationary phase. • Adsorption of analytes generally occurs at a high salt concentration and they are released by lowering the salt concentration. • Suitable for protein analysis.
Affinity Chromatography (AFC)	• Separation is based on adsorption of the analyte to the specific biologically derived ligand pair. • Highly selective. • A buffer solution with the appropriate pH and ionic strength is selected based on the type of ligand, analytes, and their interaction. • Mainly used for the purification and concentration of biological active substances.
Ligand Exchange Chromatography (LEX)	• Separation is based on differences in analytes' coordination complex. • Stationary phase modified with metal sulfonate complex ion. • Works in the combination with size exclusion and HILIC modes.
Ion Exclusion Chromatography (IEX)	• Separation is based on electrostatic interaction (repulsion) between the ion exchanger and ionic solutes. • Dissociated ionic molecules elute faster than non-dissociated forms. • Used mainly for the analysis of inorganic compounds.
Ion Chromatography (IC)	• Separation is based on electrostatic interaction (bonding) between the ion exchanger and ionic solutes. • Has a relatively small ion exchange capacity. • Electrical conductivity detector can be used by employing a low-salt-concentration of mobile phase. • Used mainly for inorganic compound analysis.
Size Exclusion Chromatography (SEC)	• The capillary pores on the surface of high-molecular-base gel works as molecular seve to separate molecules based on their sizes. • To separate molecules solely based on their sizes, it requires an analytical condition without any analyte and packing gel interaction. • The bigger the molecule size, the faster the elution sequence. • Suitable for molecular weight determination or molecular distribution of macromolecules and qualification of oligomers.
Chiral Separation (CS)	• Separation of optical isomers using chiral selectors. • Highly selective.
Multimode Chromatography	• Separation is based on the combination of different modes.

Column selection by sample character and separation mode

Sample solubility	Sample MW	Separation mode
Aqueous soluble	≥ 2,000	SEC
		LEX
		IEX
		IEC
		HIC
		RPC
		AFC
	≤ 2,000	SEC
		LEX
		IEX
		IEC
		IC
		RPC
		HILIC
		AFC
		CS

Sample solubility	Sample MW	Separation mode
Organic soluble	≥ 2,000	SEC
	≤ 2,000	SEC
		RPC
		NPC

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
IC : Ion chromatography
SEC : Size exclusion chromatography
CS : Chiral separation

Column Selection (Application)

Pharmaceuticals, Cosmetics

		Separation mode	Page
Pharmaceuticals Metabolites	Hydrophobic substances	RPC	10, 11, 20
	Hydrophilic substances	HILIC	13, 20
		IEC+RPC	12
		LEX+SEC	32
	Substances in bio-fluid (serum·plasma·urine)	RPC	11
		SEC+RPC	48, 50
Moisturizers	Polyalcohols	LEX+HILIC	33
		LEX+SEC	32
		SEC	46, 50
		RPC	11
	Protein hydrolysates	SEC	44
		RPC	10, 11, 20
	Mucopolysaccharides	SEC	46
Emulsifiers	Surfactants	SEC+RPC	50
		SEC	52, 56
Preservatives	Paraben Dehydroacetic acid	RPC	10, 11, 20
Optical active materials		CS	22

Biotechnology

		Separation mode	Page
Genomics	Nucleobases Nucleotides Nucleosides	IEC+SEC	48
		IEC	24
		RPC	11
		AFC	28
	Oligo nucleic acids	IEC+SEC	48
		IEC	24
		RPC	11
	DNA RNA	SEC	46, 50
		AFC	28
Proteomics	Amino acids	IEC	26, 40
		IEC+IEX+RPC	12
		IEC+SEC	48
		RPC	10
	Proteins Peptides	SEC	44, 48, 50
		IEC	24, 26
		RPC	10, 11
		HIC	26
		AFC	28
Glycomics	Glycoproteins	SEC	44, 48, 50
		IEC	24, 26
		RPC	10, 11
		HIC	26
		AFC	28
	Sugar chains	HILIC	13
		AFC	28
	Monosaccharides	LEX+SEC	32
		LEX+HILIC	33
		HILIC	13
	Sialic acids Uronic acids Aldonic acids	IEX+SEC	36
Hormone	Amines	RPC	10, 11
		IEC	26
	Steroids	RPC	11
		HILIC	13
		SEC	46, 50
Lipid	Phospholipids	NPC	20
		SEC	50, 52, 56
	Lipoproteins	SEC	46
		AFC	28

Separation Mode (p.4 and p.5)

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
IC : Ion chromatography
SEC : Size exclusion chromatography
CS : Chiral Separation

Foods

		Separation mode	Page
Nutritional ingredients	Monosaccharides Disaccharides Sugar alcohols	LEX+SEC	32
		LEX+HILIC	33
		HILIC	13
	Oligosaccharides	SEC	32, 46, 48
		LEX+HILIC	33
		HILIC	13
	Polysaccharides	SEC	32, 46
	Organic acids	IEX+RPC	12, 36
		IC	38
		RPC	11
	Water soluble vitamins	RPC	10, 11
		HILIC	13
		IEC+RPC	12
	Fat-soluble vitamins	RPC	10
		NPC	20
		SEC	52, 56
	Fatty acids	RPC	11, 20
		SEC	50, 52, 56
	Nucleic acids (umami)	IEC+SEC	48
	Amino acids	IEC	26
		IEC+IEX+RPC	12
Food safety	Food additives	RPC	10, 11
		HILIC	13
	Pesticides	RPC	12
		IC	38
		IEC+RPC	12
	Pretreatment of residual pesticides	SEC GPC clean-up	6

New materials

		Separation mode	Page
Synthetic polymers	Organic solvent soluble	SEC	50,52,56,58
	Polar organic solvent soluble		46,50,54,58
	High temperature/ Ultra-high temperature		58
	Water soluble		44,46,48,50
Additives, oligomers		RPC	10,11,20
	Organic solvent soluble	SEC	50,52,56,58
	Polar organic solvent soluble		50,54,58
	Water soluble		44,46,48,50

Environment

		Separation mode	Page
Water quality	Anions	IC	38
	Oxyhalides	IC	38
	Cyanide Cyanogen chloride	IEX	36
	Cations	IC	40
	Surfactants	SEC+RPC	50
		RPC	20
	Pesticides	RPC	12
		IC	38
		IEC+RPC	12
Soil	Anions	IC	38
	Heavy metals	IC	40
	Rare earths	IC	40
	Humic substances	SEC	46
	Organic arsenic	IEX+RPC	12
	Pesticides	RPC	12
		IC	38
		IEC+RPC	12
Environmental hormones	Pretreatment of phthalates PCBs Benzo [a] pyrene	SEC GPC clean-up	6
Bioethanols	Monosaccharides Oligosaccharides	LEX+SEC	32
		HILIC	13
	Polysaccharides Oligosaccharides Alcohols	LEX+SEC	32
	Saccharides Organic acids Alcohols	IEX+RPC+SEC	36
	Hemicelluloses Celluloses	SEC	54, 58
Biodiesels	Cations	IC	40
	Fatty acid glycerides	SEC	50
	Fatty acid methyl esters	RPC	11
	Organic acids	IC	38

Columns for GPC Clean-up

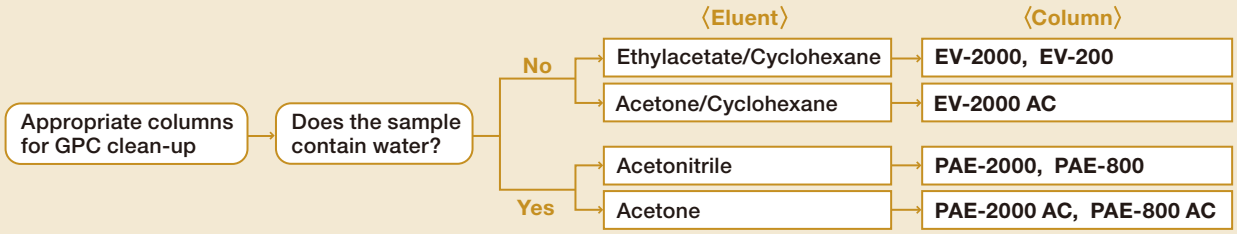
Features

EV

- Suitable for fractionation of residual pesticides in food
- Used in the purification process of test solution preparation method in Shoku-An No. 1003001 (October 3rd, 2006. Japan) of the Pharmaceutical and Food Safety Bureau, MHLW, Section 2 "Simultaneous GC/MS (LC/MS) Analyses of Agricultural Chemicals in Livestock and Marine Products"

PAE

- Suitable for cleaning up water samples such as blood and bottom sediment
- Highly effective for fractionation of endocrine disruptors in environmental samples



GPC Clean-up for residual pesticides in food, etc

Product Code	Product Name	Particle Size (µm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6090005	**CLNpak EV-200**	16	30	**2.0 × 150**	Ethylacetate/Cyclohexane=3/7
F6090001	**CLNpak EV-2000**	16	30	**20.0 × 300**	Ethylacetate/Cyclohexane=3/7
F6090002	**CLNpak EV-G**	16	(guard column)	**20.0 × 100**	Ethylacetate/Cyclohexane=3/7
F6090003	**CLNpak EV-2000 AC**	16	30	**20.0 × 300**	Acetone/Cyclohexane=3/7
F6090004	**CLNpak EV-G AC**	16	(guard column)	**20.0 × 100**	Acetone/Cyclohexane=3/7

Base Material : Styrene divinylbenzene copolymer

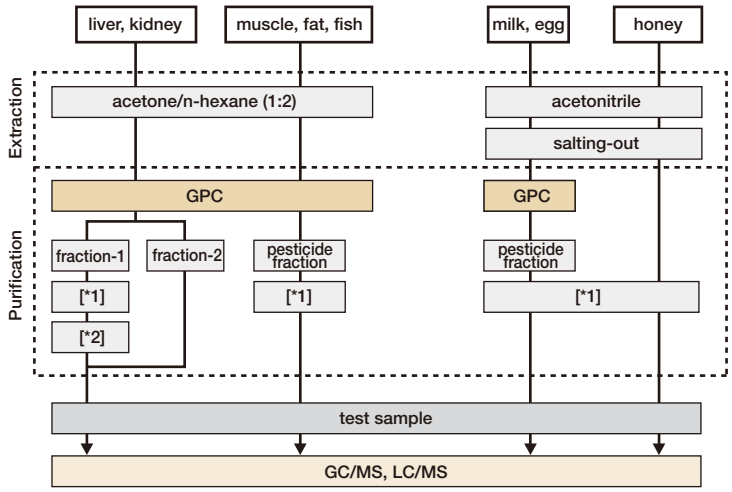
GPC Clean-up for phthalic acid esters in sediments, biological samples, blood, etc

Product Code	Product Name	Particle Size (µm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7600025	**CLNpak PAE-800**	5	400	**8.0 × 300**	Acetonitrile
F6810022	**CLNpak PAE-2000**	5	400	**20.0 × 300**	Acetonitrile
F6714007	**CLNpak PAE-G**	9	(guard column)	**8.0 × 50**	Acetonitrile
F7600026	**CLNpak PAE-800 AC**	5	400	**8.0 × 300**	Acetone
F6810023	**CLNpak PAE-2000 AC**	5	400	**20.0 × 300**	Acetone
F6714008	**CLNpak PAE-G AC**	9	(guard column)	**8.0 × 50**	Acetone

Base Material : Polyvinyl alcohol

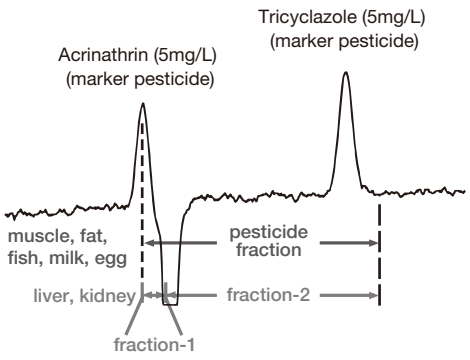
*Contact Shodex or our distributors near you for customized columns.

Preparation of Test Samples Used in Simultaneous GC/MS and LC/MS Analysis of Agricultural Chemicals in Livestock and Marine Products (Outline)



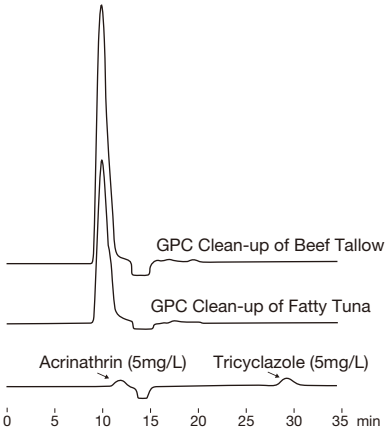
*1 purification with Ethylenediamine-N-propylsilyled silica gel mini-column
*2 purification with silica gel mini-column

GPC Clean-up of Pesticide Residues using EV-2000 AC



Column : **Shodex CLNpak EV-G AC + EV-2000 AC**
Eluent : Acetone/Cyclohexane=1/4
Flow rate : 5.0mL/min
Detector : UV(254nm)
Column temp. : 40℃
Injection vol. : 5mL

GPC Clean-up of Fatty Tuna and Beef Tallow

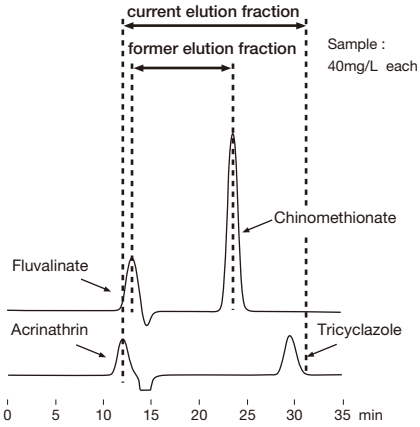


[Extraction]

1) Weigh 20.0g of the sample (5.0g for fat).
2) Add 20mL of water and homogenize.
3) Add 100mL of acetone/n-hexane (1/2) and homogenize.
4) Centrifuge (2,500rpm, 5min.) and collect the organic layer (1).
5) Add 50mL of n-hexane to the residue and homogenize.
6) Centrifuge (2,500rpm, 5min.) and collect the organic layer (2).
7) Combine (1) and (2) and add anhydrous sodium sulfate for dehydration.
8) Remove anhydrous sodium sulfate by filtering and concentrate the filtrate at 40℃ or lower.
9) Remove the solvent.
10) Weigh the residue (extracted fat).
11) Dissolve in acetone/cyclohexane (1/4).

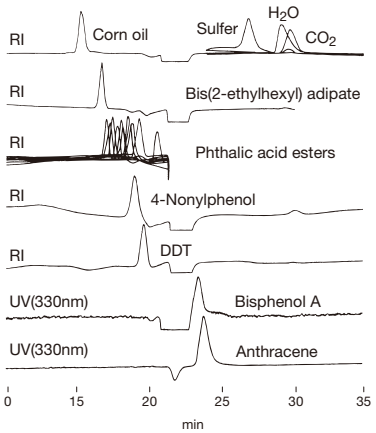
Column : **Shodex CLNpak EV-G AC + EV-2000 AC**
Eluent : Acetone/Cyclohexane=1/4
Flow rate : 5.0mL/min
Detector : UV(254nm)
Column temp. : 40℃
Injection vol. : 5mL

Fractionation Standards



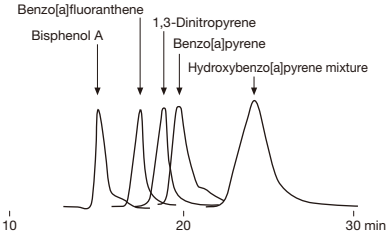
Column : **Shodex CLNpak EV-G AC + EV-2000 AC**
Eluent : Acetone/Cyclohexane=1/4
Flow rate : 5mL/min
Detector : UV(254nm)
Column temp. : 40℃
Injection vol. : 5mL

Elution Positions of Phthalic Acid Esters using PAE-800 AC



Column : **Shodex CLNpak PAE-800 AC**
Eluent : Acetone
Flow rate : 0.5mL/min
Detector : UV(330nm), RI
Column temp. : Room temp.

GPC clean-up of Carcinogens in Diesel Dust measured using PAE-800 AC

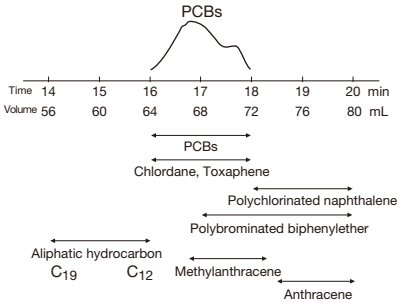


Compound	Rt(min)	Compound	Rt(min)
Anthracene	16.6	Benzo[a]pyrene	19.9
Chrysene	18.0	Hydroxybenzo[a]pyrene compound	23.0
Fluoranthene	17.1		
Benzo[a]fluranthene	17.7	Bisphenol A	16.1
Benzo[b]fluranthene	18.6	1,3-Dinitronaphthalene	16.2
Benzo[k]fluranthene	18.4	1-Nitropyrene	18.6
Pyrene	17.9	1,3-Dinitropyrene	18.6
1-Hydroxypyrene	19.7	1,6-Dinitropyrene	18.9
		1,8-Dinitropyrene	18.7

Column : **Shodex CLNpak PAE-800 AC**
Eluent : Acetone
Flow rate : 0.8mL/min
Detector : UV(210nm)
Column temp. : Room temp.

Data provided by Prof. Kazuichi Hayakawa, Faculty of Pharmaceutical Sciences, Kanazawa University.

Pretreatment of PCBs in Waste Oil



Column : **Shodex CLNpak PAE-G AC + PAE-2000 AC**
Eluent : Acetone
Flow rate : 4.0mL/min
Detector : UV(213nm)

Data provided by Mr. Koichi Sasaki et al., Analytical Center, Kokan Keisoku Corporation.

Columns for Column Switching method

News No.9, 11, 22

Features

PK
- Effective for both hydrophilic and hydrophobic substances
- High rate of protein removal

GF-4A
- High rate of protein removal than the PK columns

* GF-4A column removes proteins well but is not suitable for trapping hydrophilic substances. Use PK columns for this purpose.

KW-604S
- Suitable for the separation of proteins and chemical substances by using SEC mode

Cartridge columns and holder for column switching method

Product Code	Product Name	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent	Pcs/box
F8700000	**MSpak PK-2A 2p**	30	30	**2.0 x 10**	H_2O	2
F8700011	**MSpak PK-2A 5p**	30	30	**2.0 x 10**	H_2O	5
F8700012	**MSpak PK-4A 2p**	30	30	**4.0 x 10**	H_2O	2
F8700013	**MSpak PK-4A 5p**	30	30	**4.0 x 10**	H_2O	5
F8700001	**MSpak HLD**	–	–	**(Holder for PK)**	–	1

Base Material : Hydrophilic copolymers containing N-vinyl acetoamide

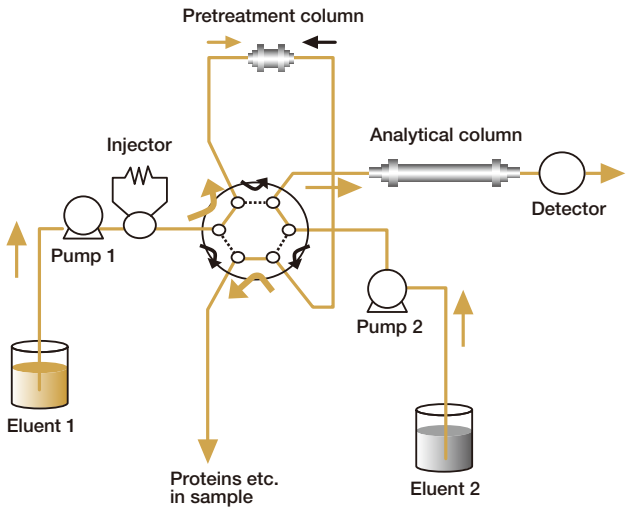
* PK series are cartridge columns and thus should be installed in a column holder "MSpak HLD" before use.

Columns for column switching method

Product Code	Product Name	Base Material	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F8700015	**MSpak GF-4A**	Polyvinyl alcohol	9	400	**4.6 × 10**	H_2O
F6989106	**PROTEIN KW-604S**	Silica	7	1,500	**6.0 × 50**	H_2O

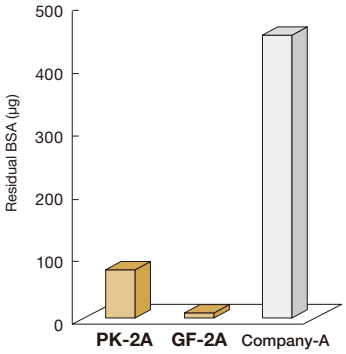
*Contact Shodex or our distributors near you for customized columns.

Systems diagram for column switching



Pretreatment columns for protein removal

Column	Removal rate of proteins
PK-2A	99.62%
GF-2A*	99.80%
Company-A	97.68%



(Pretreatment)
Eluent : 10mM Ammonium acetate buffer(pH7.0)
Flow rate : 0.5mL/min
Column temp. : Room temp.

(Analysis)
Column : Shodex PROTEIN KW-604S
Eluent : 0.1% TFA in (H_2O/CH_3CN=50/50)
Flow rate : 0.5mL/min
Detector : UV(280nm)
Column temp. : Room temp.
Switching time: 5min

*GF-2A: Custom-made column of GF-4A (2.0mmI.D. x 10mm)

Recovery Rates of Medical Compounds using PK-2A column

Sample	Recovery (%)	Sample	Recovery (%)	Sample	Recovery (%)
Acetaminophen	115	Oxazepam	97	Hydroxyzine	99
Caffeine	106	Triazolam	96	Fludiazepam	97
Barbital	94	Chlordiazepoxide	133	Trimipramine	107
Primidone	91	Phenytoin	99	Chlorpromazine	77
Trimethadione	137	Flurazepam	106	Haloperidol	99
Metharbital	94	Hypaconitine	97	Diazepam	97
Bromvalerylurea	94	Desipramine	109	Levomepromazine	96
Ethenzamide	98	Etizolam	105	Bromperidol	89
Phenobarbital	96	Aconitine	110	Clomipramine	95
Phenacetin	108	Brotizolam	97	Mianserin	92
Flumazenil	93	Nitrazepam	97	Cloxazolam	91
Warfarin	81	Maprotyline	90	Clotiazepam	96
Bromazepam	102	Nortriptyline	86	Promethazine	92
Chlormezanone	92	Biperiden	99	Haloxazolam	93
Pentobarbital	93	Imipramine	97	Carpipramine	99
Amobarbital	93	Propericiazine	90	Perfenazine	86
Acetylpheneturide	92	Trihexyphenidyl	91	Oxazolam	99
Carbamazepine	97	Clonazepam	96	Timiperone	88
Clofedanol	91	Flunitrazepam	97	Lofepramine	65
4-Hydroxytriazolam	91	Benzoylaconitine	96	Zotepine	92
Secobarbital	97	Benzoylhypaconine	83	Thioridazine	97
1-Hydroxymethyltriazolam	90	Chlorpheniramine	111	Medazepam	91
Mephobarbital	99	Propranolol	97	Clocapramine	95
Glutethimide	93	Mesaconine	118	Bromocriptine	80
Estazolam	101	Nimetazepam	90	Diphenhydramine	93
Indomethacin	93	Amitriptyline	93		
Alprazolam	99	Sildenafil citrate	95		

(Adsorption)
Eluent : 10mM Ammonium acetate buffer(pH7.0)
Flow rate : 0.5mL/min

(Elution)
Eluent : 10mM Ammonium acetate buffer(pH7.0)/CH_3CN
Flow rate : 0.5mL/min
Detector : UV(220nm)
Switching time: 5min

Polymer-based Packed Columns for Reversed Phase Chromatography

Features

ODP-50, C8P-50, C4P-50

- Relative large pore size supports the analysis of proteins, peptides, and amino acids
- Useable in a wide pH range from acidic to alkaline (pH 2 to 13)
- Useable in 100% water or buffer solution
- Best to be used for the analysis of basic substances

News No.35 Preparative Columns p.82

ODP-40

- Higher performance type of ODP-50 series

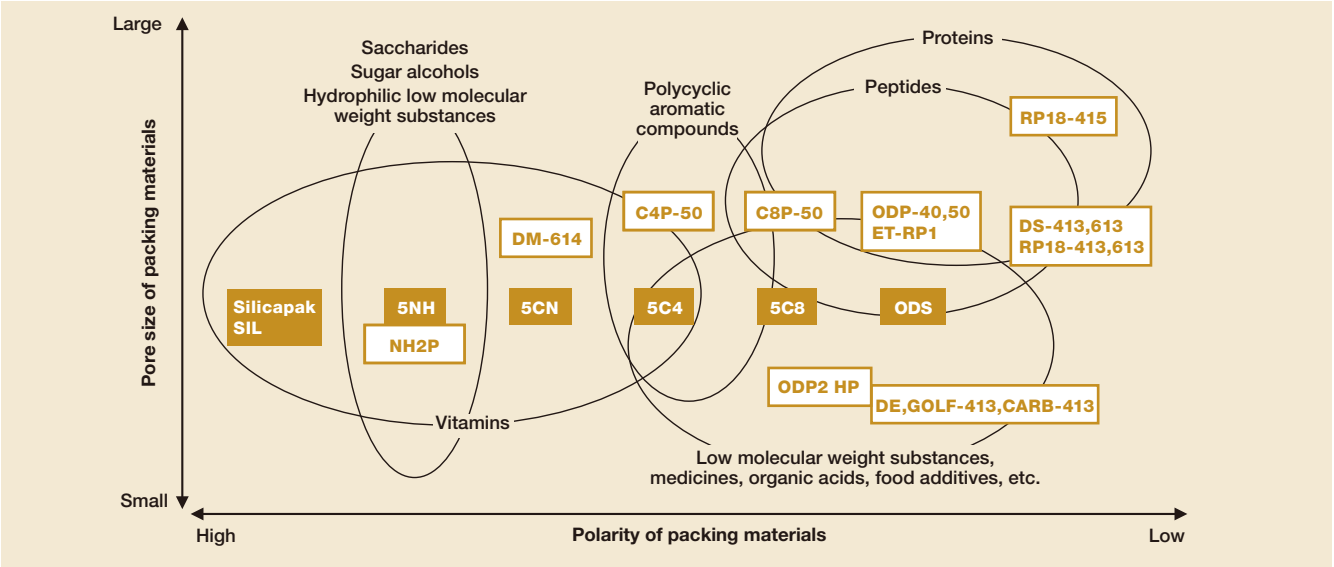
News No.1 Semi-micro Micro Columns p.70

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7621001	**Asahipak ODP-40 4D**	≥ 11,000	Octadecyl	4	250	**4.6 × 150**	H_2O/CH_3CN=35/65
F7621002	**Asahipak ODP-40 4E**	≥ 17,000	Octadecyl	4	250	**4.6 × 250**	H_2O/CH_3CN=35/65
F7620002	**Asahipak ODP-50 6D**	≥ 9,000	Octadecyl	5	250	**6.0 × 150**	H_2O/CH_3CN=35/65
F7620001	**Asahipak ODP-50 6E**	≥ 14,000	Octadecyl	5	250	**6.0 × 250**	H_2O/CH_3CN=35/65
F6710001	**Asahipak ODP-50G 6A**	(guard column)	Octadecyl	5	–	**6.0 × 10**	H_2O/CH_3CN=35/65
F6710023	**Asahipak ODP-50 4B**	≥ 2,500	Octadecyl	5	250	**4.6 × 50**	H_2O/CH_3CN=35/65
F7620004	**Asahipak ODP-50 4D**	≥ 9,000	Octadecyl	5	250	**4.6 × 150**	H_2O/CH_3CN=35/65
F7620003	**Asahipak ODP-50 4E**	≥ 14,000	Octadecyl	5	250	**4.6 × 250**	H_2O/CH_3CN=35/65
F6710022	**Asahipak ODP-50G 4A**	(guard column)	Octadecyl	5	–	**4.6 × 10**	H_2O/CH_3CN=35/65
F7620009	**Asahipak ODP-50 2D**	≥ 5,000	Octadecyl	5	250	**2.0 × 150**	H_2O/CH_3CN=35/65
F6713001	**Asahipak ODP-50G 2A**	(guard column)	Octadecyl	5	–	**2.0 × 10**	H_2O/CH_3CN=35/65
F7620006	**Asahipak C8P-50 4D**	≥ 7,000	Octyl	5	250	**4.6 × 150**	H_2O/CH_3CN=35/65
F7620005	**Asahipak C8P-50 4E**	≥ 11,000	Octyl	5	250	**4.6 × 250**	H_2O/CH_3CN=35/65
F6710002	**Asahipak C8P-50G 4A**	(guard column)	Octyl	5	–	**4.6 × 10**	H_2O/CH_3CN=35/65
F7620008	**Asahipak C4P-50 4D**	≥ 6,000	Butyl	5	250	**4.6 × 150**	H_2O/CH_3CN=35/65
F7620007	**Asahipak C4P-50 4E**	≥ 9,000	Butyl	5	250	**4.6 × 250**	H_2O/CH_3CN=35/65
F6710003	**Asahipak C4P-50G 4A**	(guard column)	Butyl	5	–	**4.6 × 10**	H_2O/CH_3CN=35/65

Base Material : Polyvinyl alcohol

Features and Applications of Different Packing Materials used for Columns for Reversed Phase, Hydrophilic Interaction and Normal phase Chromatography



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

Polymer-based Packed Columns for Reversed Phase Chromatography

Features

ODP2 HP
- Provides nearly twice as large theoretical plate number compared with generally available polymer-based reversed phase columns
- Stronger retention of high polar substances compared with ODS columns
- Suitable for reversed phase analysis of small molecules such as pharmaceutical compounds in the presence of protein matrix
- Ideal for LC/MS analysis of high polar compounds

Note book No.6 News No.30, 36

NEW ET-RP1
- Capable of high temperature analysis up to 150°C
- High temperature analysis improves column efficiency and enables rapid analysis

News No.41

RP18-415
- Large pore size is suitable for the analysis of proteins and peptides

DS-613, 413
- Suitable for reversed phase analysis of highly hydrophilic substances, which cannot be retained well by ODS columns

RP18-613, 413
- Higher performance (higher theoretical plates) version of DS-613 and DS-413

DE
- Polymer-based columns, with similar polarity to that of ODS columns, can be used in general and wide purpose
- Wide pH range ; useable in 100% water or buffer solution

Semi-micro Micro Columns p.70
News No.14, 23, 24, 35 Preparative Columns p.82

DM-614
- Suitable for the analysis of amino acids and water-soluble vitamins

Preparative Columns p.82

See also page 10, "Features and Applications of Different Packing Materials used for Columns for Reversed Phase, Hydrophilic Interaction and Normal phase Chromatography"

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Base Material	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7622001	ODP2 HP-4B	≥ 3,500	–	Polyhydroxymethacrylate	5	40	4.6 × 50	H_2O/CH_3CN=55/45
F7622002	ODP2 HP-4D	≥ 13,000	–	Polyhydroxymethacrylate	5	40	4.6 × 150	H_2O/CH_3CN=55/45
F7622003	ODP2 HP-4E	≥ 17,000	–	Polyhydroxymethacrylate	5	40	4.6 × 250	H_2O/CH_3CN=55/45
F6714010	ODP2 HPG-4A	(guard column)	–	Polyhydroxymethacrylate	5	–	4.6 × 10	H_2O/CH_3CN=55/45
F7622004	ODP2 HP-2B	≥ 3,000	–	Polyhydroxymethacrylate	5	40	2.0 × 50	H_2O/CH_3CN=55/45
F7622005	ODP2 HP-2D	≥ 7,000	–	Polyhydroxymethacrylate	5	40	2.0 × 150	H_2O/CH_3CN=55/45
F6714011	ODP2 HPG-2A	(guard column)	–	Polyhydroxymethacrylate	5	–	2.0 × 10	H_2O/CH_3CN=55/45
F7623001	NEW ET-RP1 4D	≥ 11,000	Octadecyl	Polyvinyl alcohol	4	250	4.6 × 150	H_2O/CH_3CN=35/65
F7623003	NEW ET-RP1 3D	≥ 9,000	Octadecyl	Polyvinyl alcohol	4	250	3.0 × 150	H_2O/CH_3CN=35/65
F7009000	RSpak RP18-415	≥ 5,000	–	Styrene divinylbenzene copolymer	6	450	4.6 × 150	H_2O/CH_3CN=5/95
F7009002	RSpak RP18-613	≥ 13,000	–	Styrene divinylbenzene copolymer	3.5	200	6.0 × 150	$H_2O/CH_3CN/THF$=40/30/30
F7009001	RSpak RP18-413	≥ 11,000	–	Styrene divinylbenzene copolymer	3.5	200	4.6 × 150	$H_2O/CH_3CN/THF$=40/30/30
F6709558	RSpak RP18-G	(guard column)	–	Styrene divinylbenzene copolymer	6	–	4.6 × 10	$H_2O/CH_3CN/THF$=40/30/30
F7001001	RSpak DS-613	≥ 6,500	–	Styrene divinylbenzene copolymer	6	200	6.0 × 150	$H_2O/CH_3CN/THF$=30/40/30
F7001012	RSpak DS-413	≥ 11,000	–	Styrene divinylbenzene copolymer	3.5	200	4.6 × 150	$H_2O/CH_3CN/THF$=40/30/30
F6700140	RSpak DS-G	(guard column)	–	Styrene divinylbenzene copolymer	10	–	4.6 × 10	$H_2O/CH_3CN/THF$=30/40/30
F7001004	RSpak DE-613	≥ 7,000	–	Polymethacrylate	6	25	6.0 × 150	H_2O
F7001005	RSpak DE-413	≥ 11,000	–	Polymethacrylate	4	25	4.6 × 150	H_2O/CH_3CN=50/50
F7009030	RSpak DE-413L	≥ 17,000	–	Polymethacrylate	4	25	4.6 × 250	H_2O/CH_3CN=50/50
F7001006	RSpak DE-413S	≥ 3,000	–	Polymethacrylate	4	25	4.6 × 50	H_2O/CH_3CN=50/50
F6700150	RSpak DE-G	(guard column)	–	Polymethacrylate	10	–	4.6 × 10	H_2O
F7001007	RSpak DE-213	≥ 8,000	–	Polymethacrylate	4	25	2.0 × 150	H_2O/CH_3CN=50/50
F6700151	RSpak DE-SG	(guard column)	–	Polymethacrylate	6	–	2.0 × 10	H_2O/CH_3CN=50/50
F7001002	RSpak DM-614	≥ 4,500	–	Polyhydroxymethacrylate	10	200	6.0 × 150	5mM H_3PO_4 aq.
F6700160	RSpak DM-G	(guard column)	–	Polyhydroxymethacrylate	12	–	4.6 × 10	5mM H_3PO_4 aq.

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

Polymer-based Packed Columns for Reversed Phase Chromatography

Features

NN

- The packing material contains sulfo groups, and supports multimode (reversed phase and cation exchange) analysis
- Ideal for analysis of complex samples containing neutral and ionic substances
- Applicable for the analysis of organic arsenics

Note book No.3 News No.7 Semi-micro Micro Columns p.70

JJ-50

- The packing material contains trace amounts of quaternary ammonium groups, and supports multimode (reversed phase and anion exchange) analysis
- Ideal for analysis of complex samples containing neutral and ionic substances

News No.7

GOLF-413

- Columns for pesticides analysis such as asulam and oxine-Cu
- Supports a wide pH range
- Suitable for the analysis of metal coordination substances

CARB-413

- Columns for N-methylcarbamate pesticides analysis

See also page 10, "Features and Applications of Different Packing Materials used for Columns for Reversed Phase, Hydrophilic Interaction and Normal phase Chromatography"

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Base Material	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7008140	**RSpak NN-814**	≥ 9,000	Sulfo	Polyhydroxymethacrylate	10	200	**8.0 × 250**	0.1M Sodium phosphate buffer (pH3.0)
F7008150	**RSpak NN-614**	≥ 4,000	Sulfo	Polyhydroxymethacrylate	10	200	**6.0 × 150**	0.1M Sodium phosphate buffer (pH3.0)
F6700510	**RSpak NN-G**	(guard column)	Sulfo	Polyhydroxymethacrylate	10	–	**6.0 × 50**	0.1M Sodium phosphate buffer (pH3.0)
F7008160	**RSpak NN-414**	≥ 6,000	Sulfo	Polyhydroxymethacrylate	10	200	**4.6 × 150**	0.1M Sodium phosphate buffer (pH3.0)
F7008240	**RSpak JJ-50 4D**	≥ 4,500	Quaternary ammonium	Polyvinyl alcohol	5	100	**4.6 × 150**	H_2O/CH_3CN=40/60
F7008220	**RSpak JJ-50 2D**	≥ 3,500	Quaternary ammonium	Polyvinyl alcohol	5	100	**2.0 × 150**	H_2O/CH_3CN=40/60

For pesticides

Product Code	Product Name	Application	Functional Group	Column Size (mm) I.D. x L	Shipping Solvent
F7009010	**RSpak GOLF-413**	Asulam, Oxine-Cu, etc	–	**4.6 × 150**	H_2O/CH_3CN=50/50
F7009040	**RSpak CARB-413**	N-methylcarbamate pesticides	–	**4.6 × 150**	H_2O/CH_3CN=50/50
F7009041	**RSpak CARB-413L**	N-methylcarbamate pesticides	–	**4.6 × 250**	H_2O/CH_3CN=50/50
F6700152	**RSpak CARB-LF**	(Line Filter for CARB-413, 413L)	–	**6.0 × 10**	H_2O/CH_3CN=50/50
F6700150	**RSpak DE-G**	(guard column)	–	**4.6 × 10**	H_2O/CH_3CN=50/50

Base Material : Polymethacrylate

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

Polymer-based Packed columns for Hydrophilic Interaction Chromatography (HILIC)

Features

NH2P-50

- Suitable for saccharides analysis by hydrophilic interaction chromatography (HILIC)
- Polymer-based packing material provides excellent chemical stability and resistance to degradation over time
- Washable with alkaline solution
- Also suitable for evaporative light-scattering detector, corona-charged aerosol detector, and LC/MS

Note book No.2 News No.6, 14, 17, 32 Preparative Columns p.83

NEW NH2P-40

- Higher performance of the NH2P-50 series
- Performs high resolution and enables solvent savings with a conventional equipment

News No.44 Semi-micro Micro Columns p.70

See also page 10, "Features and Applications of Different Packing Materials used for Columns for Reversed Phase, Hydrophilic Interaction and Normal phase Chromatography"

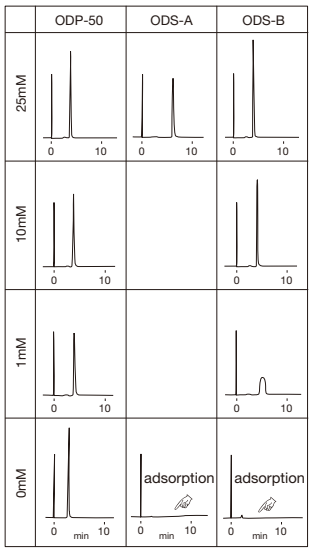
Standard columns

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7630007	NEW **Asahipak NH2P-40 3E**	≥ 8,500	Amino	4	100	**3.0 × 250**	H_2O/CH_3CN=25/75
F6710030	NEW **Asahipak NH2P-50G 3A**	(guard column)	Amino	5	–	**3.0 × 10**	H_2O/CH_3CN=25/75
F7630002	**Asahipak NH2P-50 4D**	≥ 5,500	Amino	5	100	**4.6 × 150**	H_2O/CH_3CN=25/75
F7630001	**Asahipak NH2P-50 4E**	≥ 7,500	Amino	5	100	**4.6 × 250**	H_2O/CH_3CN=25/75
F6710016	**Asahipak NH2P-50G 4A**	(guard column)	Amino	5	–	**4.6 × 10**	H_2O/CH_3CN=25/75
F7630006	**Asahipak NH2P-50 2D**	≥ 3,500	Amino	5	100	**2.0 × 150**	H_2O/CH_3CN=25/75
F6713000	**Asahipak NH2P-50G 2A**	(guard column)	Amino	5	–	**2.0 × 10**	H_2O/CH_3CN=25/75
F6710100	**Asahipak NH2P-LF**	(line filter)	Amino	–	–	**8.0 × 75**	H_2O/CH_3CN=25/75

Base Material : Polyvinyl alcohol

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

Effect of salt concentration in the analysis of basic substance

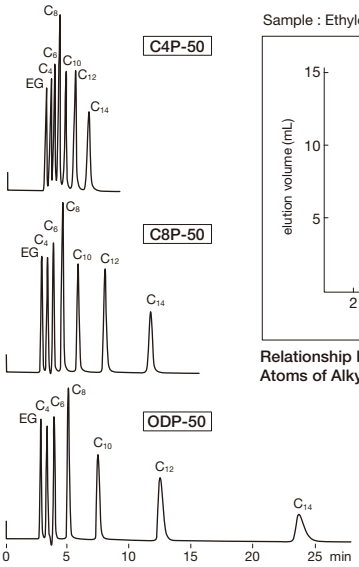


Sample : Scopolamine 1.0mg/mL, 50μL

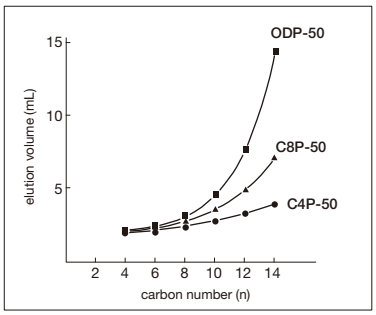
When using an ODS column, nonspecific adsorption of samples is observed under low ionic concentration conditions, and complete adsorption without any elution is achieved under the absence of coexisting ions.
However, when using ODP-50, a polymer-based column, the sharp peak of scopolamine is observed regardless of the ionic concentration, even under the absence of coexisting ions, suggesting that the problematic nonspecific adsorption has been eliminated.

Column : **Shodex Asahipak ODP-50 4D**
ODS-A (company-A)
ODS-B (company-B)
Eluent : Phosphate buffer(pH7.0) /CH_3CN=60/40
Flow rate : 0.6mL/min
Detector : UV(254nm)
Column temp. : 30℃

Alkylalcohols



Sample : Ethyleneglycol, n-Alkylalcohol

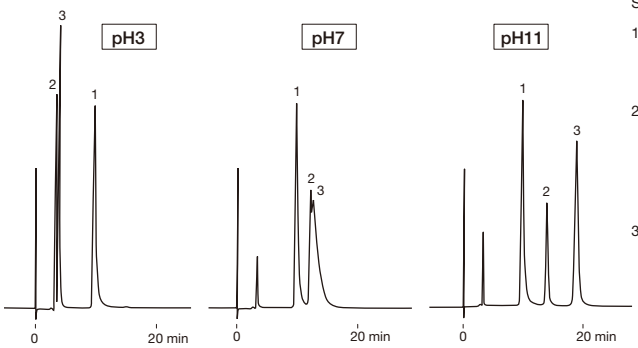


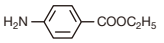
Relationship between the Number of Carbon Atoms of Alkylalcohols and Elution Volume

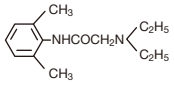
Column : **Shodex Asahipak ODP-50 4D**
C8P-50 4D
C4P-50 4D
Eluent : H_2O/CH_3OH=20/80
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 30℃

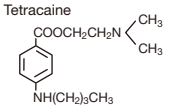
Local anesthetics

Dissociation of tertiary amino groups contained in basic chemical substances can be suppressed by making the pH of the eluent higher than the pKa of the amino groups.
This increases the relative hydrophobicity of the chemical substances, thereby allowing the column to hold the chemical substances stronger to separate them more clearly.



Sample :
1. Benzocaine


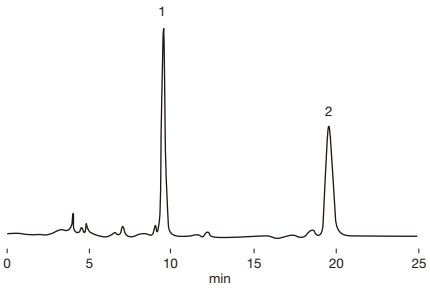
2. Lidocaine


3. Tetracaine


Column : **Shodex AsahipakODP-50 4D**
Eluent : 25mM Phosphate buffer/CH_3CN=60/40
Flow rate : 0.6mL/min
Detector : UV(254nm)
Column temp. : 30℃

Macrolide antibiotics

Sample : 0.1% each, 10μL
1. Erythromycin
2. Azithromycin

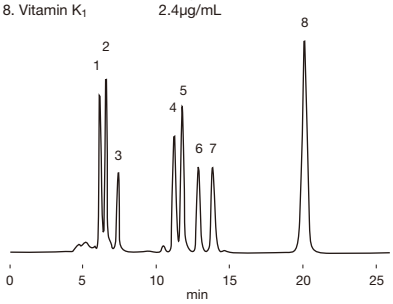


Column : **Shodex Asahipak ODP-40 4E**
Eluent : 40mM Potassium phosphate buffer(pH11.0) /CH_3CN=40/60
Flow rate : 0.5mL/min
Detector : UV(223nm)
Column temp. : 40℃

Fat-soluble vitamins

Sample : 20μL

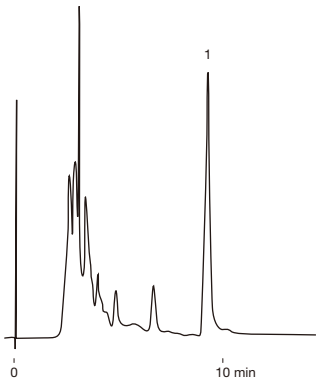
1. Vitamin K_3	1.5μg/mL
2. Vitamin A	1.0 IU/mL
3. Vitamin A acetate	0.5 IU/mL
4. Vitamin D_2	13.2μg/mL
5. Vitamin D_3	13.2 IU/mL
6. Vitamin E acetate	2.4μg/mL
7. Vitamin E	2.5μg/mL
8. Vitamin K_1	2.4μg/mL



Column : **Shodex Asahipak ODP-50 4E**
Eluent : CH_3CN/CH_3OH=50/50
Flow rate : 0.6mL/min
Detector : UV(280nm)
Column temp. : 30℃

Glycyrrhizin in licorice powders

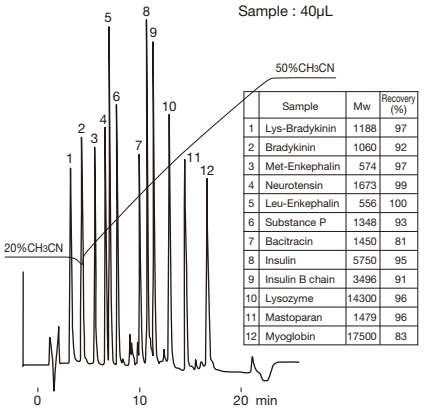
Sample : Licorice
1. Glycyrrhizin



Column : **Shodex Asahipak ODP-50 6D**
Eluent : 0.05% TFA aq./CH_3CN=62/38
Flow rate : 1.0mL/min
Detector : UV(248nm)
Column temp. : 30℃

Gradient analysis of proteins and peptides

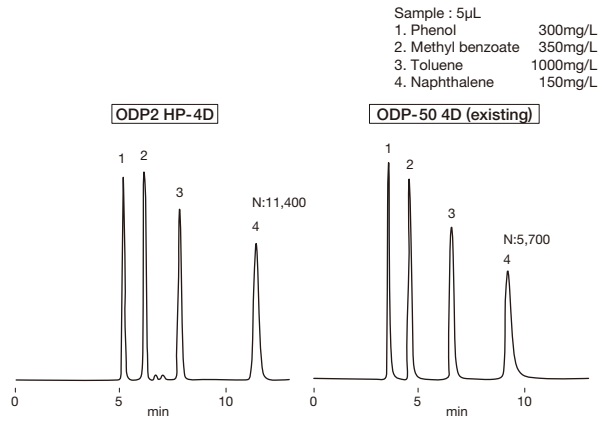
Sample : 40μL



	Sample	Mw	Recovery (%)
1	Lys-Bradykinin	1188	97
2	Bradykinin	1060	92
3	Met-Enkephalin	574	97
4	Neurotensin	1673	99
5	Leu-Enkephalin	556	100
6	Substance P	1348	93
7	Bacitracin	1450	81
8	Insulin	5750	95
9	Insulin B chain	3496	91
10	Lysozyme	14300	96
11	Mastoparan	1479	96
12	Myoglobin	17500	83

Column : **Shodex Asahipak ODP-50 6D**
Eluent : (A); 0.05% TFA aq./CH_3CN=80/20
(B); 0.05% TFA aq./CH_3CN=50/50
Linear gradient; (A) to (B), 20min
Flow rate : 1.0mL/min
Detector : UV(220nm)
Column temp. : 30℃

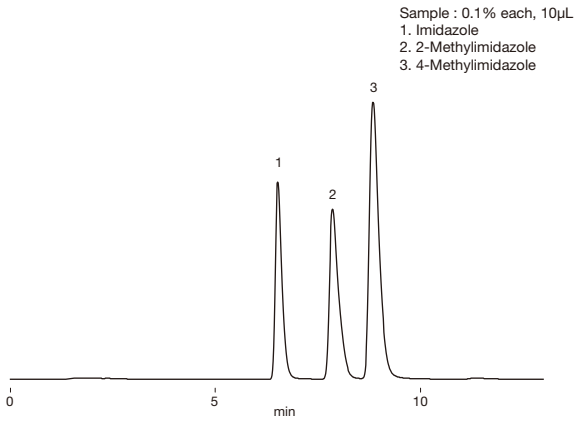
Comparison between ODP2 HP and ODP-50 (existing)



Column : **Shodex ODP2 HP-4D**
Eluent : H_2O/CH_3CN=55/45
Flow rate : 0.6mL/min
Detector : UV(254nm)
Column temp. : 40℃

Column : **Shodex Asahipak ODP-50 4D**
Eluent : H_2O/CH_3CN=35/65
Flow rate : 0.6mL/min
Detector : UV(254nm)
Column temp. : 40℃

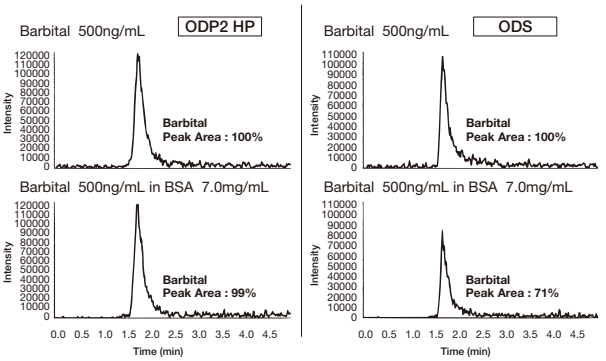
Imidazoles



Column : **Shodex ODP2 HP-4E**
Eluent : 10mM Na_2HPO_4 aq./CH_3CN=90/10
Flow rate : 0.8mL/min
Detector : UV(220nm)
Column temp. : 40℃

Comparison of recovery rates of the barbital in BSA between ODP2 HP-2B and ODS

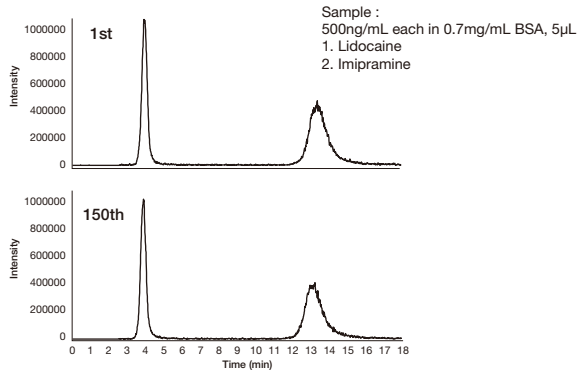
For the LC/MS analysis of chemical substances containing proteins or other similar samples, it is generally said that an ODS column is susceptible to ion suppression due to the presence of proteins. However, ODP2 HP does not hold proteins and elutes them at one time, and thus is resistant to the effects of such ion suppression.



Column : **Shodex ODP2 HP-2B, ODS** (company-A)
Eluent : 10mM Ammonium acetate aq./CH_3CN=70/30
Flow rate : 0.2mL/min
Detector : ESI-MS(SIM Negative : m/z 183)
Column temp. : 30℃
Injection vol. : 10µL

Repeated results of LC/MS analysis

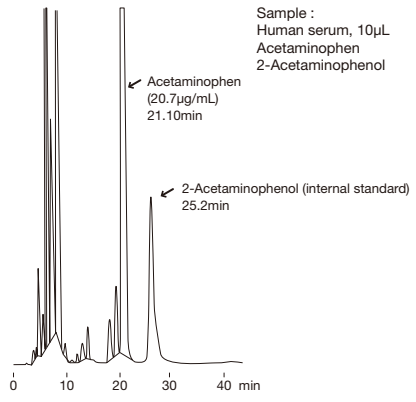
An experiment repeated 150 times for chemical substance analysis in the presence of protein (BSA) revealed that ODP2 HP elutes protein without retaining it and hence poses no significant problem in terms of repeatability.



Column : **Shodex ODP2 HP-2B**
Eluent : 10mM Ammonium acetate aq./CH_3CN=70/30
Flow rate : 0.2mL/min
Detector : ESI-MS
Column temp. : 40℃

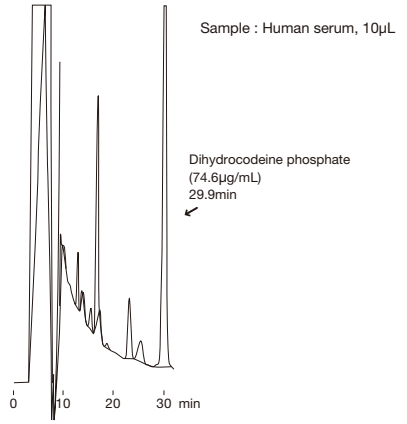
Direct analysis of chemical substances in biofluids without pretreatment

[Direct analysis of serum acetaminophen]



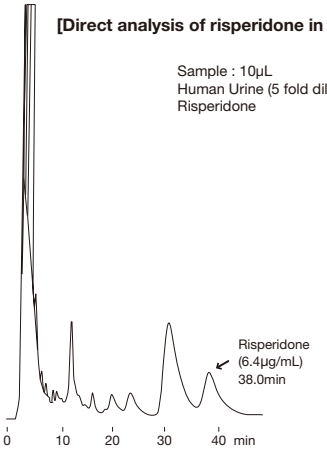
Column : **Shodex ODP2 HP-4D**
Eluent : 0.1% TFA aq./CH_3CN=93/7
Flow rate : 0.5mL/min
Detector : UV(254nm)
Column temp. : 40℃

[Direct analysis of serum dihydrocodeine phosphate]



Column : **Shodex ODP2 HP-4D**
Eluent : 0.1% TFA aq./CH_3CN=93/7
Flow rate : 0.3mL/min
Detector : UV(230nm)
Column temp. : 40℃

[Direct analysis of risperidone in urine]



Column : **Shodex ODP2 HP-4D**
Eluent : 0.1% TFA aq./CH_3CN=93/7
Flow rate : 0.6mL/min
Detector : UV(215nm)
Column temp. : 40℃

Data provided by Dr. Katsuko Hara and Dr. Yutaka Komiyama of the Department of Clinical Laboratory, Kansai Medical University Takii Hospital

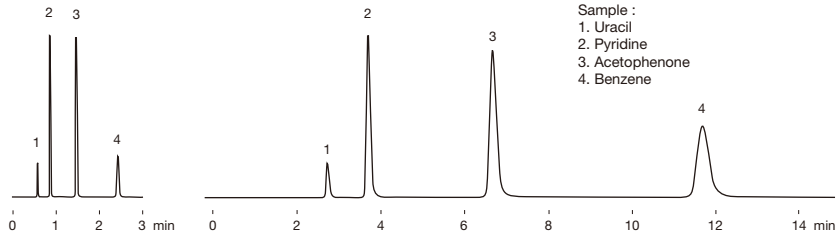
Comparison of the ET-RP1 column's efficiency (theoretical plate height) between high and normal temperatures

Sample	Reduced plate height *	
	40°C	150°C
Acetophenone	3.2	**2.4**
Benzene	3.6	**2.3**

* Plate height / particle diameter of the packed resin

high temp. (150°C)
2.4mL/min

normal temp. (40°C)
0.5mL/min

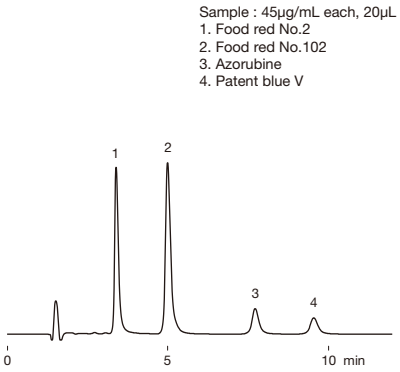


Column : **Shodex ET-RP1 4D**
Eluent : (Left) H_2O/CH_3CN=50/50
(Right) H_2O/CH_3CN=75/25
Detector : Diode array(210nm)
Column Oven : Polaratherm 9000 Series
(SandraSelerity Technonogies, Inc)

Note :
The eluent was introduced into the column after being preheated and was cooled after column elution, then introduced into the detector.

Data provided by Research Institute for Chromatography bvba

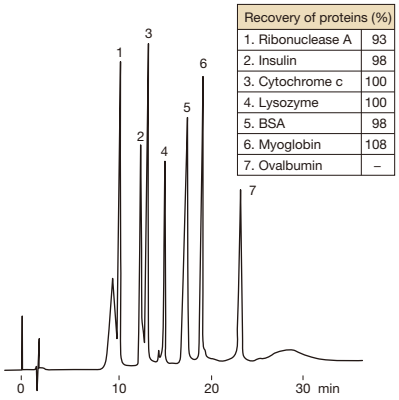
Rapid analysis of artificial colorants at high temperatures



Column : **Shodex ET-RP1 3D**
Eluent : 6mM Tetrabutylammonium bromide in (25mM Ammonium acetate aq./CH_3CN =70/30)
Flow rate : 0.5mL/min
Detector : UV(254nm)
Column temp. : 70°C

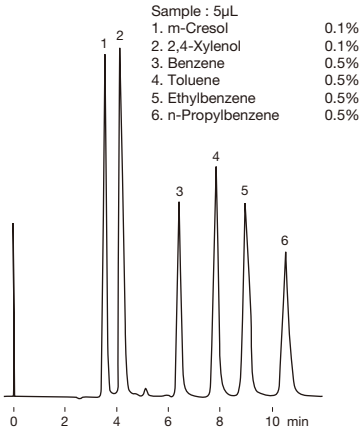
Separation and recovery rates of standard proteins

Recovery of proteins (%)	
1. Ribonuclease A	93
2. Insulin	98
3. Cytochrome c	100
4. Lysozyme	100
5. BSA	98
6. Myoglobin	108
7. Ovalbumin	–



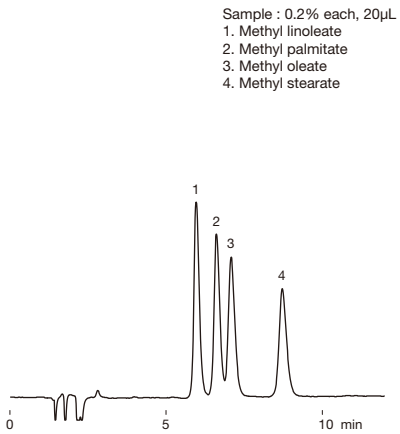
Column : **Shodex RSpak RP18-415**
Eluent : (A); 0.1% TFA aq./CH_3CN=99/1
(B); 0.1% TFA aq./CH_3CN=5/95
Linear gradient; 20%(B) to 60%(B), 20min
Flow rate : 1.0mL/min
Detector : UV(220nm)
Column temp. : Room temp.

Alkylbenzenes



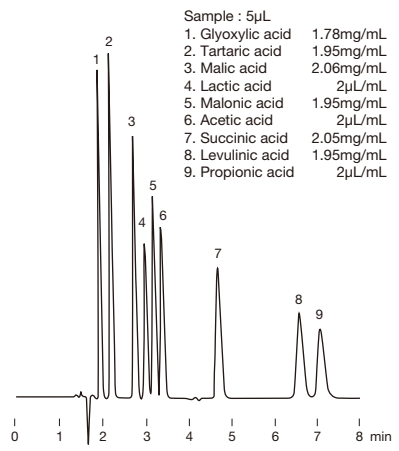
Column : **Shodex RSpak DS-613**
Eluent : $H_2O/CH_3CN/THF$=30/40/30
Flow rate : 1.0mL/min
Detector : UV(254nm)
Column temp. : 40°C

Fatty acid methyl esters



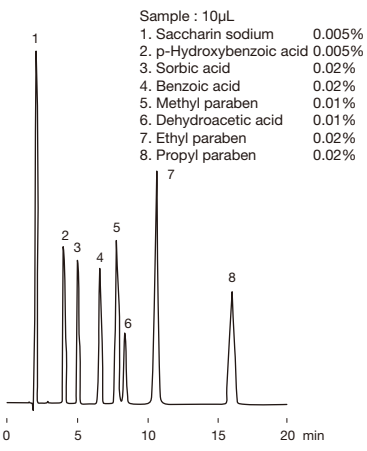
Column : **Shodex RSpak DS-413**
Eluent : $H_2O/CH_3CN/THF$=25/45/30
Flow rate : 1.0mL/min
Detetor : RI
Column temp. : 40°C

Organic acids



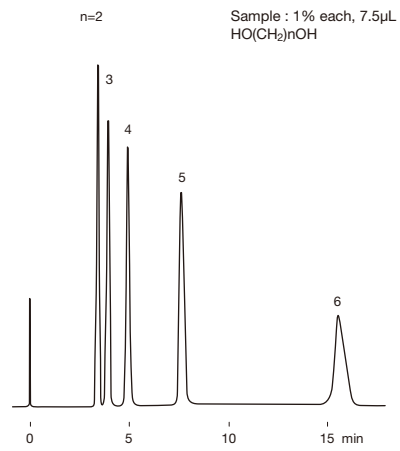
Column : **Shodex RSpak DE-413**
Eluent : 10mM Phosphoric acid aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 50°C

Food additives (Preservatives)



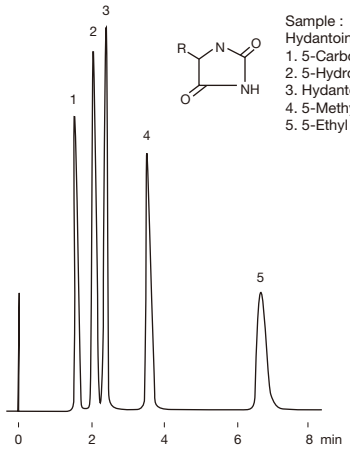
Column : **Shodex RSpak DE-413**
Eluent : (50mM KH_2PO_4 + 0.1% H_3PO_4) aq. /CH_3CN=65/35
Flow rate : 1.0mL/min
Detector : UV(210nm)
Column temp. : 40°C

Diols



Column : **Shodex RSpak DE-613**
Eluent : H_2O
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 60°C

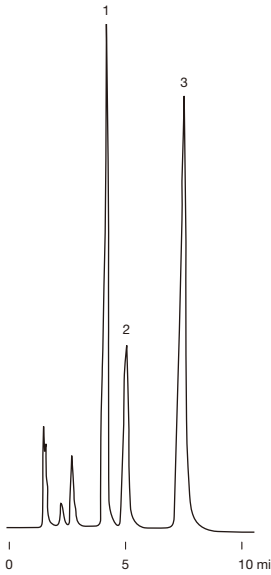
Hydantoins



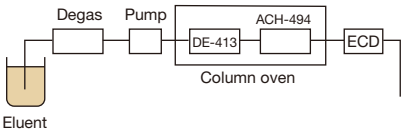
Sample :
Hydantoins, 0.05% each, 3µL
1. 5-Carboxyethyl hydantoin
2. 5-Hydroxymethyl hydantoin
3. Hydantoin
4. 5-Methyl hydantoin
5. 5-Ethyl hydantoin

Column : Shodex RSpak DE-613
Eluent : 1/30M Na_2HPO_4 + 1/30M KH_2PO_4 aq.
Flow rate : 2.0mL/min
Detector : UV(210nm)
Column temp. : 50°C

Choline and acetylcholine



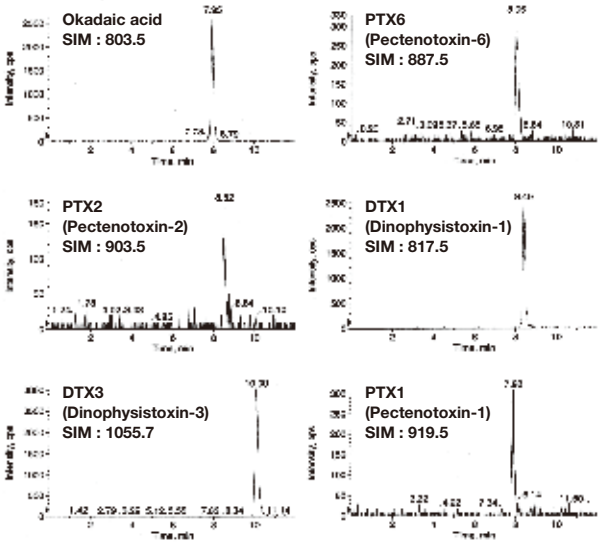
Sample : 10µL
1. Choline 5mg/L
2. Ethylhomocholine 10mg/L
3. Acetylcholine 10mg/L



Column : Shodex RSpak DE-413
Post column : Shodex AFpak ACH-494
Eluent : 0.1M Phosphoric acid + 300mg/L Sodium 1-decansulfonate + 65mg/L Tetramethylammonium chloride (pH8.0 adjusted by 1M NaOH)
Flow rate : 1.0mL/min
Detector : EC(Electrode: Pt, 350mV SCE)
Column temp. : 37°C

* See p.28 for ACH-494

Analysis of diarrheal and fat-soluble shellfish poisoning



While a toxicity testing using mice is a mainstream method for examination of shellfish poisoning, an analytical method using LC/MS was developed to meet the efficient and high-performance shellfish poisoning examination to cope with the long inspection time and variance in laboratory results of the conventional inspection method, and to reduce the use of animals. The use of LC/MS enabled rapid detection of components which are difficult to be detected in an animal study.

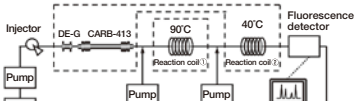
■Sample pretreatment

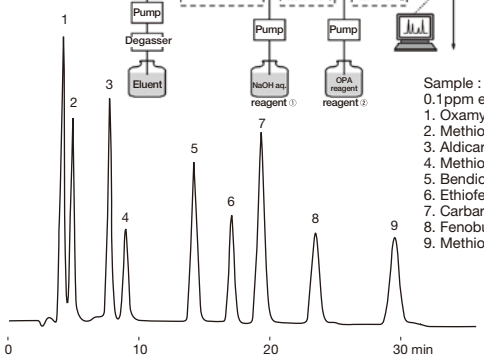
digestive cecum of shellfish, 1g
↓ ⟵ 90% Methanol, 9mL
homogenize (3-5 min)
↓
centrifuge (3,000rpm, 5min)
↓
inject into LCMS 5uL of supernatant

Column : Shodex DE413-2B
Eluent : (A); 50mM HCOOH + 2mM $HCOONH_4$ aq.
(B); 50mM HCOOH + 2mM $HCOONH_4$ in (H_2O/CH_3CN=5/95)
0 to 5min, 20% (B)
5 to 12min, 20% (B) to 100% (B)
Flow rate : 0.2mL/min
Detector : ESI-MS(Negative)

Data provided by Mr. Toshiyuki Suzuki of the Fisheries Research Agency

N-methylcarbamate pesticides

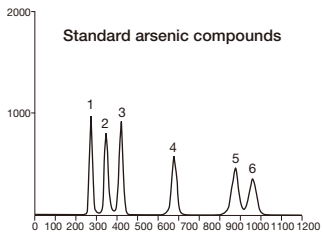




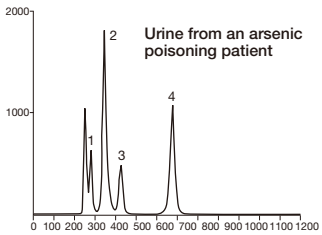
Sample :
0.1ppm each, 20µL
1. Oxamyl
2. Methiocarb sulfoxide
3. Aldicarb
4. Methiocarb sulfone
5. Bendiocarb
6. Ethiofencarb
7. Carbaryl
8. Fenobucarb
9. Methiocarb

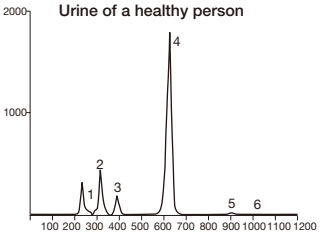
Column : Shodex RSpak CARB-413
Eluent : CH_3CN/H_2O=37/63
Flow rate : 0.8mL/min
Reagent : (A); 50mM NaOH
(B); 0.05% o-Phthalaldehyde + 0.1% Mercaptoethanol
Detector : Fluorescence(Ex. : 340nm, Em. : 450nm)
Column temp. : 40°C

Morphology of arsenic compounds



Sample : Arsenic compounds, 50µL
1. Monomethylarsonic acid
2. Arsinic acid
3. Dimethylarsinic acid
4. Arsenobetaine
5. Tetramethylarsonium
6. Trimethylarsine oxide



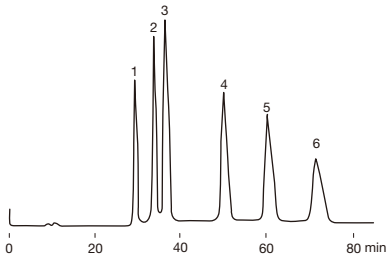


Column : Shodex RSpak NN-614
Eluent : 5mM HNO_3/8mM NH_4NO_3 aq.
Flow rate : 0.8mL/min
Detector : IC-ICP-MS(SIM m/z=75)

Noriko TSUNODA,
National Reseach Institute of Police Science, Pharmacia, vol.34 No.12 (1998), p1237-12421

Amino acid analysis using multimode

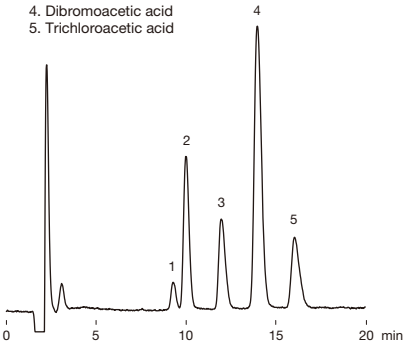
Sample : 20μL
1. Aspartic acid
2. Glycine
3. Alanine
4. Valine
5. Methionine
6. Isoleucine



Column : **Shodex RSpak NN-814**
Eluent : 40mM Phosphoric acid aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

Haloacetic acid analysis using multimode

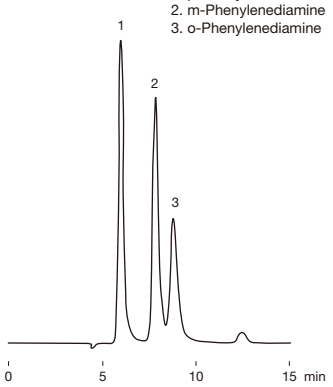
Sample : 500mg/L each, 2μL
1. Chloroacetic acid
2. Bromoacetic acid
3. Dichloroacetic acid
4. Dibromoacetic acid
5. Trichloroacetic acid



Column : **Shodex RSpak JJ-50 2D**
Eluent : 25mM Ammonium acetate buffer(pH9.2) /CH_3CN=50/50
Flow rate : 0.2mL/min
Detector : UV(210nm)
Column temp. : 40℃

Phenylenediamine isomers analysis using multimode

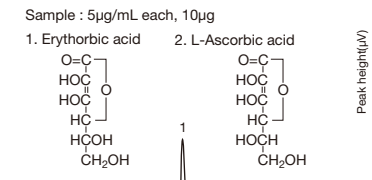
Sample : 100mg/L each, 20μL
1. p-Phenylenediamine
2. m-Phenylenediamine
3. o-Phenylenediamine

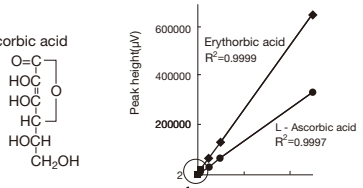


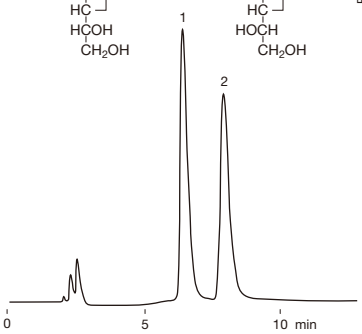
Column : **Shodex RSpak JJ-50 4D**
Eluent : 25mM Ammonium acetate buffer(pH9.2) /CH_3CN=70/30
Flow rate : 0.4mL/min
Detector : UV(254nm)
Column temp. : 30℃

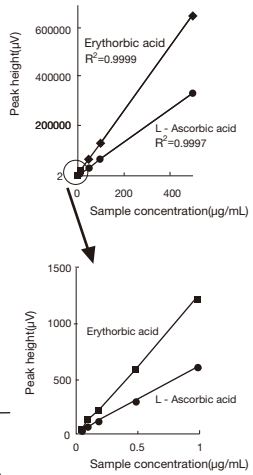
Ascorbic acid and erythorbic acid

Sample : 5μg/mL each, 10μg
1. Erythorbic acid
2. L-Ascorbic acid





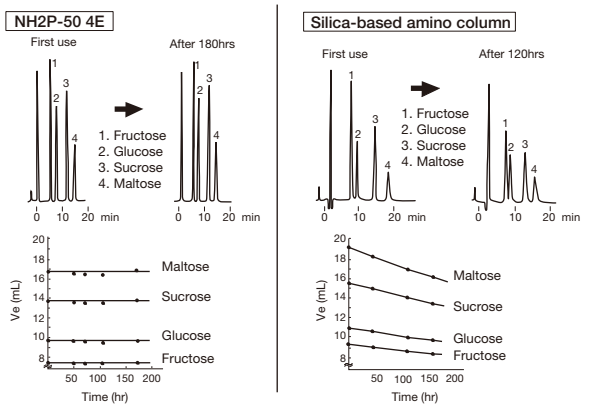




Column : **Shodex Asahipak NH2P-50 4E**
Eluent : 20mM NaH_2PO_4 + 30mM H_3PO_4(pH2.2)/CH_3CN=20/80
Flow rate : 1.0mL/min
Detector : UV(254nm)
Column temp. : 30℃

Repeated analysis with NH2P-50 column and silica-based amino column

For every kind of saccharide, the resistance to time degradation of our polymer-based amino column NH2P, enables to maintain a stable retention time and obtaining sharp peaks.

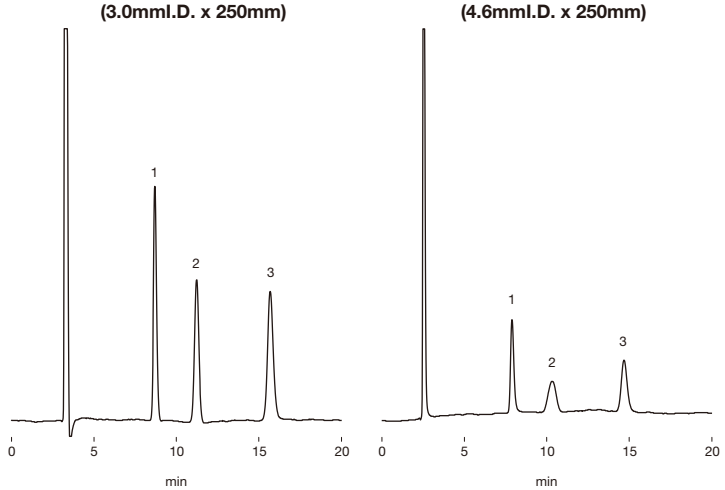


Column : **Shodex Asahipak NH2P-50 4E, Silica based amino column** (company-A)
Eluent : H_2O/CH_3CN=25/75
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 30℃

Comparison between NH2P-40 3E and NH2P-50 4E

NH2P-40 3E (New)
(3.0mmI.D. x 250mm)

NH2P-50 4E (existing)
(4.6mmI.D. x 250mm)



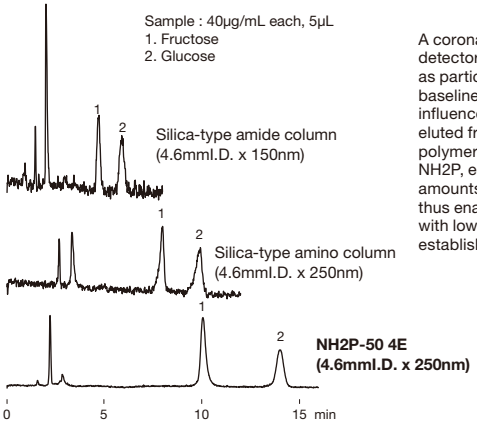
The NH2P-40 3E is a polymer-based amino column (3 mm inner diameter) packed by downsizing particle size. This general-purpose column perform higher resolution and separation of the conventional column (NH2P-50 4E).

Sample : 0.5% each, 4μL
1. Fructose
2. Glucose
3. Sucrose

		NH2P-40 3E	NH2P-50 4E
TPN (Sucrose)		11,300	8,700
Rs	Fructose/Glucose	6.4	4.2
	Glucose/Sucrose	8.5	5.9

Column : **Shodex Asahipak NH2P-40 3E, NH2P-50 4E**
Eluent : H_2O/CH_3CN=25/75
Flow rate : (NH2P-40 3E) 0.35mL/min, (NH2P-50 4E) 1.0mL/min
Detector : RI
Column temp. : 25℃

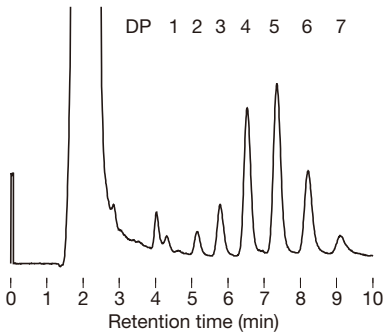
Saccharides analysis using corona-charged aerosol detector



A corona-charged aerosol detector measures effluents as particles. Accordingly, the baseline will be significantly influenced by components eluted from the column. The polymer-based amino column, NH2P, elutes extremely small amounts of components, and thus enables a stable baseline with lower noise level to be established.

Column : **Shodex Asahipak NH2P-50 4E**
Silica based amino column (company-A),
Silica based amide column (company-B)
Eluent : $H_2O/CH_3CN/$=20/80
Flow rate : 1.0mL/min
Detector : Corona charged aerosol
Column temp : 30℃(Amino column), 80℃(Amide column)

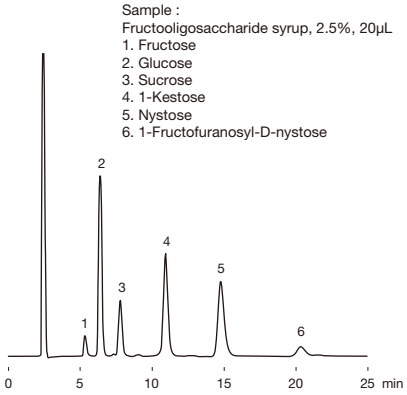
Products for cellulose degradation by cellulase (PcCel45A) treatment



Column : **Shodex Asahipak NH2P-50 4E**
Eluent : (A);H_2O/CH_3CN=40/60
(B);H_2O/CH_3CN=50/50
Linear gradient; (A) to (B),10min
Flow rate : 1.0mL/min
Detector : Corona charged aerosol
Column temp : 40℃

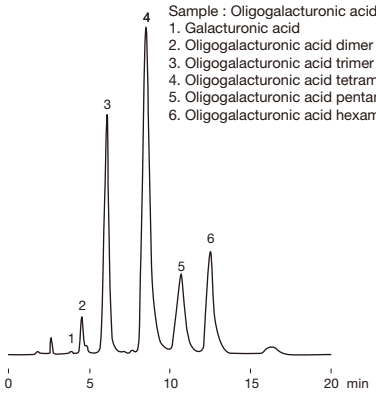
Data provided by Kiyohiko Igarashi, Professor of the Laboratory of Forest Chemistry, Biomass Chemistry Course, Department of Biomaterial Sciences, Graduate School of Agricultural and Life Sciences, University of Tokyo

Fructooligosaccharide syrup



Column : **Shodex Asahipak NH2P-50 4E**
Eluent : CH_3CN/H_2O=70/30
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 25℃

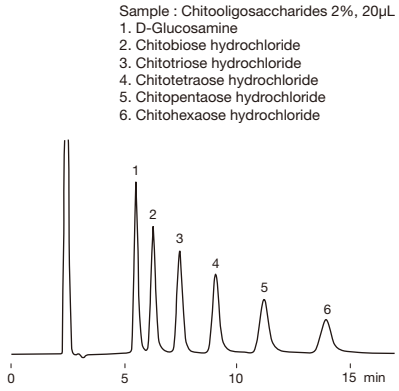
Oligogalacturonic acids



Column : **Shodex Asahipak NH2P-50 4E**
Eluent : 0.3M Sodium phosphate buffer(pH4.4)
Flow rate : 1.0mL/min
Detector : UV(210nm)
Column temp. : 40℃

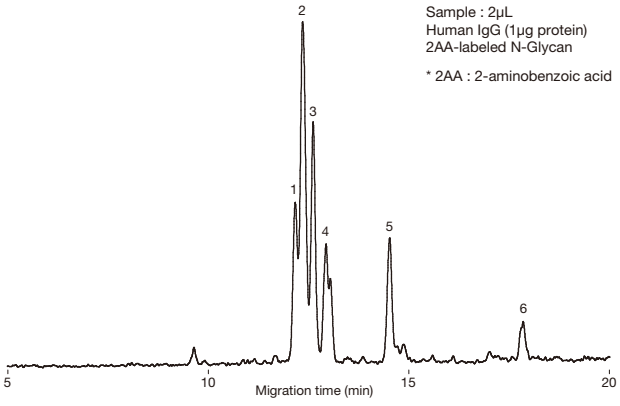
Sample offered by Prof. Yoshino in Kyoto Women's Univ.

Chitooligosaccharides



Column : **Shodex Asahipak NH2P-50 4E**
Eluent : CH_3CN/H_2O=70/30
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 25℃

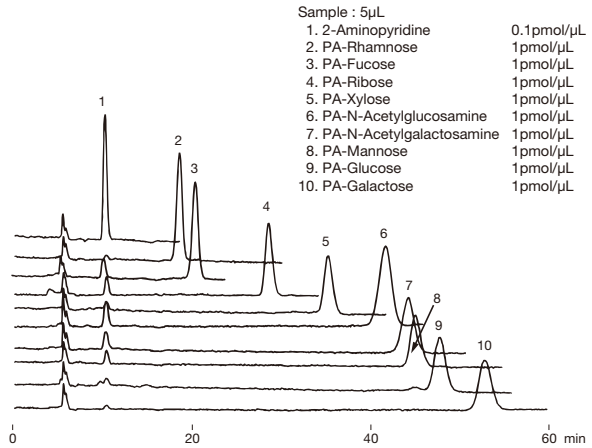
LC/TOF-MS analysis of 2-amino benzoic acid-derivatized sugar chains



Column : **Shodex NH2P40-2D**
Eluent : A; 95% CH_3CN/0.1% Formic acid
B; 5% CH_3CN/0.1% Formic acid
Gradient : Linear gradient: B%, 30%(0-2.5min), 30-95%(2.5-20min)
Flow rate : 0.2mL/min
Detector : ESI-TOF MS(Polarity : Negative, Full MS range : 2000)
Column oven : 45℃

Data provided by Mr. Michihiro Kinoshita, Faculty of Pharmacy, Kinki University

Pyridylaminated monosaccharides



Column : **Shodex Asahipak NH2P-50 4E**
Eluent : $H_3PO_4/H_2O/CH_3CN$=1/14/85
Flow rate : 0.5mL/min
Detector : Fluorescence(Ex. : 310nm, Em. : 380nm)
Column temp. : 40℃

Silica-based Packed Columns for Reversed Phase, HILIC and Normal Phase Chromatography

[ODS columns]

Features

F
- This ODS column remains for over 30 years as the selling product

C18M
- Monomeric type ODS column, fully end-capped high-purity silica (99.99% or higher)

Preparative Columns p.83

C18P
- Polymeric type ODS column, fully end-capped high-purity silica (99.99% or higher)
- Excellent acid resistance
- Advantageous for separating planar and nonplanar compounds from each other

C18
- ODS columns listed in USP L1 available at very reasonable price

See also page 10, "Features and Applications of Different Packing Materials used for Columns for Reversed Phase, Hydrophilic Interaction and Normal phase Chromatography"

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Carbon Load (%)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6604112	ODSpak F-411	≥ 8,000	Octadecyl	5	14	100	4.6 × 150	H_2O/CH_3OH=20/80
F6605110	ODSpak F-511	≥ 14,000	Octadecyl	5	14	100	4.6 × 250	H_2O/CH_3OH=20/80
F6604113	ODSpak F-411/S	≥ 10,000	Octadecyl	3	14	100	4.6 × 100	H_2O/CH_3OH=20/80
F6650040	Silica C18M 4D	≥ 10,000	Octadecyl	5	16	100	4.6 × 150	H_2O/CH_3OH=30/70
F6650041	Silica C18M 4E	≥ 16,000	Octadecyl	5	16	100	4.6 × 250	H_2O/CH_3OH=30/70
F6650042	Silica C18M 2D	≥ 9,000	Octadecyl	5	16	100	2.0 × 150	H_2O/CH_3OH=40/60
F6650045	Silica C18P 4D	≥ 10,000	Octadecyl	5	17	100	4.6 × 150	H_2O/CH_3OH=30/70
F6650046	Silica C18P 4E	≥ 16,000	Octadecyl	5	17	100	4.6 × 250	H_2O/CH_3OH=30/70
F6650047	Silica C18P 2D	≥ 9,000	Octadecyl	5	17	100	2.0 × 150	H_2O/CH_3OH=40/60
F6651010	C18-4D	≥ 13,000	Octadecyl	5	17	120	4.6 × 150	H_2O/CH_3OH=25/75
F6651011	C18-4E	≥ 21,000	Octadecyl	5	17	120	4.6 × 250	H_2O/CH_3OH=25/75
F6651013	C18-4C 3µm	≥ 13,000	Octadecyl	3	17	120	4.6 × 100	H_2O/CH_3OH=25/75

Base Material : Silica

[Other Silica-based columns]

Features

E-411
- Silica gel packed column without any chemical modification

5SIL
- Uses high-purity silica (99.99% or higher)
- Like E-411, suitable for normal phase analysis using a nonpolar organic solvent

Preparative Columns p.83

5C8
- To use when the retention capacity of C18 is excessively higher or that of 5C4 is excessively lower
- Applicable to ion-pair chromatography because of its rapid mass transfer and achievement of equilibrium

Preparative Columns p.83

5C4
- To use when the retention capacity of C18 or C8 is excessively high

Preparative Columns p.83

5CN
- Utilizes reversed phase interaction and π-electron interaction to separate regioisomers, which typically cannot be separated with ODS, C8, or C4 columns

5NPE, 5PYE
- Utilizes several types of interactions based on π-electrons to separate structural isomers

5NH
- Suitable for saccharides analysis by hydrophilic interaction chromatography (HILIC)

Preparative Columns p.83

See also page 10, "Features and Applications of Different Packing Materials used for Columns for Reversed Phase, Hydrophilic Interaction and Normal phase Chromatography"

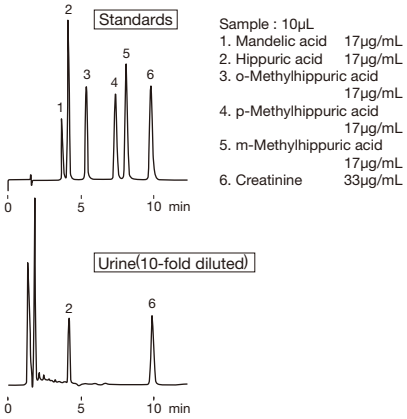
Standard columns

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Carbon Load (%)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6604110	Silicapak E-411	≥ 8,000	–	5	–	50	4.6 × 150	IPA/Dichloromethane/n-Hexane =1/50/49
F6650050	Silica 5SIL 4D	≥ 9,000	–	5	–	100	4.6 × 150	C_6H_{14}/C_2H_5OH=95/5
F6650051	Silica 5SIL 4E	≥ 15,000	–	5	–	100	4.6 × 250	C_6H_{14}/C_2H_5OH=95/5
F6650052	Silica 5C8 4D	≥ 9,000	Octyl	5	10	100	4.6 × 150	H_2O/CH_3OH=34/66
F6650053	Silica 5C8 4E	≥ 15,000	Octyl	5	10	100	4.6 × 250	H_2O/CH_3OH=34/66
F6650054	Silica 5C4 4D	≥ 9,000	Butyl	5	7	100	4.6 × 150	H_2O/CH_3OH=45/55
F6650055	Silica 5C4 4E	≥ 15,000	Butyl	5	7	100	4.6 × 250	H_2O/CH_3OH=45/55
F6650058	Silica 5CN 4D	≥ 7,000	Cyanopropyl	5	–	100	4.6 × 150	H_2O/CH_3OH=60/40
F6650059	Silica 5CN 4E	≥ 12,000	Cyanopropyl	5	–	100	4.6 × 250	H_2O/CH_3OH=60/40
F6650062	Silica 5NPE 4D	≥ 8,000	Nitrophenylethyl	5	–	100	4.6 × 150	H_2O/CH_3OH=45/55
F6650063	Silica 5PYE 4D	≥ 7,000	Pyrenylethyl	5	–	100	4.6 × 150	H_2O/CH_3OH=30/70
F6650060	Silica 5NH 4D	≥ 5,000	Aminopropyl	5	–	100	4.6 × 150	H_2O/CH_3CN=5/95
F6650061	Silica 5NH 4E	≥ 8,000	Aminopropyl	5	–	100	4.6 × 250	H_2O/CH_3CN=5/95

Base Material : Silica

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

Hippuric acids in urine

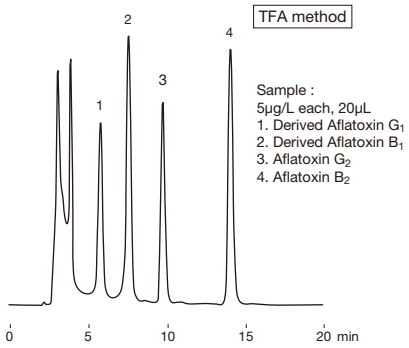


Sample : 10μL
1. Mandelic acid 17μg/mL
2. Hippuric acid 17μg/mL
3. o-Methylhippuric acid 17μg/mL
4. p-Methylhippuric acid 17μg/mL
5. m-Methylhippuric acid 17μg/mL
6. Creatinine 33μg/mL

Column : Shodex ODSpak F-411
Eluent : [20mM Phosphoric acid + 20mM β-Cyclodextin(pH2.5)]/CH_3CN=88/12 + 4.5mM Sodium dodecyl sulfate
Flow rate : 1.0mL/min
Detector : UV(225nm)
Column temp. : 50℃

Aflatoxins

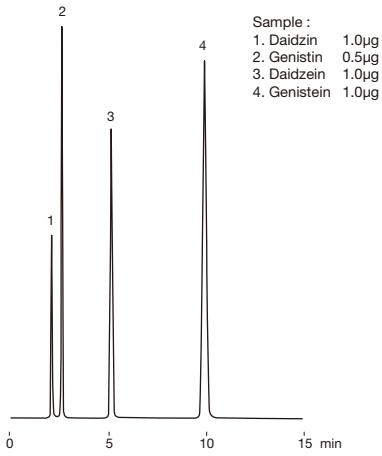
Reference : Shoku-An No. 0728001 (July 28, 2006, Japan)
Test method of Aflatoxin B1 in cereals, puises, nuts and seeds, spices "multifunctional column"



Sample :
5μg/L each, 20μL
1. Derived Aflatoxin G_1
2. Derived Aflatoxin B_1
3. Aflatoxin G_2
4. Aflatoxin B_2

Column : Shodex Silica C18M 4E
Eluent : $H_2O/CH_3CN/CH_3OH$=60/10/30
Flow rate : 1.0mL/min
Detector : Fluorescence(Ex. : 365nm, Em. : 450nm)
Column temp. : 40℃

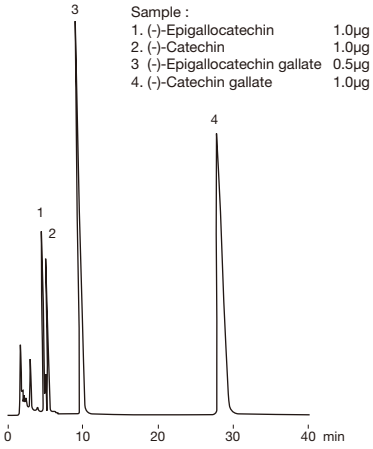
Isoflavones



Sample :
1. Daidzin 1.0μg
2. Genistin 0.5μg
3. Daidzein 1.0μg
4. Genistein 1.0μg

Column : Shodex Silica C18P 4D
Eluent : 0.1% Acetic acid aq./CH_3OH=70/30
Flow rate : 1.0mL/min
Detector : UV(254nm)
Column temp. : 30℃

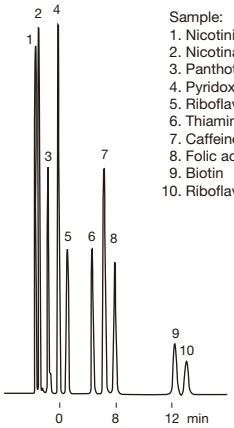
Catechins in green tea



Sample :
1. (-)-Epigallocatechin 1.0μg
2. (-)-Catechin 1.0μg
3 (-)-Epigallocatechin gallate 0.5μg
4. (-)-Catechin gallate 1.0μg

Column : Shodex Silica C18P 4D
Eluent : 0.1% Phosphoric acid aq./CH_3OH=20/80
Flow rate : 1.0mL/min
Detector : UV(254nm)
Column temp. : 30℃

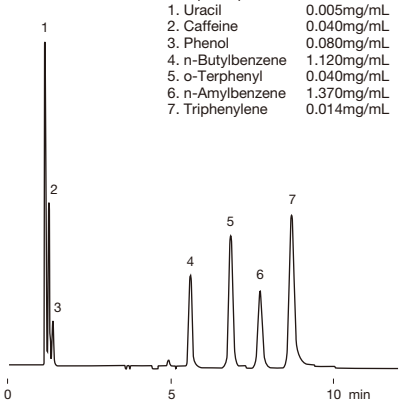
Water soluble vitamins



Sample:
1. Nicotinic Acid 0.2μg
2. Nicotinamide 0.2μg
3. Panthothenic Acid 1.2μg
4. Pyridoxine 0.2μg
5. Riboflavin Phosphate 0.4μg
6. Thiamine 0.4μg
7. Caffeine 0.1μg
8. Folic acid 0.2μg
9. Biotin 0.6μg
10. Riboflavin 0.1μg

Column : Shodex C18-4D
Eluent : 100mM Phosphate buffer (pH2.1) +0.8mM Octane sodium sulfonate /Acetonitrile=9/1
Flow rate : 1.0ml/min
Detector : UV(210nm)
Column temp. : 40℃

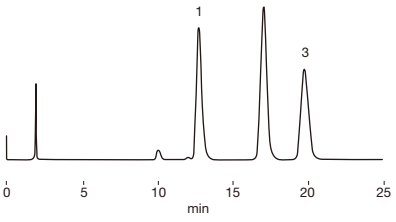
Aromatic compounds



Sample : 5μL
1. Uracil 0.005mg/mL
2. Caffeine 0.040mg/mL
3. Phenol 0.080mg/mL
4. n-Butylbenzene 1.120mg/mL
5. o-Terphenyl 0.040mg/mL
6. n-Amylbenzene 1.370mg/mL
7. Triphenylene 0.014mg/mL

Column : Shodex C18-4C 3μm
Eluent : H_2O/CH_3OH=20/80
Flow rate : 1.0mL/min
Detector : UV(254nm)
Column temp. : 40℃

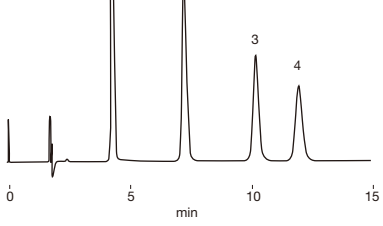
Benzylpyridine isomers



Sample :
1. 2-Benzylpyridine
2. 3-Benzylpyridine
3. 4-Benzylpyridine

Column : Shodex Silica 5PYE 4D
Eluent : 20mM KH_2PO_4 aq./CH_3OH=40/60
Flow rate : 1.0mL/min
Detector : UV(254nm)
Column temp. : 30℃

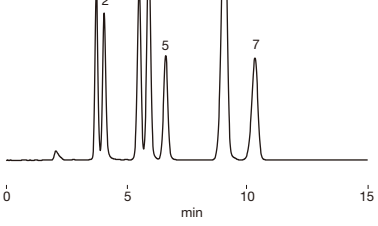
Dinitronaphthalene isomers



Sample :
1. Naphtalene
2. 1,5-Dimethylnaphtalene
3. 1,5-Dinitronaphtalene
4. 1,8-Dinitronaphtalene

Column : Shodex Silica 5NPE 4D
Eluent : H_2O/CH_3OH=30/70
Flow rate : 1.0mL/min
Detector : UV(254nm)
Column temp. : 30℃

Vitamin E



Sample : 20μL
1. α-Tocopherol 5μg/mL
2. α-Tocotrienol 10μg/mL
3. β-Tocopherol 5μg/mL
4. γ-Tocopherol 5μg/mL
5. γ-Tocotrienol 10μg/mL
6. δ-Tocopherol 5μg/mL
7. δ-Tocotrienol 10μg/mL

Column : Shodex Silica 5SIL 4D
Eluent : n-Hexane/Isopropanol/Acetic acid =1000/6/5
Flow rate : 1.0mL/min
Detector : Fluorescence(Ex. 298nm, Em. 325nm)
Column temp. : 30℃

Columns for Chiral Separation

Features

CD

- α-, β-, and γ-cyclodextrin derivatives bound to packing materials as the functional group
- Separates by using differences in conformational compatibility of optical isomers
- Silica-based and polymer-based packing materials
- Versatile columns for chiral separation

News No.26, 27

CRX-853

- L-amino acids derivatives bound to the packing material as the functional group
- Separates optical isomers by using difference in capacity of metal complex formation between metal ion and optical isomers after the functional group and the metal ion in eluent forms complex
- Suitable for amino acids, hydroxy acids, and derivatives thereof

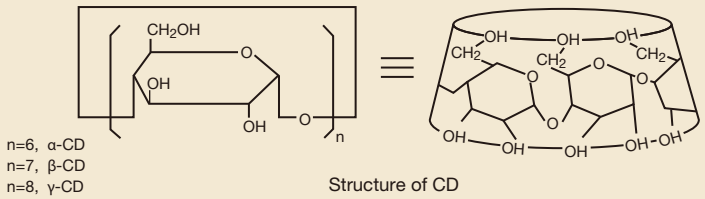
ABA-894

- Bovine serum albumin (BSA) bound to packing materials as the functional group
- Separates optical isomers by using interactions between the isomers captured by hydrophobic pockets of BSA and surrounding amino acid residues
- Suitable for the separation of optical isomers of amino acids and carboxylic acids

News No.21 Semi-micro Micro Columns p.73

Standard columns

Product Code	Product Name	Functional Group	Base Material	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F7146000	**ORpak CDA-453 HQ**	α-Cyclodextrin derivative	Polyhydroxymethacrylate	6	**4.6 × 150**	H_2O
F7146001	**ORpak CDB-453 HQ**	β-Cyclodextrin derivative	Polyhydroxymethacrylate	6	**4.6 × 150**	1.7% TEA-acetate buffer + 0.1M NaCl(pH4.0)/CH_3CN=80/20
F7146002	**ORpak CDC-453 HQ**	γ-Cyclodextrin derivative	Polyhydroxymethacrylate	6	**4.6 × 150**	1.0% Acetic acid + 0.2M NaCl aq. /CH_3CN=90/10
F7146003	**ORpak CDBS-453**	β-Cyclodextrin derivative	Silica	3	**4.6 × 150**	1.0% Acetic acid + 0.2M NaCl aq. /CH_3CN=70/30
F6709250	**ORpak CD-G**	(guard column)	Polyhydroxymethacrylate	6	**4.6 × 10**	H_2O
F7140040	**ORpak CRX-853**	L-amino acid derivative	Polyhydroxymethacrylate	6	**8.0 × 50**	0.25mM $CuSO_4$ aq.
F6709300	**ORpak CRX-G**	(guard column)	Polyhydroxymethacrylate	6	**4.6 × 10**	0.25mM $CuSO_4$ aq.
F7118960	**AFpak ABA-894**	Bovine serum albumin	Polyhydroxymethacrylate	6	**8.0 × 50**	50mM Tris-HCl buffer +150mM NaCl+ 0.02% NaN_3(pH7.4)



n=6, α-CD
n=7, β-CD
n=8, γ-CD

Structure of CD

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

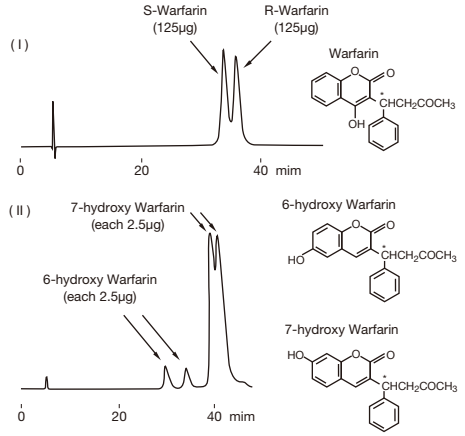
Medicinal chemicals

sample	k'	α	Rs	eluent
Alprenolol	3.3	1.05	0.7	A
Brompheniramine	4.4	1.35	4.2	A
Caprofen	4.5	1.09	1.4	C
Chlorpheniramine	0.6	1.30	1.4	C
Chlorthalidone	6.8	1.29	3.8	A
Clidiniumbromide	9.8	1.06	0.8	A
Homatropine	4.3	1.27	2.5	B
Indapamide	10.6	1.18	2.3	A
Laudanosoline	7.6	1.32	2.0	B
Nefopam	2.1	1.29	3.4	A
Norlaudanosoline	7.6	1.39	2.8	B
Orphenadrine	16.0	1.07	1.2	A
Oxyphencyclimine	17.4	1.11	1.6	C
Procyclidine	5.8	1.09	1.2	C
Promethazine	15.5	1.06	1.0	A
Propranolol	18.6	1.12	1.3	B
Terbutaline	1.5	1.19	1.8	A
Tolperizone	21.3	1.19	1.6	B
Trihexyphenidyl	6.1	1.14	1.8	C
Valethamate*	3.2	1.07	0.9	C
// *	3.9	1.08	1.0	C
Warfarin	3.1	1.12	1.2	C
Zopiclone	1.8	1.22	1.8	A

Column : **Shodex ORpak CDBS-453**
Eluent : (A) (1.1% Acetic acid+0.2M NaCl) aq./CH_3CN=90/10
(B) 2.2% Acetic acid+1.2% Triethylamine + 0.2M NaCl aq.
(C) (1.1% Acetic acid+0.2M NaCl) aq./CH_3CN=70/30
Flow rate : (A, C) 0.5mL/min, (B) 1.0mL/min
Detector : UV(254nm)
Column temp. : 20℃

* Two asymmetric centers exist

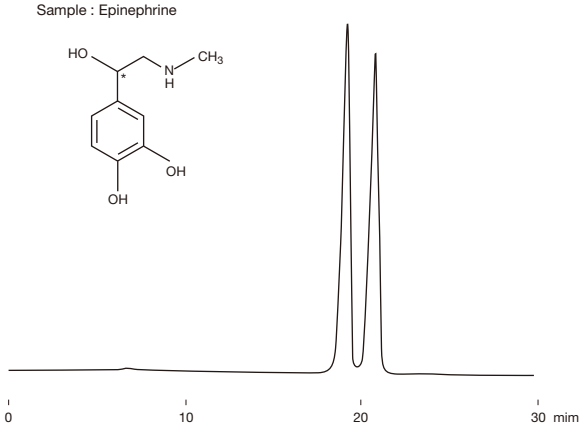
Warfarins



Column : **Shodex ORpak CDBS-453**
Eluent : (1.0% Acetic acid + 0.2M NaCl) aq./CH_3CN=80/20
Flow rate : 0.4mL/min
Detector : (I) UV(310nm)
(II) Fluorescence(Ex. : 335nm, Em. : 415nm)
Column temp. : 16.5℃

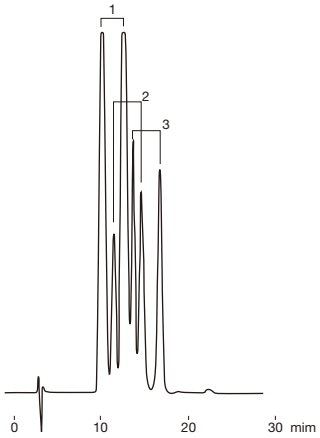
Epinephrine

Sample : Epinephrine



Column : **Shodex ORpak CDBS-453**
Eluent : (0.05% Acetic acid + 0.2M NaCl) aq./CH_3CN=99/1
Flow rate : 0.5mL/min
Detector : UV(254nm)
Column temp. : 10℃

Chlorpheniramine and its methabolites



Sample :
1. Chlorpheniramine
2. Monodesmethyl-chlorpheniramine
3. Didesmethyl-chlorpheniramine

Column : **Shodex ORpak CDBS-453**
Eluent : (1.0% Acetic acid + 0.2M NaCl) aq./CH_3CN=90/10
Flow rate : 0.5mL/min
Detector : UV(254nm)
Column temp. : 30℃

Data provided by Dr.Sakurai,
Tokyo University of Pharmacy and Life Science

Amino acids

	Optical isomers		Rs	α	Eluent	Column
Amino acids	6-Fluorotryptophan		1.98	1.33	A	ORpak CDA-453 HQ
	Alanine-β-naphthylamide		2.43	1.60	B	ORpak CDB-453 HQ
	MTH-Phenylalanine		3.30	2.0	C	ORpak CDB-453 HQ
	DNS-Leucine		2.79	1.97	D	ORpak CDC-453 HQ

A : H_2O
B : [1.4% Acetic acid + 0.7% Triethylamine + 0.1M NaCl(pH3.9)]/CH_3CN=80/20
C : (1.8% Acetic acid + 0.1M NaCl) aq./CH_3CN=80/20
D : (1.1% Acetic acid + 0.2M NaCl) aq./CH_3CN=90/10

Amino acids, Hydroxy acids and Carboxylic acids

	Optical isomers		Rs	α	Eluent	Column
Amino acids	Phenylalanine		2.17	2.26	W	ORpak CRX-853
Amino acids	DNS-Valine		1.58	1.43	X	AFpak ABA-894
Hydroxy acids	Mandelic acid		2.30	1.44	Y	ORpak CRX-853
Carboxylic acids	4-(1-Oxo-2-cyclohexylmethyl)-benzoic acid		1.48	1.41	Z	AFpak ABA-894

W : 0.5mM $CuSO_4$ aq./CH_3CN=60/40
X : 25mM Phosphate buffer(pH7.0) + 0.5% Isopropanol
Y : 0.25mM $CuSO_4$ aq.
Z : 50mM Sodium phosphate buffer(pH7.0)

Columns for Anion Exchange Chromatography

Features

QA-825, DEAE-825

- Suitable for the analysis of relatively high-molecular-weight compounds, such as proteins, peptides, DNA, and RNA
- Uses eluents over a wide pH range from 2 to 12

Note book No.7 Semi-micro Micro Columns p.71 Preparative Columns p.84

DEAE3N-4T

- Non-porous base material
- For rapid analysis

Note book No.6 News No.33 Semi-micro Micro Columns p.71

NEW DEAE-2B

- Non-porous base material
- Supports UHPLC (available under hyperbaric conditions up to 30 MPa)

News No.42

ES-502N 7C

- Polyvinyl alcohol as a base material offers different separation properties
- Low hydrophobic interaction of proteins allows analysis under mild conditions

Semi-micro Micro Column p.71 Preparative Columns p.84

WA-624

- Suitable for anion exchange analysis of low-molecular-weight compounds such as nucleotides

Standard columns

Strong anion exchange resin (Functional Group : Sulfopropyl)

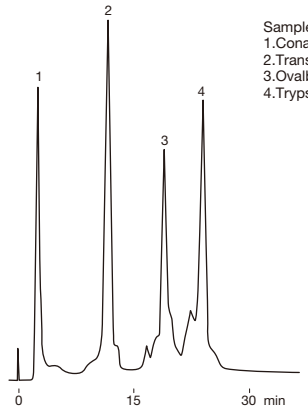
Product Code	Product Name	Ion Exchange Capacity (meq/g)	Base Material	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6110011	**IEC QA-825**	0.45	Polyhydroxymethacrylate	12	5,000	**8.0 × 75**	50mM Na_2SO_4 aq.

Weak anion exchange resin (Functional Group : Diethylaminoethyl)

Product Code	Product Name	Ion Exchange Capacity (meq/g)	Base Material	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6118255	**IEC DEAE-825**	0.6	Polyhydroxymethacrylate	8	5,000	**8.0 × 75**	50mM Na_2SO_4 aq.
F6112100	**IEC DEAE3N-4T**	0.4	Polyhydroxymethacrylate	2.5	–	**4.6 × 35**	H_2O
F6112110	**NEW PIKESS DEAE-2B**	0.4	Polyhydroxymethacrylate	2.5	–	**2.0 × 50**	H_2O
F7640002	**Asahipak ES-502N 7C**	0.55	Polyvinyl alcohol	9	2,000	**7.5 × 100**	50mM 1,3-Diaminopropane + 50mM NaCl(pH10.0)
F6356240	**AXpak WA-624**	1.2	Polyhydroxymethacrylate	10	2,000	**6.0 × 150**	0.1M Sodium phosphate buffer (pH3.0)/CH_3CN=80/20
F6700245	**AXpak WA-G**	(guard column)	Polyhydroxymethacrylate	10	–	**4.6 × 10**	0.1M Sodium phosphate buffer (pH3.0)/CH_3CN=80/20

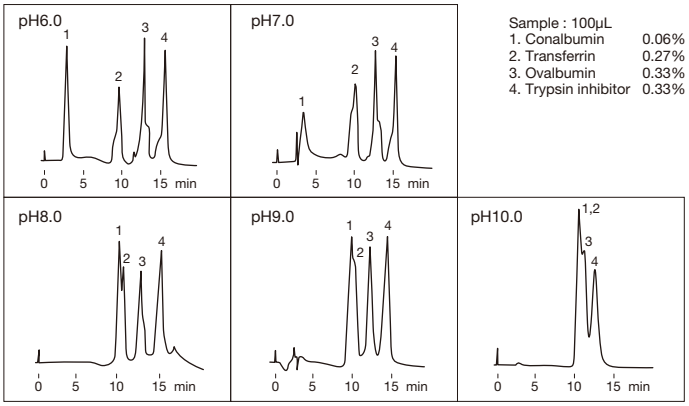
*Contact Shodex or our distributors near you for customized columns.

Protein separation using QA-825



Column : **Shodex IEC QA-825**
Eluent : (A); 20mM Piperazine-HCl buffer(pH6.0)
(B); (A) + 0.5M NaCl
Linear gradient; 100%(A) to 50%(A), 30min
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

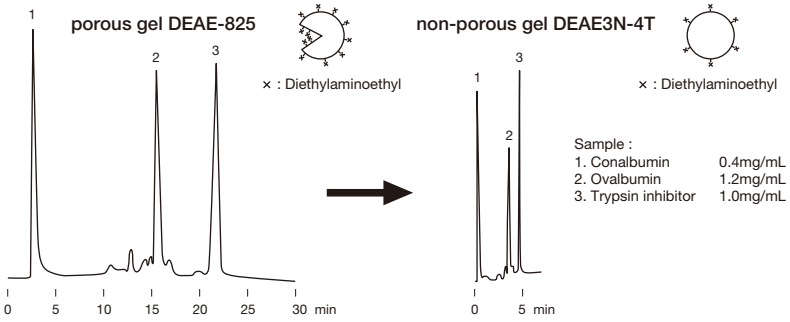
Effect of eluent pH for DEAE-825



Column : **Shodex IEC DEAE-825**
Eluent : (A); 20mM Piperazine-HCl buffer(pH6.0), 20mM Tris-Trispropanol-HCl buffer(pH7.0)
20mM Tris-HCl buffer(pH8.0), 20mM Ethanolamine-HCl buffer(pH9.0)
20mM 1,3-Diaminopropane-HCl buffer(pH10.0)
(B); (A) + 0.5M NaCl
Linear gradient; (A) to (B), 20min
Flow rate : 1.0mL/min

Comparison data of porous DEAE-825 and non-porous DEAE3N-4T

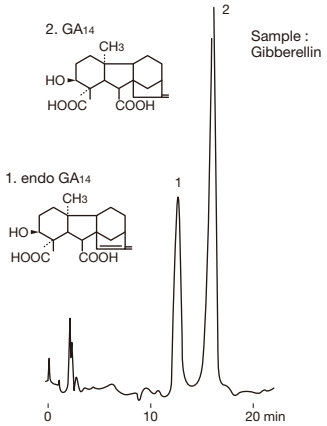
IEC DEAE3N-4T is a weak anion exchange column. Diethyaminoethyl group is on the surface of a non-porous gel.
Rapid analysis of proteins and peptides are possible with non-porous packing materials.
Its peak shape is still sharp, when a small volume of the sample is injected.



Column : **Shodex IEC DEAE-825**
Eluent : (A); 20mM Piperazine-HCl buffer(pH6.0)
(B); (A) + 0.5M NaCl
Linear gradient; (A) to (B), 60min
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.
Injection vol. : 100μL

Column : **Shodex IEC DEAE3N-4T**
Eluent : (A); 25mM Piperazine-HCl buffer(pH6.0)
(B); A + 0.5M NaCl
Linear gradient; (A) to (B), 10min
Flow rate : 1.5mL/min
Detector : UV(280nm)
Column temp. : Room temp.
Injection vol. : 20μL

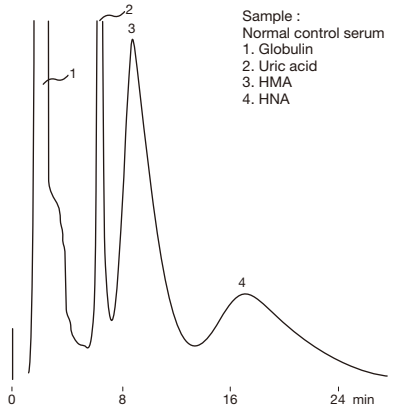
Gibberellin Isomers



Column : **Shodex Asahipak ES-502N 7C**
Eluent : Acetic acid/H_2O/CH_3OH
=0.1/0.4/99.5
Flow rate : 1.5mL/min
Detector : UV(210nm)
Column temp. : 50°C

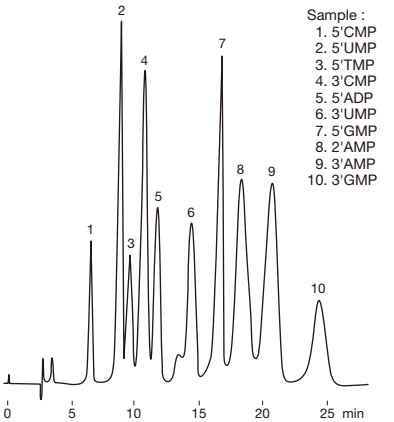
Data was provided by
Prof. Yamaguch,
Faculty of Agliculture,
University of Tokyo.

Mercaptoalbumins and non-mercaptoalbumins



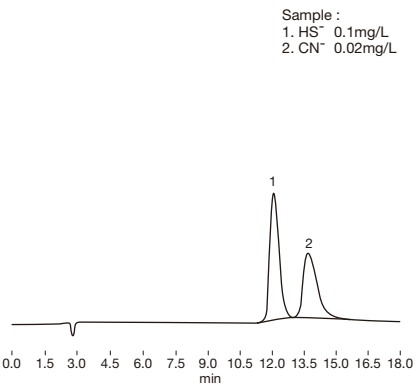
Column : **Shodex Asahipak ES-502N 7C**
Eluent : 50mM N-methylpiperazine-HCl buffer(pH4.8) + 400mM Na_2SO_4 + 0.3% C_2H_5OH
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : 35°C

Nucleotides



Column : **Shodex AXpak WA-624**
Eluent : 0.35M Ammonium acetate buffer (pH4.3)
Flow rate : 1.0mL/min
Detector : UV(260nm)
Column temp. : 60°C

Sulfide ion and cyanide ion



Column : **Shodex IEC DEAE-825**
Eluent : 10mM Na_2CO_3 + 1mM Ethylenediamine + 10% CH_3OH
Flow rate : 1.0mL/min
Detector : EC(Electrode; Silver, 0mV SCE)
Column temp. : 25°C

Columns for Cation Exchange Chromatography

Features

SP-825, CM-825
- Suitable for the analysis of relatively high-molecular-weight compounds, such as proteins, peptides, DNA, and RNA
- Uses eluents over a wide pH range from 2 to 12

Note book No.7 Semi-micro Micro Columns p.72 Preparative Columns p.84

SP-420N
- Non-porous base material
- For rapid analysis

Semi-micro Micro Columns p.72

NEW SP-2B
- Non-porous base material
- Supports UHPLC (available under hyperbaric conditions for up to 30 MPa)

Note book No.6 News No.42

ES-502C 7C
- Polyvinyl alcohol as a base material offers different separation properties
- Low hydrophobic interaction with proteins allows analysis under mild conditions

Note book No.7 Semi-micro Micro Columns p.72 Preparative Columns p.84

P-421S
- Columns for Amino acid analysis in the strong cation exchange mode
- Supports simultaneous analysis of different amino acids

Note book No.3

Standard columns

Strong cation exchange resin (Functional Group : Sulfopropyl)

Product Code	Product Name	Ion Exchange Capacity (meq/g)	Base Material	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6118250	**IEC SP-825**	0.4	Polyhydroxymethacrylate	8	5,000	**8.0 × 75**	50mM Na_2SO_4 aq.
F6113000	**IEC SP-420N**	0.3	Polyhydroxymethacrylate	2.5	–	**4.6 × 35**	20mM Sodium acetate buffer + 0.5M Na_2SO_4(pH5.0)
F6113110	NEW **PIKESS SP-2B**	0.3	Polyhydroxymethacrylate	2.5	–	**2.0 × 50**	20mM Sodium acetate buffer + 0.5M Na_2SO_4(pH5.0)

Week cation exchange resin (Functional Group : Carboxymethyl)

Product Code	Product Name	Ion Exchange Capacity (meq/g)	Base Material	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6110002	**IEC CM-825**	0.4	Polyhydroxymethacrylate	8	5,000	**8.0 × 75**	50mM Na_2SO_4 aq.
F7640001	**Asahipak ES-502C 7C**	0.55	Polyvinyl alcohol	9	2,000	**7.5 × 100**	0.1M Sodium phosphate buffer (pH4.4)

For amino acids

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Base Material	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6354211	**CXpak P-421S**	≥ 3,500	Sulfo(Na^+)	Styrene divinylbenzene copolymer	6	**4.6 × 150**	H_2O
F6700210	**CXpak P-G**	(guard column)	Sulfo(Na^+)	Styrene divinylbenzene copolymer	6	**4.6 × 10**	H_2O

Column for Hydrophobic Interaction Chromatography

Features

PH-814
- Separates proteins without denaturation
- Applicable to samples after treatment of ammonium sulfate fractions

Standard column

Product Code	Product Name	Functional Group	Base Material	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F6110003	**HIC PH-814**	Phenyl	Polyhydroxymethacrylate	10	2,000	**8.0 × 75**	H_2O

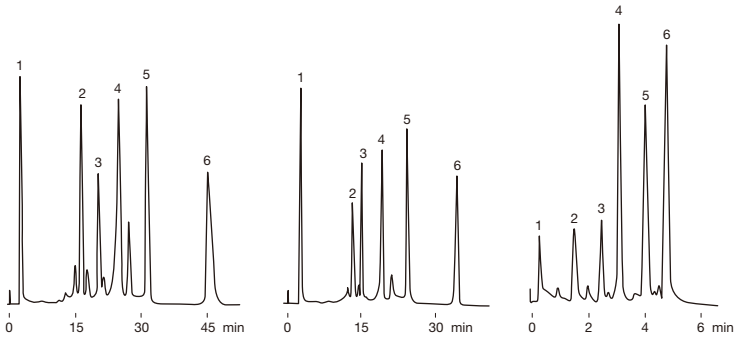
*Contact Shodex or our distributors near you for customized columns.

Protein separation using cation exchange columns

(I) CM-825
(weak cation ion exchange)
90µL injected

(II) SP-825
(strong cation ion exchange)
30µL injected

(III) SP-420N
(strong cation ion exchange)
non-porous type gel

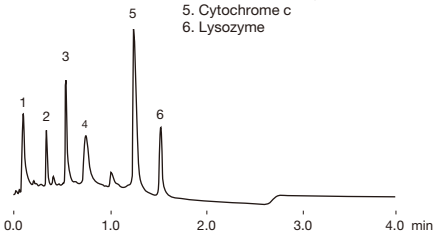


Column : **(I) Shodex IEC CM-825, (II) Shodex IEC SP-825, (III) Shodex IEC SP-420N**
Eluent : (A); 20mM Sodium phosphate buffer(pH7.0) (B); (A) + 0.5M NaCl
(I , II) Linear gradient; (A) to (B), 60min (III) Linear gradient; (A) to (B), 10min
Flow rate : (I , II)1.0mL/min (III)1.5mL/min
Detector : UV(280nm)
Column temp. : Room temp.

Sample :
1. Myoglobin
2. Trypsinogen
3. Ribonucrease A
4. α-Chymotrypsinogen A
5. Cytochrome c
6. Lysozyme

Rapid analysis of proteins using UHPLC

Sample : 5µL (13mg total protein)
1.Myoglobin
2. Trypsinogen
3. Ribonuclease A
4. α-Chymotrypsinogen A
5. Cytochrome c
6. Lysozyme

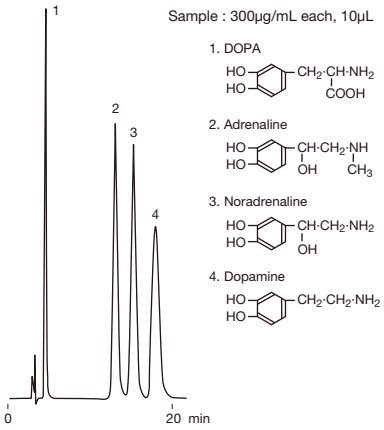


Column : **Shodex PIKESS SP-2B**
Eluent : (A); 20mM Sodium phosphate buffer(pH 7.0)
(B); (A) + 0.5 M NaCl
Linear gradient; 100%(A) to 50%(A), 2.5min
Flow rate : 1.2mL/min
Detector : UV(280nm)
Column temp. : 25℃

Catecholamines

Sample : 300µg/mL each, 10µL

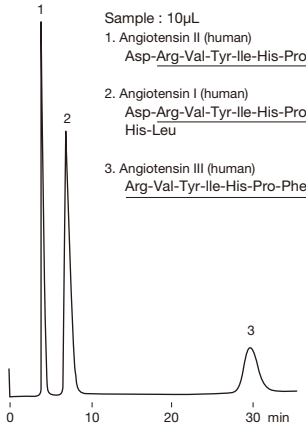
1. DOPA
2. Adrenaline
3. Noradrenaline
4. Dopamine



Column : **Shodex Asahipak ES-502C 7C**
Eluent : 20mM Sodium malonate buffer + 0.5M NaCl(pH6.0)
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : 30℃

Angiotensins

Sample : 10µL
1. Angiotensin II (human)
Asp-Arg-Val-Tyr-Ile-His-Pro-Phe
2. Angiotensin I (human)
Asp-Arg-Val-Tyr-Ile-His-Pro-Phe-His-Leu
3. Angiotensin III (human)
Arg-Val-Tyr-Ile-His-Pro-Phe



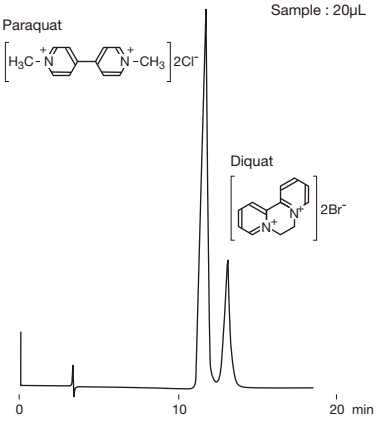
Column : **Shodex Asahipak ES-502C 7C**
Eluent : 50mM Sodium malonate buffer(pH6.0) /CH_3CN=80/20
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : 30℃

Paraquat and diquat

Sample : 20µL

Paraquat

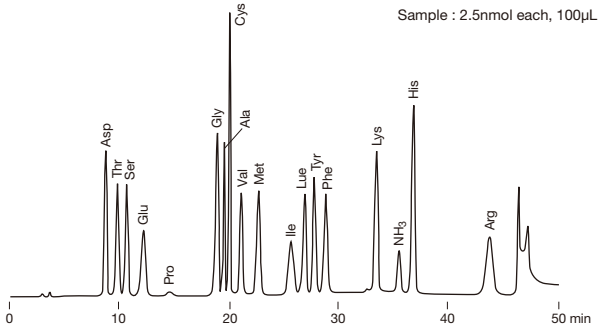
Diquat



Column : **Shodex Asahipak ES-502C 7C**
Eluent : 50mM Sodium phosphate buffer + 150mM NaCl(pH7.0)
Flow rate : 1.0mL/min
Detector : UV(288nm)
Column temp. : 30℃

Standard amino acids

Sample : 2.5nmol each, 100µL

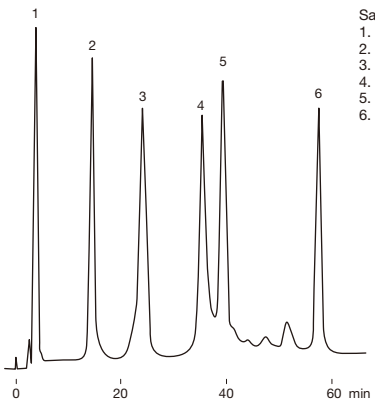


Column : **Shodex CXpak P-421S**
Eluent : No.1 0.12M Sodium citrate buffer(pH3.3)
No.2 0.13M Sodium citrate buffer(pH3.2)
No.3 0.11M Sodium citrate buffer(pH4.0)
No.4 1.02M Sodium citrate buffer(pH4.9)
No.5 0.2M NaOH aq./Ethanol=90/10 (Rinse solution)
Low pressure gradient;
No.1 (0min), No.2 (1.2min), No.3 (10.0min), No.4 (21.2min), No.5 (40min)
Flow rate : 0.5mL/min
Detector : VIS(570nm)
post column method (ninhydrin reaction 0.35mL/min, 120℃)
Column temp. : 63℃

Protein separation using hydrophobic interaction chromatography

Sample : 370µL

1. Cytochrome c	0.03%
2. Myoglobin	0.08%
3. Ribonuclease A	0.16%
4. Ovalbumin	0.16%
5. Lysozyme	0.04%
6. α-Chymotrypsinogen	0.05%



Column : **Shodex HIC PH-814**
Eluent : (A); 1.8M Ammonium sulfate + (B)
(B); 0.1M Phosphate buffer(pH7.0)
Linear gradient; (A) to (B), 60min
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

Columns for Affinity Chromatography

Features

AFpak

- Rigid polymer-based packing materials enable high speed analysis
- Binds functional group through chemically stable ligands (spacers)
- Minimizes detachment of functional groups, ensuring highly repeatable analysis

Semi-micro Micro Columns p.73-76

Standard columns

Product Code	Product Name	Ligand	Ligand Load / gel (g)	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent see below table
F7118948	**AFpak AAB-894**	Aminobenzamidine	100μmol	18	**8.0 × 50**	①
F7118940	**AFpak AAF-894**	Acriflavine	10μmol	18	**8.0 × 50**	②
F7113000	**AFpak AAM-894**	5'AMP	10μmol	18	**8.0 × 50**	③
F7112000	**AFpak AAP-894**	Aprotinin	5mg	18	**8.0 × 50**	③
F7118963	**AFpak AAV-894**	Avidin	5mg	18	**8.0 × 50**	③
F7118960	**AFpak ABA-894**	Bovine serum albumin (BSA)	20mg	6	**8.0 × 50**	④
F7118955	**AFpak ABT-894**	Biotin	–	18	**8.0 × 50**	⑤
F7118943	**AFpak ACA-894**	Concanavalin A (Con A)	15mg	18	**8.0 × 50**	⑥
F7118942	**AFpak ACB-894**	Cibacron blue	40μmol	18	**8.0 × 50**	⑦
F7118954	**AFpak ADS-894**	Dextran sulfate	30mg	18	**8.0 × 50**	⑧
F7118949	**AFpak AED-894**	Ethylenediaminediacetic acid	30μmol	18	**8.0 × 50**	⑨
F7118947	**AFpak AGA-894**	N-acetylglucosamine	–	18	**8.0 × 50**	⑩
F7118952	**AFpak AGE-894**	Gelatin	30mg	18	**8.0 × 50**	④
F7113010	**AFpak AGT-894**	Glutathione	50μmol	18	**8.0 × 50**	③
F7118945	**AFpak AHR-894**	Heparin	5mg	18	**8.0 × 50**	⑪
F7118944	**AFpak AIA-894**	Iminodiacetic acid	70μmol	18	**8.0 × 50**	⑨
F7113080	**AFpak ALC-894**	Lentil lectin	6-7mg	18	**8.0 × 50**	⑫
F7118962	**AFpak ALS-894**	Lysine	–	18	**8.0 × 50**	③
F7113020	**AFpak ANA-894**	Nicotinamide Adenine Dinucleotide (NAD)	10μmol	18	**8.0 × 50**	③
F7118958	**AFpak AOV-894**	Ovomucoid	10mg	18	**8.0 × 50**	①
F7118946	**AFpak APA-894**	Protein A	4mg	18	**8.0 × 50**	⑬
F7118950	**AFpak APB-894**	Aminophenylboronic acid	800μmol	10	**8.0 × 50**	⑭
F7113030	**AFpak APD-894**	Procion red	40-60μmol	18	**8.0 × 50**	③
F7113070	**AFpak APE-894**	Phosphorylethanolamine	–	18	**8.0 × 50**	③
F7113050	**AFpak APG-894**	Protein G	4-5mg	18	**8.0 × 50**	③
F7118957	**AFpak APH-894**	Phenylalanine	50μmol	18	**8.0 × 50**	⑮
F7113040	**AFpak APR-894**	Protamine	4-5mg	18	**8.0 × 50**	③
F7118956	**AFpak ARC-894**	Ricinus communis agglutinin I (RCA-I)	20mg	18	**8.0 × 50**	⑯
F7118953	**AFpak AST-894**	Soybean trypsin inhibitor	20mg	18	**8.0 × 50**	①
F7118959	**AFpak AWG-894**	Wheat germ agglutinin (WGA)	14mg	18	**8.0 × 50**	⑰
F7118964	**AFpak ACH-494**	Choline oxydase, acetylcholine esterase	–	18	**4.6 × 10**	⑱
F7111000	**AFpak AGO-494**	Glucose oxydase	–	18	**4.6 × 10**	⑲

Shipping Solvent

① 0.1M Sodium acetate buffer + 0.5M NaCl + 0.02% NaN_3(pH7.0)
② 0.1M Ethyl morpholine-acetic acid buffer + 0.02% NaN_3(pH7.0)
③ 10mM Sodium phosphate buffer + 0.15M NaCl + 0.02% NaN_3(pH7.4)
④ 50mM Tris-HCl buffer + 0.15M NaCl + 0.02% NaN_3(pH7.0)
⑤ 10mM Sodium acetate buffer + 0.02% NaN_3(pH6.5)
⑥ 50mM Tris-HCl buffer + 0.15M NaCl + 0.5mM $MnCl_2$ + 0.5mM $CaCl_2$ + 0.02% NaN_3(pH7.0)
⑦ 0.1M Potassium phosphate buffer + 0.02% NaN_3(pH5.0)
⑧ 50mM Sodium phosphate buffer + 0.02% NaN_3(pH7.4)
⑨ 50mM Ethyl morpholine-acetic acid buffer + 0.02% NaN_3(pH6.0)
⑩ 10mM Tris-HCl buffer + 0.02% NaN_3(pH8.0)
⑪ 10mM Tris-HCl buffer + 10mM NaCl + 0.02% NaN_3(pH7.4)
⑫ 50mM Tris-HCl buffer + 0.1M NaCl + 1mM $MnCl_2$ + 1mM $CaCl_2$ + 0.2M Glucose + 0.01% Merthiolate(pH7.2)
⑬ 0.1M Sodium phosphate buffer + 0.5M NaCl + 0.02% NaN_3(pH7.0)
⑭ 10mM Sodium phosphate buffer + 0.1M NaCl + 0.02% NaN_3(pH7.0)
⑮ 20mM Sodium phosphate buffer + 0.02% NaN_3(pH6.0)
⑯ 0.1M Sodium phosphate buffer + 0.15M NaCl + 0.2M Galactose + 0.02% NaN_3(pH7.4)
⑰ 0.1M Tris-HCl buffer + 0.15M NaCl + 0.2M N-Acetylglucosamine + 0.02% NaN_3(pH7.4)
⑱ 10mM Phosphate buffer + 1.0M NaCl(pH7.4)
⑲ 50mM Phosphate buffer + 0.15M NaCl(pH6.0)

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

Application

Product Name	Application
AFpak AAB-894	Serine protease, etc
AFpak AAF-894	RNA, DNA, vitamins, etc
AFpak AAM-894	NAD-dependent dehydrogenase, ATP-dependent kinase, etc
AFpak AAP-894	Serine protease, etc
AFpak AAV-894	Biotin, Biotin derivatives
AFpak ABA-894	Chiral separation (amino acid), etc
AFpak ABT-894	Avidin, etc
AFpak ACA-894	Glycoproteins, polysaccharides, etc
AFpak ACB-894	Albumin, NAD dependent enzymes, etc
AFpak ADS-894	Lipoproteins, blood coagulation factors, etc
AFpak AED-894	Nucleic acids, serum proteins, etc.
AFpak AGA-894	Lectins, carbohydrate metabolizing enzymes, etc
AFpak AGE-894	Fibronectin, etc
AFpak AGT-894	Enzymes related to glutathione, etc
AFpak AHR-894	Lipoproteins, blood coagulation factors, etc
AFpak AIA-894	Interferon, serum proteins, etc

Product Name	Application
AFpak ALC-894	Glycoproteins, polysaccharides, etc
AFpak ALS-894	Plasminogen, Plasminogen activator, RNA, DNA, etc
AFpak ANA-894	NAD- dependent dehydrogenase, etc
AFpak AOV-894	Trypsin-like protease, etc
AFpak APA-894	IgG, immune complexes, etc
AFpak APB-894	Nucleic acids, catecholamines, etc
AFpak APD-894	NAD, NADP-dependent enzymes, interferon, etc
AFpak APE-894	C-reactive proteins, etc
AFpak APG-894	IgG, immune complexes, etc
AFpak APH-894	Alkalophilic protease, etc
AFpak APR-894	IgM, etc
AFpak ARC-894	Glycoproteins, polysaccharides
AFpak AST-894	Trypsin-like protease, etc
AFpak AWG-894	Glycoproteins, polysaccharides
AFpak ACH-494	Choline, acetylcholine (Enzyme-substrate immobilized column)
AFpak AGO-494	Glucose (Enzyme-substrate immobilized column)

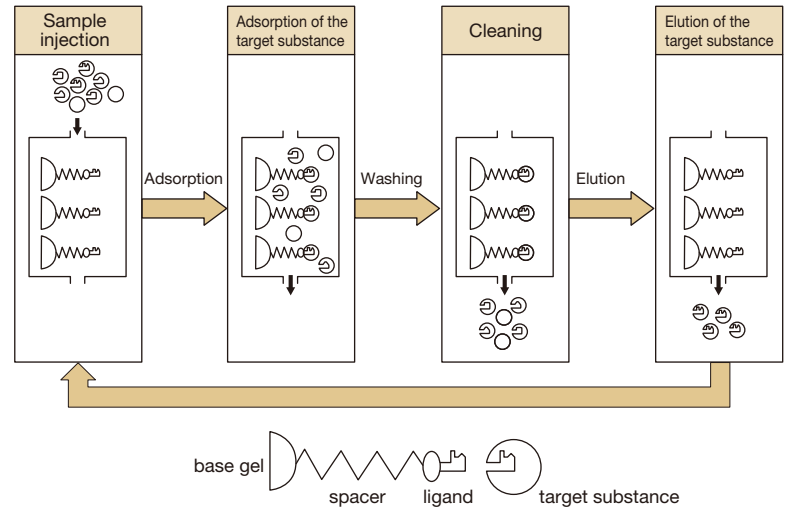
Capacity

Product Name	Capacity	
AFpak AAB-894	—	
AFpak AAF-894	ATP Na	1.8mg/column
AFpak AAM-894	Lactic dehydronase	1.5mg/g
AFpak AAP-894	Trypsin	3mg/g
AFpak AAV-894	Biotin	8μg/column
AFpak ABA-894	—	
AFpak ABT-894	Avidin	9mg/g
AFpak ACA-894	—	
AFpak ACB-894	BSA	20mg/column
AFpak ADS-894	LDL	5mg/g
AFpak AED-894	—	
AFpak AGA-894	Lysozyme	0.6mg
AFpak AGE-894	Fibronectin	150mg/g
AFpak AGT-894	—	
AFpak AHR-894	Lysozyme	4mg/column
AFpak AIA-894	BSA	70mg/column

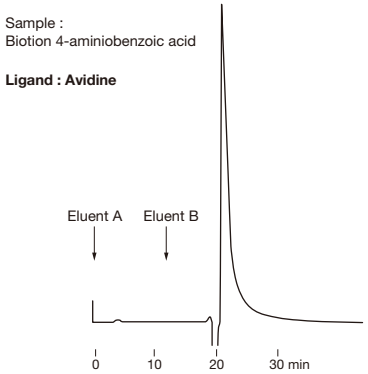
Product Name	Capacity	
AFpak ALC-894	—	
AFpak ALS-894	Plasminogen	54μg/g
AFpak ANA-894	Lactic dehydronase	1.4mg/g
AFpak AOV-894	Trypsin	100mg/g
AFpak APA-894	IgG Human	13mg/g
AFpak APB-894	Sorbitol	0.2mg/column
AFpak APD-894	BSA	72mg/g
AFpak APE-894	C-reactive protein	0.91mg/g
AFpak APG-894	IgG Humnan	10mg/g
AFpak APH-894	Subtilisin Carlsberg	9mg/g
AFpak APR-894	IgM Human	1.9mg/column
AFpak ARC-894	—	
AFpak AST-894	Trypsin	100mg/g
AFpak AWG-894	—	
AFpak ACH-494	—	
AFpak AGO-494	—	

See p.30 for applications.

Principle of affinity chromatography

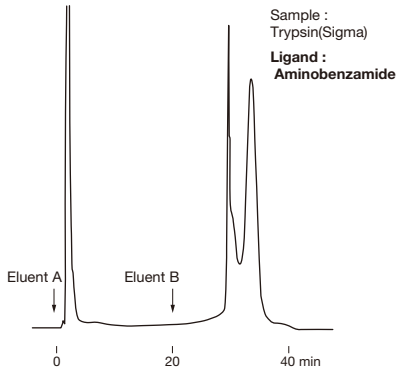


Biotin 4-aminobenzoic acid



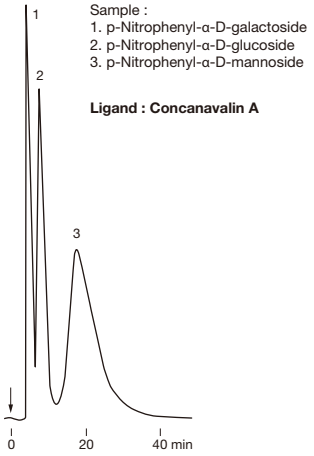
Column : **Shodex AFpak AAV-894**
Eluent : (A); 0.01M Sodium acetate buffer + 0.15M NaCl(pH7.0)
(B); 0.1M Acetic acid aq./Isopropanol =50/50
Step gradient; (A) to (B)
Flow rate : 1.0mL/min
Detector : UV(260nm)
Column temp. : Room temp.

Trypsin



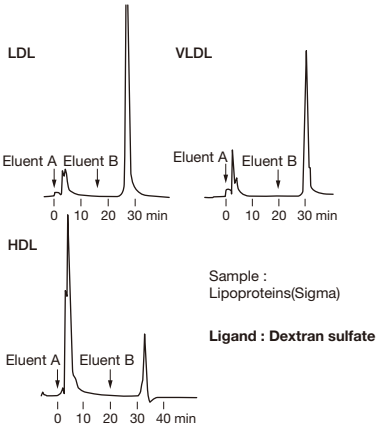
Column : **Shodex AFpak AAB-894**
Eluent : (A); 0.1M Sodium acetate buffer + 0.5M NaCl(pH7.0)
(B); 0.1M Sodium acetate buffer + 0.5M NaCl(pH2.8)
Step gradient; (A) to (B)
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

p-Nitrophenol-glucosides



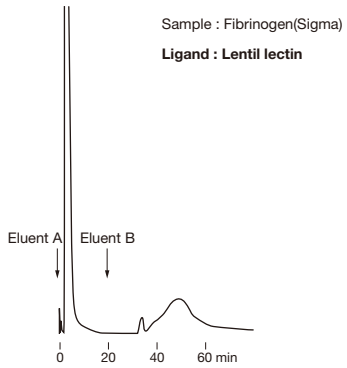
Column : **Shodex AFpak ACA-894**
Eluent : 0.02M Tris-HCl buffer + 0.25M NaCl(pH7.4)
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

Lipoproteins in plasma



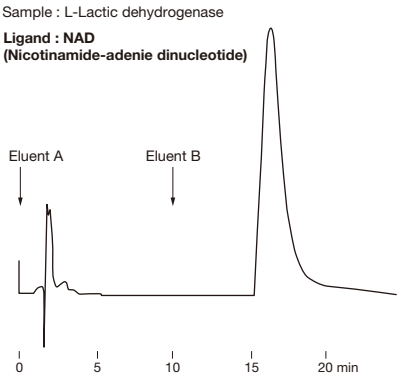
Column : **Shodex AFpak ADS-894**
Eluent : (A); 0.05M Sodium phosphate buffer(pH7.4)
(B); (A) + 1.0M NaCl
Step gradient; (A) to (B)
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

Fibrinogen



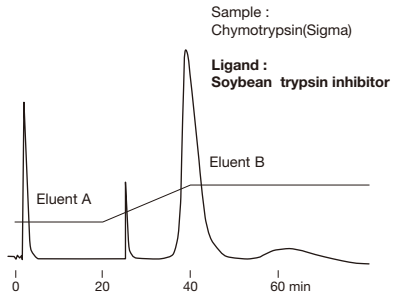
Column : **Shodex AFpak ALC-894**
Eluent : (A); 50mM Tris-HCl buffer + 0.15M NaCl + 0.5mM $CaCl_2$ + 0.5mM $MnCl_2$(pH7.4)
(B); (A) + 0.1M Methyl mannoside
Step gradient; (A) to (B)
Flow rate : 0.5mL/min
Detector : UV(280nm)
Column temp. : Room temp.

L-Lactic dehydrogenase



Column : **Shodex AFpak ANA-894**
Eluent : (A); 10mM Potassium phosphate buffer(pH7.0)
(B); (A) + 0.5M KCl
Step gradient; (A) to (B)
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

Chymotrypsin

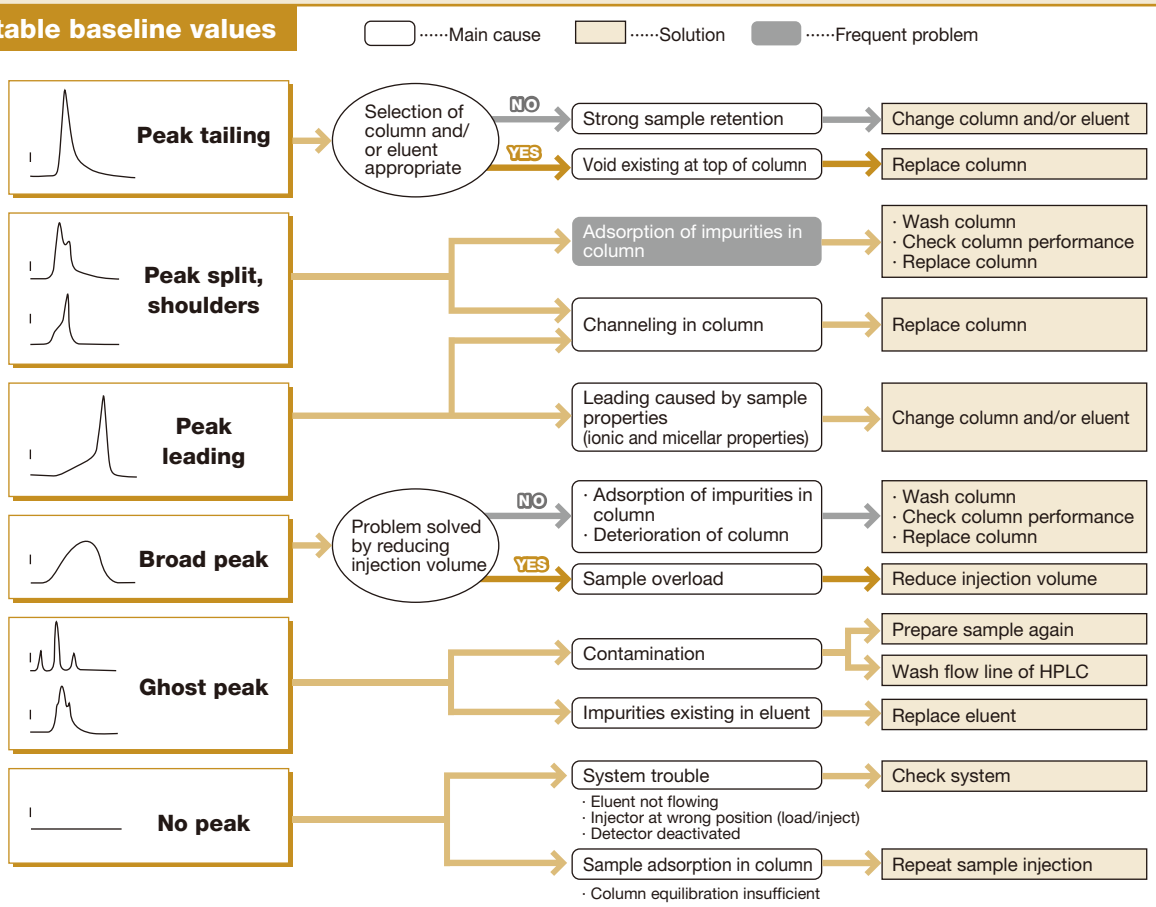


Column : **Shodex AFpak AST-894**
Eluent : (A); 0.1M Sodium acetate buffer + 0.5M NaCl(pH7.7)
(B); 0.1M Sodium acetate buffer + 0.5M NaCl(pH2.8)
Linear gradient; 0 to 20min, (A) 20 to 40min, (A) to (B) after 40min (B)
Flow rate : 1.0mL/min
Detector : UV(280nm)
Column temp. : Room temp.

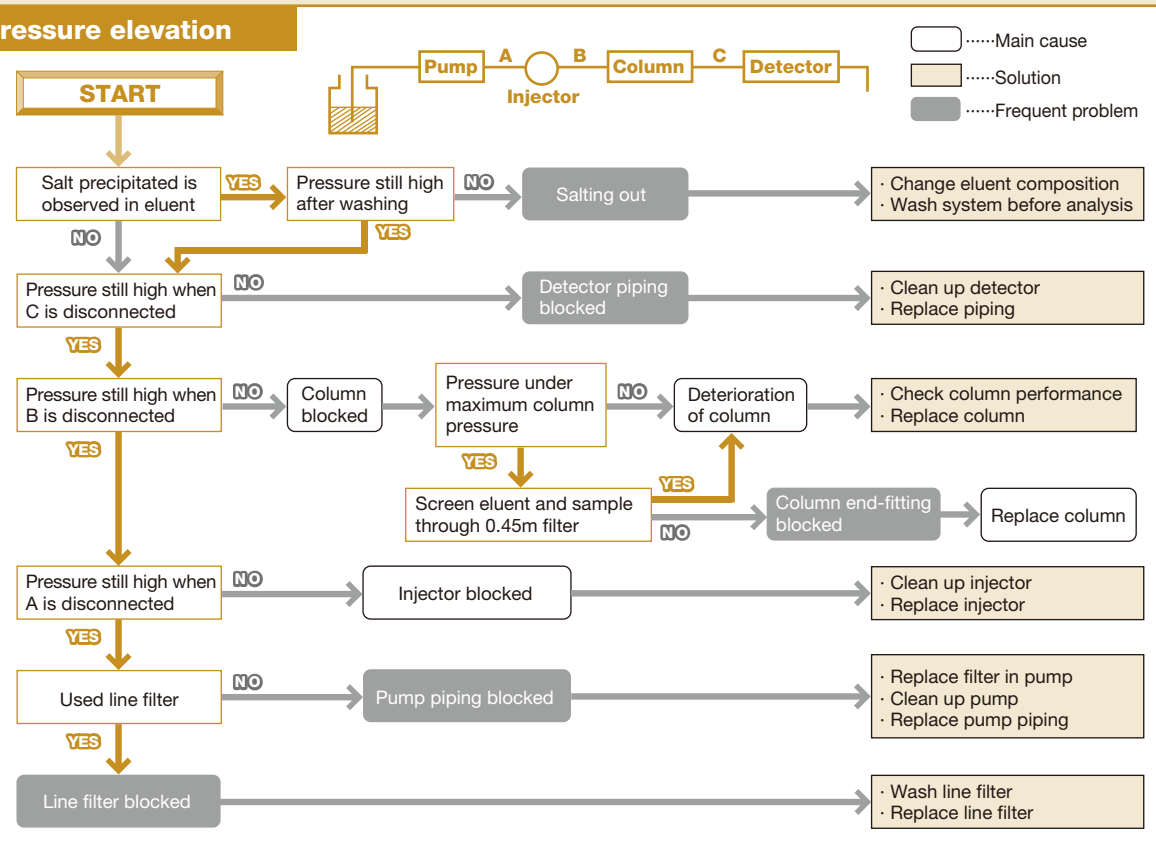
Column Trouble Shooting

Common causes for abnormal chromatograms

Unstable baseline values



Pressure elevation



Columns for Ligand Exchange Chromatography

* A list of elution volumes of saccharides for our columns is available.
Please refer to our website (http://www.shodex.com/) or technical notebook (No.2 and 3).

Features

SC1011, 1821, SP0810, KS-801, 802

- Separates saccharides by combining ligand exchange and size exclusion modes
- Three types of counter ions are available: Ca, Pb, and Na ions
- Solvents other than water are not required for the analysis of neutral sugars [KS-801, 802]

Note book No.3 News No.6, 40, 43 Preparative Columns p.85

KS-803~807

- Suitable for separation of polysaccharides in the size exclusion mode
- Available in combination with KS-802 and KS-801
- Solvents other than water are not required for the analysis of neutral sugars [KS-803~806]

Note book No.3, 8, 13 Preparative Columns p.85

MN-431

- Column for the analysis of mannitol in conformity with USP
- Column for Ca-type ligand exchange chromatography
- Solvents other than water are not required for analysis

EP SC1011-7F

- Column for Ca-type ligand exchange chromatography
- Column for the analysis of sugar alcohols and saccharides in conformity with EP

Standard columns

Ligand exchange and Size exclusion

Product Code	Product Name	Plate Number (TP/column)	Functional group (Counter Ion)	Exclusion Limit (Pullulan)	Particle Size (µm)	Column Size (mm) I.D. x L	Shipping Solvent
F6378102	**SUGAR SC1011**	≥ 13,000	Sulfo(Ca^{2+})	1,000	6	**8.0 × 300**	H_2O
F6378103	**SUGAR SC1821**	≥ 13,000	Sulfo(Ca^{2+})	10,000	6	**8.0 × 300**	H_2O
F6700090	**SUGAR SC-LG**	(guard column)	Sulfo(Ca^{2+})	–	10	**6.0 × 50**	H_2O
F6378105	**SUGAR SP0810**	≥ 11,000	Sulfo(Pb^{2+})	1,000	7	**8.0 × 300**	H_2O
F6700081	**SUGAR SP-G**	(guard column)	Sulfo(Pb^{2+})	–	10	**6.0 × 50**	H_2O
F6378010	**SUGAR KS-801**	≥ 17,000	Sulfo(Na^{+})	1,000	6	**8.0 × 300**	H_2O
F6378020	**SUGAR KS-802**	≥ 17,000	Sulfo(Na^{+})	10,000	6	**8.0 × 300**	H_2O
F6378025	**SUGAR KS-803**	≥ 17,000	Sulfo(Na^{+})	50,000	6	**8.0 × 300**	H_2O
F6378035	**SUGAR KS-804**	≥ 17,000	Sulfo(Na^{+})	400,000	7	**8.0 × 300**	H_2O
F6378050	**SUGAR KS-805**	≥ 9,000	Sulfo(Na^{+})	5,000,000	17	**8.0 × 300**	H_2O
F6378060	**SUGAR KS-806**	≥ 9,000	Sulfo(Na^{+})	(50,000,000)*	17	**8.0 × 300**	H_2O
F6700020	**SUGAR KS-G**	(guard column)	Sulfo(Na^{+})	–	10	**6.0 × 50**	H_2O
F6378070	**SUGAR KS-807**	≥ 4,000	Sulfo(Na^{+})	(200,000,000)*	30	**8.0 × 300**	H_2O
F6700021	**SUGAR KS-807G**	(guard column)	Sulfo(Na^{+})	–	30	**8.0 × 50**	H_2O

*( )Estimated value

Base Material : Styrene divinylbenzene copolymer

For the United States Pharmacopeia (USP)

Product Code	Product Name	Functional group (Counter Ion)	Particle Size (µm)	Column Size (mm) I.D. x L	Shipping Solvent
F6379230	**USPpak MN-431**	Sulfo(Ca^{2+})	8	**4.0 × 250**	H_2O

See p.69 for USP column list.

Base Material : Styrene divinylbenzene copolymer

For the European Pharmacopoeia (EP)

Product Code	Product Name	Functional group (Counter Ion)	Particle Size (µm)	Column Size (mm) I.D. x L	Shipping Solvent
F6379230	**EP SC1011-7F**	Sulfo(Ca^{2+})	8	**7.8 × 300**	H_2O

Base Material : Styrene divinylbenzene copolymer

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

Features

DC-613, SC1211, SZ5532

- Separation is performed by combining ligand exchange and HILIC modes
- DC-613 can analyze sugars without removing sodium salts in the sample
- SC1211 is suitable for separation of sugar alcohols
- SZ5532 is recommended for the separation of disaccharides or trisaccharides

[DC-613]
Note book No.2
Preparative Columns p.85

Standard columns

Ligand exchange and HILIC

Product Code	Product Name	Plate Number (TP/column)	Functional group (Counter Ion)	Particle Size (μm)	Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
F7001003	**RSpak DC-613**	≥ 5,500	Sulfo(Na^+)	6	100	**6.0 × 150**	H_2O/CH_3CN=30/70
F6700170	**RSpak DC-G**	(guard column)	Sulfo(Na^+)	10	–	**4.6 × 10**	H_2O/CH_3CN=30/70
F7001400	**SUGAR SC1211**	≥ 5,500	Sulfo(Ca^{2+})	6	50	**6.0 × 250**	H_2O/CH_3CN=75/25
F6700120	**SUGAR SC-G**	(guard column)	Sulfo(Ca^{2+})	10	–	**4.6 × 10**	H_2O/CH_3CN=75/25
F7001300	**SUGAR SZ5532**	≥ 5,500	Sulfo(Zn^{2+})	6	100	**6.0 × 150**	H_2O/CH_3CN=30/70
F6700110	**SUGAR SZ-G**	(guard column)	Sulfo(Zn^{2+})	6	–	**4.6 × 10**	H_2O/CH_3CN=30/70

Base Material : Styrene divinylbenzene copolymer

Elution volume of saccharides analysis with various columns [Partial list only; refer to website for complete list]

Substabces	Elution Volume (mL)						
	SP0810	SC1011	KS-801	SZ5532	NH2P-50 4E	SC1211	DC-613
Arabinose	10.42	8.91	8.21	5.11	6.18	5.56	6.03
D-Arabitol	15.86	11.33	7.63	7.27	6.29	8.16	6.06
Dulcitol	20.18	12.76	7.40	9.46	7.45	11.28	7.81
***meso*-Erythritol**	12.70	10.09	7.86	5.73	5.43	6.27	4.95
D(-)-Fructose	11.05	8.85	7.71	5.37	6.75	5.90	6.52
D(+)-Fucose	10.48	8.84	8.09	4.50	5.43	4.96	5.04
D(+)-Galactose	9.74	7.98	7.58	6.46	8.10	4.98	7.91
Gentiobiose	7.22	6.08	5.75	10.50	16.36	*	14.45
Glucose	8.63	7.30	7.17	5.87	8.61	4.76	7.35
***myo*-Inositol**	12.77	8.86	7.99	12.63	9.96	7.87	17.36
Isomaltose	7.68	6.26	5.95	10.57	15.18	*	15.24
Isomaltotriose	7.09	5.75	5.34	21.17	27.55	*	37.45
1-Kestose	6.79	5.75	5.26	13.09	20.11	*	11.11
Kojibiose	7.56	6.21	5.88	9.65	14.82	*	12.70
Lactitol	13.27	8.09	6.13	16.35	11.82	6.67	15.26
Lactose	8.05	6.51	5.99	10.12	13.27	4.07	13.04
Lactulose	9.13	6.99	6.19	9.16	10.72	4.65	11.88
Maltitol	12.23	8.26	6.03	13.04	11.82	6.77	13.12
Maltose	7.85	6.34	5.94	8.67	14.24	*	11.46
Maltotriose	7.48	5.89	5.38	13.79	24.96	*	19.92
Mannitol	15.80	11.10	7.23	8.75	7.39	9.03	7.22

Substabces	Elution Volume (mL)						
	SP0810	SC1011	KS-801	SZ5532	NH2P-50 4E	SC1211	DC-613
D-Mannose	10.72	8.17	7.64	5.83	7.84	5.01	7.15
Melibiose	8.16	6.45	5.98	11.69	14.70	4.23	16.39
Nystose	6.38	5.45	4.93	20.05	31.90	*	—
Palatinit	2peaks	2peaks	5.90	2peaks	12.73	2peaks	2peaks
Palatinose	7.84	6.45	5.89	8.08	12.12	3.99	10.56
Panose	7.14	5.78	5.32	16.87	25.60	*	25.89
D(+)-Raffinose	7.14	5.78	5.29	16.36	20.25	*	21.60
Rhamnose	9.77	8.23	7.37	3.93	5.52	4.43	4.23
D(-)-Ribose	19.35	13.66	9.04	4.82	5.45	8.64	5.55
D(-)-Sorbitol	21.61	13.31	7.42	9.79	7.09	11.88	7.68
Sorbose	9.67	8.03	7.38	5.12	7.35	4.92	6.15
Stachyose	6.82	5.57	4.97	—	36.22	*	—
Sucrose	7.54	6.29	5.87	7.91	11.87	*	9.45
α-D-Talose	21.33	12.59	8.76	5.69	6.47	8.51	6.86
Trehalose	7.62	6.27	5.78	10.85	13.25	*	12.42
Trehalulose	8.92	6.95	6.10	9.54	11.68	4.78	12.41
Xylitol	19.87	13.14	7.94	7.77	6.10	10.16	6.44
Xylobiose	8.16	6.68	6.40	5.65	9.05	*	7.04
D(+)-Xylose	9.21	7.90	7.71	4.55	6.58	4.48	5.35
D-Xylulose	10.64	9.02	8.04	4.06	5.41	5.07	4.65

(–)→Not detected (+)→Overlap with solvent peak

Column : SUGAR SP0810, SC1011, KS-801
Eluent : H_2O
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 80℃

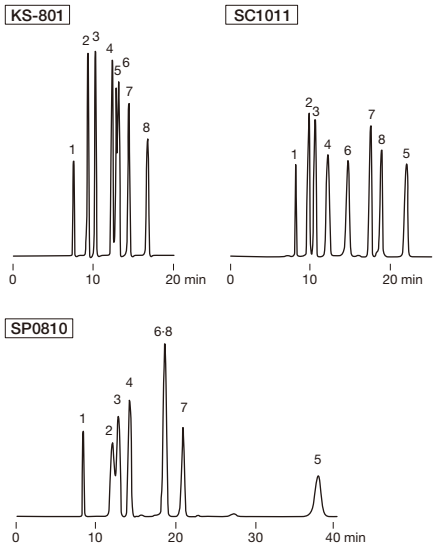
Column : SUGAR SC1211
Eluent : H_2O/CH_3CN=65/35
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 70℃

Column : SUGAR SZ5532
Eluent : H_2O/CH_3CN=25/75
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 60℃

Column : Asahipak NH2P-50 4E
Eluent : H_2O/CH_3CN=25/75
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 30℃

Column : RSpak DC-613
Eluent : H_2O/CH_3CN=25/75
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 70℃

Comparison of saccharides analysis based on different counter ions



In the ligand exchange mode, the elution pattern depends on the kind of counter ion. Therefore, select the column applicable to analyze the combination of saccharides. Refer list of "Elution volume of various columns for saccharides analysis" (p33)

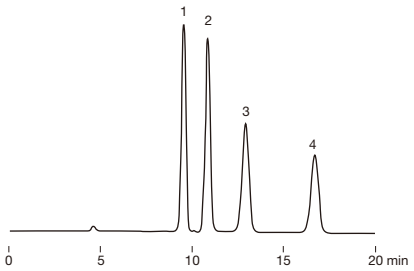
Sample : 5μL

1. Pullulan P10	0.5%
2. Maltotriose	1.0%
3. Maltose	1.0%
4. Glucose	1.0%
5. Sorbitol	1.0%
6. Fructose	1.0%
7. Glycerol	1.0%
8. EtOH	2.0%

Column : Shodex SUGAR KS-801 SC1011 SP0810
Eluent : H_2O
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 80°C

Ketohexoses

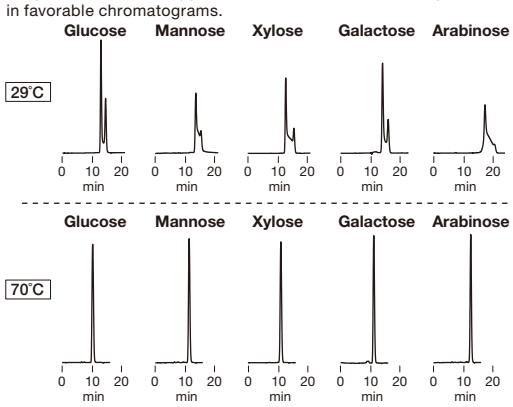
Sample : 0.025% each, 10μL
1. Sorbose
2. Fructose
3. Tagatose
4. Psicose



Column : Shodex SUGAR SP0810
Eluent : H_2O
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 80°C

Anomer separation of saccharides

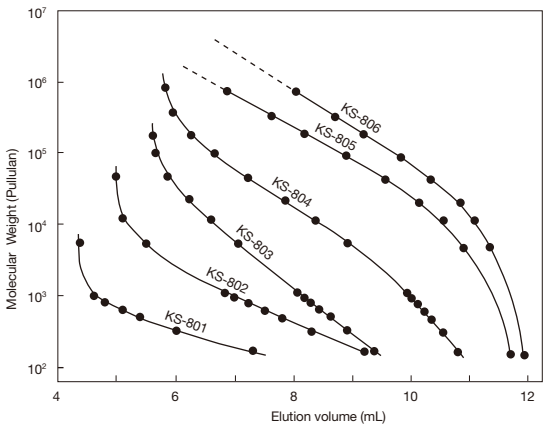
Saccharides may affect a chromatogram through anomer separation. When using a SUGAR column to analyze saccharides, the analysis at high temperatures would suppress the influence of anomer separation, resulting in favorable chromatograms.



Sample : 0.5% each, 10μL

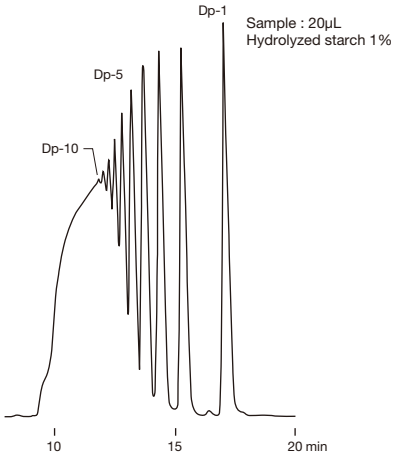
Column : Shodex SUGAR SC1011
Eluent : H_2O
Flow rate : 0.7mL/min
Detector : RI
Column temp. : 29°C, 70°C

Calibration curves for KS-800 series using pullulan



Column : Shodex SUGAR KS-800 series
Eluent : H_2O
Detector : RI
Column temp. : 80°C

Hydrolyzed starch



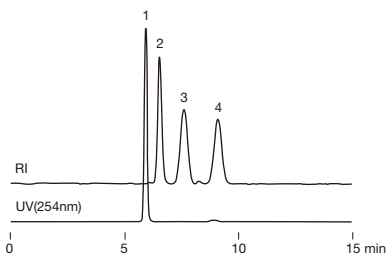
Sample : 20μL
Hydrolyzed starch 1%

Column : Shodex SUGAR KS-802 x 2
Eluent : H_2O
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 80°C

Acesulfame K and saccharides

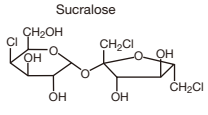
Sample : 10μL

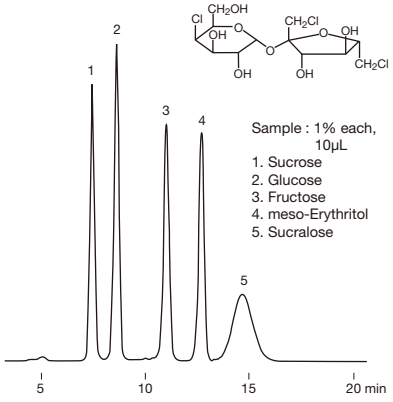
1. Acesulfame K	0.005%
2. Sucrose	0.5%
3. Glucose	0.5%
4. Fructose	0.5%



Column : Shodex SUGAR SC1011
Eluent : 10mM $CaSO_4$ aq.
Flow rate : 1.0mL/min
Detector : RI, UV(254nm)
Column temp. : 80°C

Sucralose and saccharides

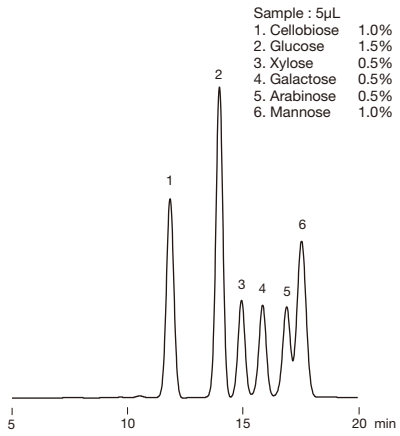




Sample : 1% each, 10μL
1. Sucrose
2. Glucose
3. Fructose
4. meso-Erythritol
5. Sucralose

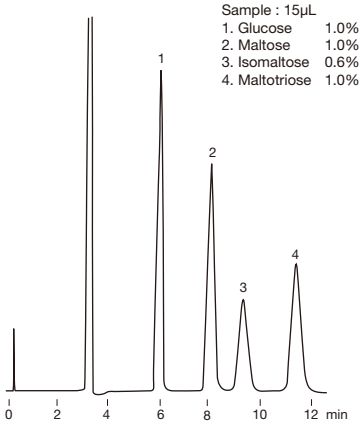
Column : Shodex SUGAR SP0810
Eluent : H_2O
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 80°C

Saccharides in wood



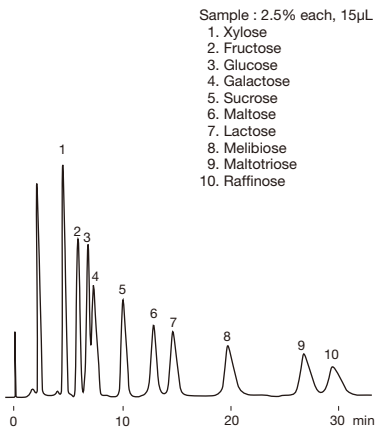
Column : **Shodex SUGAR SP0810**
Eluent : H_2O
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 85℃

Maltose and isomaltose



Column : **Shodex SUGAR SZ5532**
Eluent : H_2O/CH_3CN=25/75
Flow rate : 0.9mL/min
Detector : RI
Column temp. : 60℃

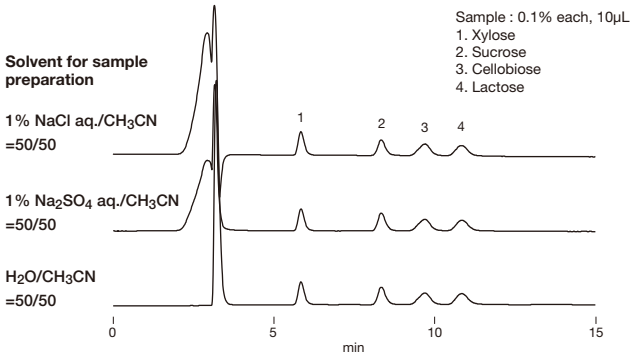
Standard saccharides



Columnn : **Shodex RSpak DC-613**
Eluent : H_2O/CH_3CN=20/80
Flow rate : 1.5mL/min
Detector : RI
Column temp. : 70℃

Saccharides in the presence of sodium salt

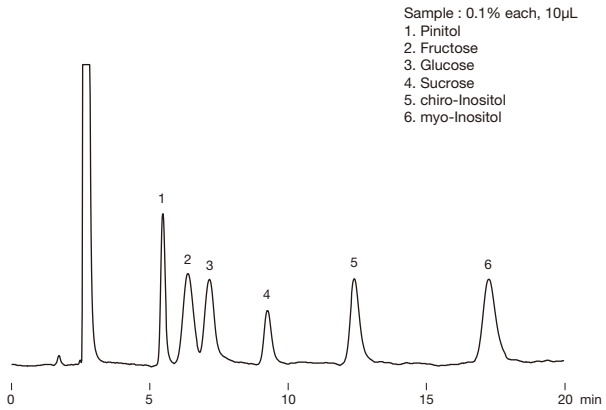
The RSpak DC-613 enables the analysis of saccharides in sodium-salt containing sample without desalting because the column uses Na as counter ion. Hydrolyzed samples with acids such as hydrochloric acid and sulfuric acid can be analyzed as sample solution after being neutralized with sodium hydroxide.



Column : **Shodex RSpak DC-613**
Eluent : H_2O/CH_3CN=30/70
Flow rate : 0.8mL/min
Detector : RI
Column temp. : 50℃

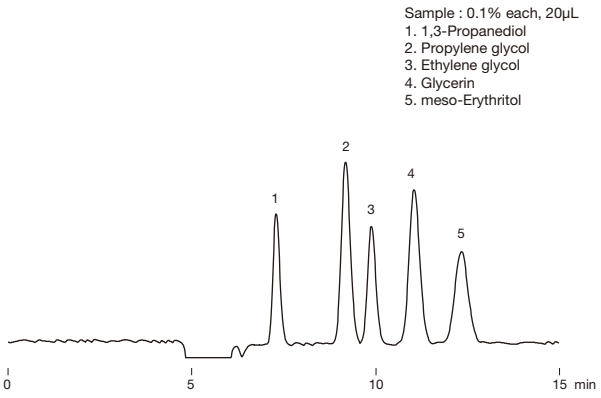
* High concentration of acetonitlie is applied to eluent of saccharide analysis using DC-613. Take care of salt concentration in sample to avoid salt deposition from sample solution.

Pinitol



Column : **Shodex RSpak DC-613**
Eluent : H_2O/CH_3CN=25/75
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 70℃

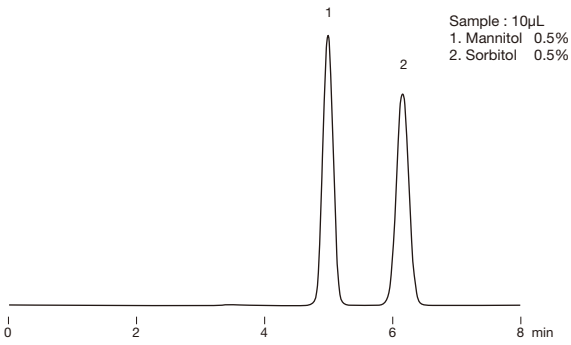
Moisturizing components



Column : **Shodex SUGAR SC1211**
Eluent : H_2O/CH_3CN=60/40
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 40℃

Mannitol analysis with USP method

According to the USP (United States Pharmacopeia) method, mannitol should be analyzed using a column which can separate mannitol and sorbitol with a degree of separation equal to or greater than 2.0. The USPpak MN-431 is a column specially designed for mannitol analysis, which satisfies this criteria.



Column : **Shodex USPpak MN-431**
Eluent : H_2O
Flow rate : 0.5mL/min
Detector : RI
Column temp. : 60℃

Columns for Ion Exclusion Chromatography

Features

SH1011, 1821

- Columns for simultaneous analysis of saccharides and organic acids
- Separates neutral sugars in size exclusion mode, and organic acids in ion exclusion mode
- Suitable for the analysis of uronic and aldonic acids

Note book No.3 News No.25, 40, 43

KC-811

- Columns for the analysis of organic acids
- Ion exclusion mode (plus reversed phase mode)
- Highly selective detection with post column method
- KC-811 6E supports the analysis of cyanide ions and cyanogen chloride in accordance with the Japanese Water Supply Act

Note book No.3 News No.6, 34 Preparative Columns p.85

Standard columns

For simultaneous analysis of saccharides and organic acids

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Exclusion Limit (Pullulan)	Particle Size (µm)	Column Size (mm) I.D. x L	Shipping Solvent
F6378100	**SUGAR SH1011**	≥ 17,000	Sulfo	1,000	6	**8.0 × 300**	H_2O
F6378101	**SUGAR SH1821**	≥ 17,000	Sulfo	10,000	6	**8.0 × 300**	H_2O
F6700080	**SUGAR SH-G**	(guard column)	Sulfo	–	10	**6.0 × 50**	H_2O

Base Material : Styrene divinylbenzene copolymer

For organic acids, cyanide ions and cyanogen chloride

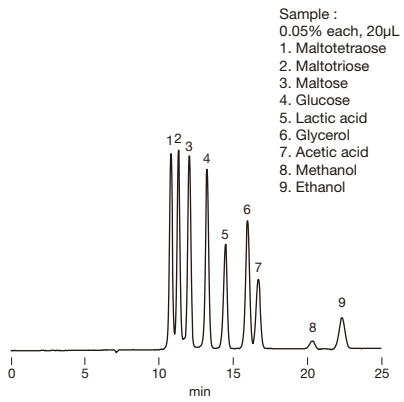
Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Column Size (mm) I.D. x L	Shipping Solvent
F6378030	**RSpak KC-811**	≥ 17,000	Sulfo	6	**8.0 × 300**	0.1% H_3PO_4 aq.
F6378033	**RSpak KC-811 6E**	≥ 13,000	Sulfo	6	**6.0 × 250**	0.1% H_3PO_4 aq.
F6700030	**RSpak KC-G**	(guard column)	Sulfo	10	**6.0 × 50**	0.1% H_3PO_4 aq.
F6700010	**RSpak KC-LG**	(guard column)	Sulfo	13	**8.0 × 50**	0.1% H_3PO_4 aq.

* As a guard column, use KC-LG for samples with relatively low purity and KC-G for samples with relatively high purity.

Base Material : Styrene divinylbenzene copolymer

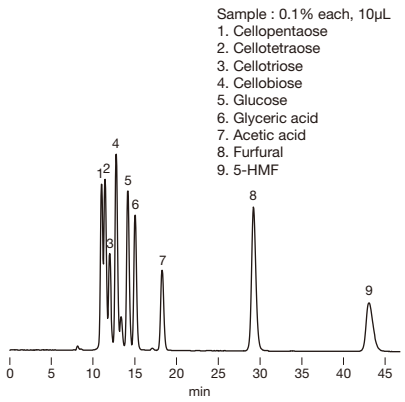
*Contact Shodex or our distributors near you for customized columns.

Maltooligosuccharides, organic acids and ethanol



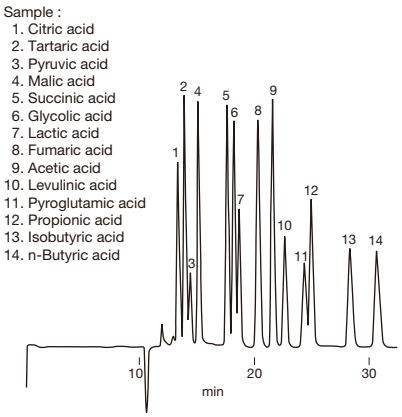
Column : Shodex SUGAR SH1821
Eluent : 0.5mM H_2SO_4 aq.
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 75°C

Cello-oligosaccharides and furfurals



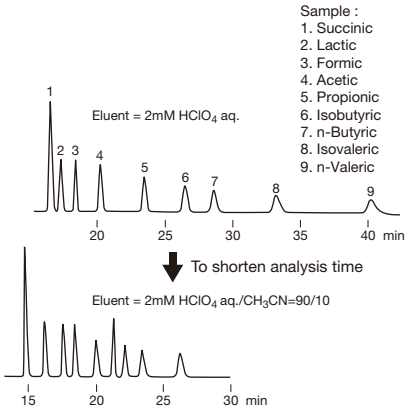
Column : Shodex SUGAR SH1821
Eluent : 2mM H_2SO_4 aq.
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 60°C

Standard organic acids



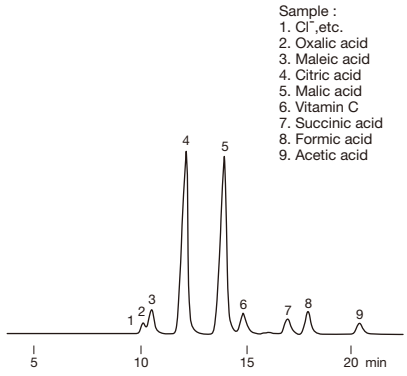
Column : Shodex RSpak KC-811 x 2
Eluent : 6mM $HClO_4$ aq.
Flow rate : 1.0mL/min
Detector : VIS(430nm)
post column method
Column temp. : 50°C

Highly hydrophobic organic acids



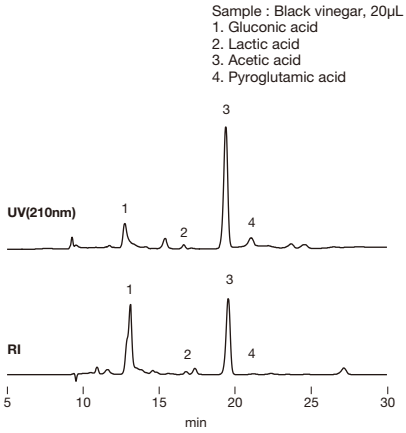
Column : Shodex RSpak KC-LG + KC-811 x 2
Flow rate : 1.0mL/min
Detector : VIS(430nm)
post column method
Column temp. : 47°C

Organic acids and vitamin C in fruit juice



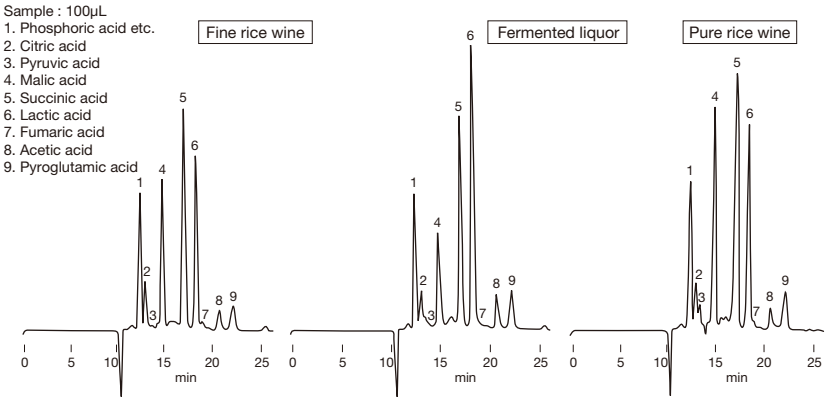
Column : Shodex RSpak KC-LG + KC-811 x 2
Eluent : 1mM $HClO_4$ aq.
Flow rate : 1.0mL/min
Detector : VIS(430nm)
post column method
Column temp. : 40°C

Organic acids in black vinegar



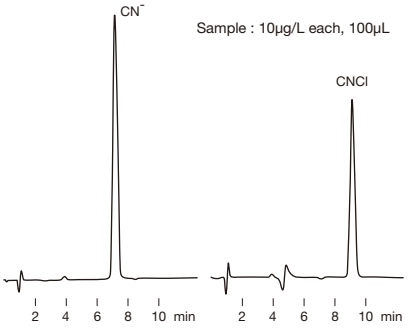
Column : Shodex RSpak KC-811x 2
Eluent : 3mM $HClO_4$ aq.
Flow rate : 1.0mL/min
Detector : UV(210nm), RI
Column temp. : 50°C

Organic acids in Japanese sake



Column : Shodex RSpak KC-LG + KC-811 x 2
Eluent : 4.8mM $HClO_4$ aq.
Flow rate : 1.0mL/min
Detector : VIS(430nm)
post column method
Column temp. : 63°C

Cyan and cyanogen chloride with post column method



Column : Shodex RSpak KC-811 6E
Eluent : 1.0mM H_2SO_4 aq.
Reagent A : Chloramine T solution
Reagent B : 4-Pyridinecarboxylic acid-Pyrazolone solution
Flow rate : (Eluent) 1.0mL/min
(Reagent) 0.5mL/min each
Detector : VIS(638nm)
Column temp. : 40°C
Reaction temp. : (Reagent A) 40°C
(Reagent B) 80°C

Columns for Ion Chromatography (Anion analysis)

Features

NI-424, I-524A
- Columns for anion analysis with non-suppressor method
- NI-424 supports the simultaneous analysis of fluoride and phosphate ions

News No.15

SI-90, 50
- Columns for anion analysis with suppressor method
- Suitable for the quantitative analysis of fluoride ion
- SI-50 separates target substances from organic acids
- Not affected by the system peak derived from carbonate

News No.5

SI-52, 91
- Columns for the analysis of oxyhalides
- SI-52 supports simultaneous analysis of oxyhalides and general inorganic ions
- SI-91 is used with the post column method

News No.34

VH-anion
- Enables anion analysis in wine without being affected by organic acids
- Supports rapid analysis

News No.37

Standard columns

For anions (non-suppressor method)

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6995243	IC NI-424	≥ 5,000	Quaternary ammonium	5	4.6 × 100	8mM 4-Hydroxybenzoic acid + 2.8mM Bis-Tris + 2mM Phenylboronic acid + 0.005mM CyDTA aq.
F6709616	IC NI-G	(guard column)	Quaternary ammonium	5	4.6 × 10	8mM 4-Hydroxybenzoic acid + 2.8mM Bis-Tris + 2mM Phenylboronic acid + 0.005mM CyDTA aq.
F6995240	IC I-524A	≥ 2,000	Quaternary ammonium	12	4.6 × 100	2.5mM Phthalic acid aq.
F6700400	IC IA-G	(guard column)	Quaternary ammonium	12	4.6 × 10	2.5mM Phthalic acid aq.

Base Material : Polyhydroxymethacrylate

For anions (suppressor method)

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6995244	IC SI-90 4E	≥ 5,000	Quaternary ammonium	9	4.0 × 250	1.8mM Na_2CO_3 + 1.7mM $NaHCO_3$ aq.
F6709620	IC SI-90G	(guard column)	Quaternary ammonium	9	4.6 × 10	1.8mM Na_2CO_3 + 1.7mM $NaHCO_3$ aq.
F6995245	IC SI-50 4E	≥ 10,000	Quaternary ammonium	5	4.0 × 250	3.2mM Na_2CO_3 + 1.0mM $NaHCO_3$ aq.
F6709625	IC SI-50G	(guard column)	Quaternary ammonium	5	4.6 × 10	3.2mM Na_2CO_3 + 1.0mM $NaHCO_3$ aq.

Base Material : Polyvinyl alcohol Housing material : PEEK

For oxyhalides

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6995260	IC SI-52 4E	≥ 14,000	Quaternary ammonium	5	4.0 × 250	3.6mM Na_2CO_3 aq.
F6709626	IC SI-92G	(guard column)	Quaternary ammonium	9	4.6 × 10	3.6mM Na_2CO_3 aq.
F6995280	IC SI-91 4C	≥ 2,500	Quaternary ammonium	9	4.0 × 100	1.8mM Na_2CO_3 + 1.7mM $NaHCO_3$ aq.
F6709620	IC SI-90G	(guard column)	Quaternary ammonium	9	4.6 × 10	1.8mM Na_2CO_3 + 1.7mM $NaHCO_3$ aq.

Base Material : Polyvinyl alcohol Housing material : PEEK

For anions in wine

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6995263	WINE VH-anion 4D	≥ 7,000	Quaternary ammonium	5	4.6 × 150	3.2mM Na_2CO_3 + 1.0mM $NaHCO_3$ aq.
F6709623	WINE VH-anionG 4A	(guard column)	Quaternary ammonium	9	4.6 × 10	1.8mM Na_2CO_3 + 1.7mM $NaHCO_3$ aq.

Base Material : Polyvinyl alcohol Housing material : PEEK

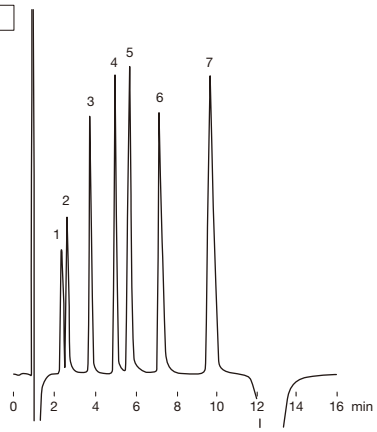
Line Filters for IC

Product Code	Product Name	Application	Contents
F8500630	IC FL-1	For general purposes (not for the substitution of Y-521L)	one holder and one filter
F8500640	IC FL-1 filter	Replacement filter for IC FL-1	5 filters
F8500650	IC FL-2	non-metal type (not for the substitutionof Y-521L)	one holder and one filter
F8500660	IC FL-2 filter	Replacement filter for IC FL-2	4 filters

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

Anion analysis with non-suppressor method (NI-424 and I-524A)

NI-424

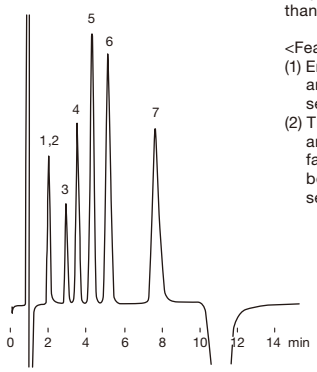


Sample : 50µL
1. $H_2PO_4^-$ 20mg/L
2. F^- 1.5mg/L
3. Cl^- 2.5mg/L
4. NO_2^- 6mg/L
5. Br^- 10mg/L
6. NO_3^- 10mg/L
7. SO_4^{2-} 10mg/L

Column : Shodex IC NI-424
Eluent : 8mM 4-Hydroxybenzoic acid + 2.8mM Bis-Tris + 2mM Phenylboronic acid + 5µM *CyDTA(pH4.2)
Flow rate : 1.0mL/min
Detector : Non-suppressed conductivity
Column temp. : 40°C

*CyDTA : trans-1,2-Diaminocyclohexane-N,N,N',N'-tetra acetic acid

I-524A

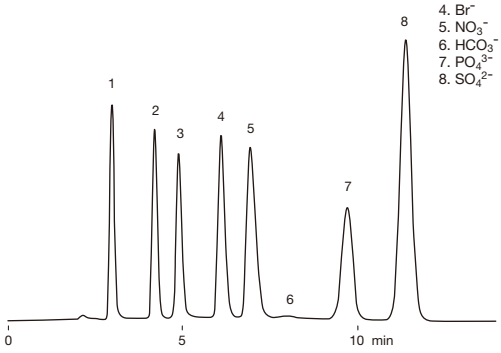


NI-424 is a high-performance column with a theoretical plate number which is approximately twice as large as than that of I-524A.

<Features>
(1) Enables the separation of $H_2PO_4^-$ and F^- ions which were difficult to separate with I-524A.
(2) The shape of each peak is sharper, and the separation balance is favorable. Improvements have been made especially in the separation of Cl^- and NO_2^- ions.

Column : Shodex IC I-524A
Eluent : 2.5mM Phthalic acid + 2.3mM Tris(pH4.2)
Flow rate : 1.2mL/min
Detector : Non-suppressed conductivity
Column temp. : 40°C

Anion analysis with suppressor method using SI-90 4E

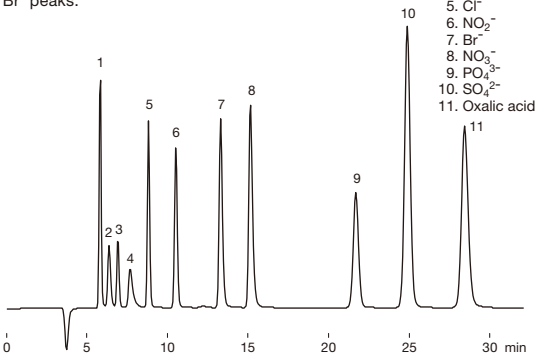


Sample : 20µL
1. F^- 2mg/L
2. Cl^- 3mg/L
3. NO_2^- 5mg/L
4. Br^- 10mg/L
5. NO_3^- 10mg/L
6. HCO_3^- 300mg/L
7. PO_4^{3-} 15mg/L
8. SO_4^{2-} 15mg/L

Column : Shodex IC SI-90 4E
Eluent : 1.8mM Na_2CO_3 + 1.7mM $NaHCO_3$ aq.
Flow rate : 1.2mL/min
Detector : Suppressed conductivity
Column temp. : 25°C

Anion analysis with suppressor method using SI-50 4E

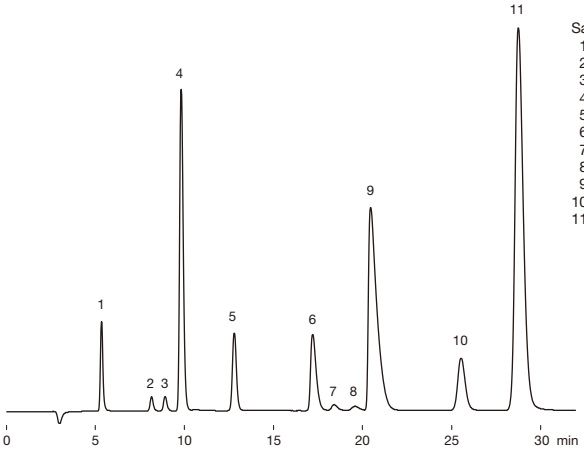
SI-50 4E is a high-performance version of SI-90 4E. Acetic acid, formic acid, and methacrylic acid are eluted later than F^- ion and faster than Cl^- ion. The carbonate system peak appears between NO_2^- and Br^- peaks.



Sample : 20µL
1. F^- 2mg/L
2. Acetic acid 10mg/L
3. Formic acid 2mg/L
4. Methacrylic acid 10mg/L
5. Cl^- 3mg/L
6. NO_2^- 5mg/L
7. Br^- 10mg/L
8. NO_3^- 10mg/L
9. PO_4^{3-} 15mg/L
10. SO_4^{2-} 15mg/L
11. Oxalic acid 15mg/L

Column : Shodex IC SI-50 4E
Eluent : 3.2mM Na_2CO_3 + 1.0mM $NaHCO_3$ aq.
Flow rate : 0.7mL/min
Detector : Suppressed conductivity
Column temp. : 25°C

Oxyhalides analysis with suppressor method using SI-52 4E



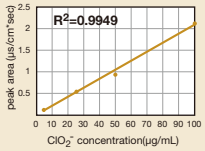
Sample : 50µL
1. F^- 2mg/L
2. ClO_2^- 1mg/L
3. BrO_3^- 1mg/L
4. Cl^- 10mg/L
5. NO_2^- 5mg/L
6. Br^- 10mg/L
7. ClO_3^- 1mg/L
8. Dichloroacetate 1mg/L
9. NO_3^- 30mg/L
10. PO_4^{3-} 15mg/L
11. SO_4^{2-} 40mg/L

Column : Shodex IC SI-52 4E
Eluent : 3.6mM Na_2CO_3 aq.
Flow rate : 0.8mL/min
Detector : Suppressed conductivity
Column temp. : 45°C

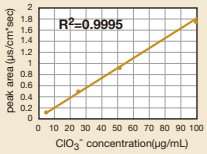
SI-52 4E is a high-resolution column exhibiting a number of theoretical plates of 14,000 or higher. It supports simultaneous analysis of Oxyhalides and inorganic anions.
The recommended temperature is 45°C.

Calibration curves of Oxyhalides with the SI-52 4E

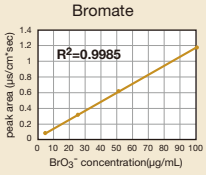
Chlorite



Chlorate



Bromate



Columns for Ion Chromatography (Cation analysis)

Features

YS-50

- Higher performance type of YK-421
- Applicable to both analyses with suppressor and non-suppressor methods
- Peak shape is sharper, especially for divalent cation analysis
- Supports the analysis of alkylamines and transition metals

Note book No.4 News No.28

YK-421

- Columns for cation analysis with non-suppressor method
- Simultaneous analysis of monovalent and divalent cations
- Suitable for separation of alkylamines

Y-521

- Columns for cation analysis with non-suppressor method
- For the separation of monovalent or divalent cations

T-521, R-621

- T-521 and R-621 are applicable for the analysis of transition metals and rare earth metal ions, respectively
- High sensitivity analysis is developed by the post column color reaction method

Standard columns

For cations

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Base Material	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F7122000	IC YS-50	≥ 5,500	Carboxyl	Polyvinyl alcohol	5	4.6 × 125	H_2O
F6700530	IC YS-G	(guard column)	Carboxyl	Polyvinyl alcohol	5	4.6 × 10	H_2O
F7120012	IC YK-421	≥ 2,800	Carboxyl	Silica	5	4.6 × 125	5mM Tartaric acid + 1mM Dipicolinic acid + 1.5g/L Boric acid aq.
F6709608	IC YK-G	(guard column)	Carboxyl	Silica	5	4.6 × 10	5mM Tartaric acid + 1mM Dipicolinic acid + 1.5g/L Boric acid aq.
F6995210	IC Y-521	≥ 3,000	Sulfo	Styrene divinylbenzene copolymer	12	4.6 × 150	4mM HNO_3 aq.
F6700230	IC Y-G	(guard column)	Sulfo	Styrene divinylbenzene copolymer	12	4.6 × 10	4mM HNO_3 aq.

For transition metal ions

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Base Material	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6995250	IC T-521	≥ 3,000	Sulfo	Styrene divinylbenzene copolymer	12	4.6 × 150	3mM HNO_3 aq.
F6700412	IC T-G	(guard column)	Sulfo	Styrene divinylbenzene copolymer	12	4.6 × 10	3mM HNO_3 aq.

Housing material : PEEK

For rare earth metal ions

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Base Material	Particle Size (μm)	Column Size (mm) I.D. x L	Shipping Solvent
F6998000	IC R-621	≥ 1,000	Sulfo	Styrene divinylbenzene copolymer	5	6.0 × 50	H_2O
F6709090	IC R-G	(guard column)	Sulfo	Styrene divinylbenzene copolymer	5	4.6 × 10	H_2O

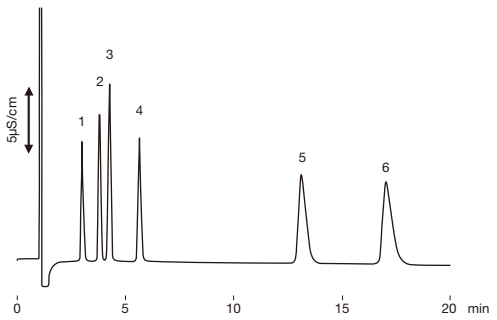
Line Filters for IC

Product Code	Product Name	Application	Column Size (mm) I.D. x L	Contents
F8500630	IC FL-1	For general purposes (not for the substitution of Y-521L)	–	one holder and one filter
F8500640	IC FL-1 filter	Replacement filter for IC FL-1	–	5 filters
F8500650	IC FL-2	non-metal type (not for the substitutionof Y-521L)	–	one holder and one filter
F8500660	IC FL-2 filter	Replacement filter for IC FL-2	–	4 filters
F6700240	IC Y-521L	For the analysis of monovalent cations (used with Y-521)	8.0 × 50	—

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

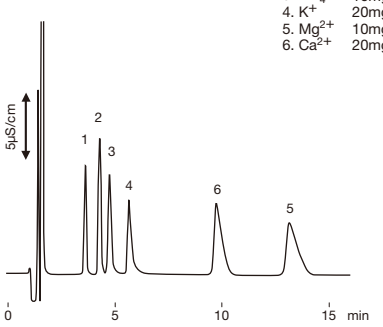
Standard cations (YS-50 and YK-421)

YS-50 10μL inj.



YK-421 15μL inj.

Sample :
1. Li^+ 2mg/L
2. Na^+ 10mg/L
3. NH_4^+ 10mg/L
4. K^+ 20mg/L
5. Mg^{2+} 10mg/L
6. Ca^{2+} 20mg/L



YS-50 is a high-performance column with a theoretical plate number which is approximately twice as large as that of YK-421. In particular, the peak shape and quantitative performance for divalent ions have been improved. The quantitative performance for NH_4^+ in a system containing Na^+ at high concentration has been enhanced as well

Resolution factor of $Na^+$and NH_4^+	YS-50	YK-421
	2.3	1.8

TP	YS-50	YK-421
Mg^{2+}	7,000	3,200
Ca^{2+}	6,900	3,300

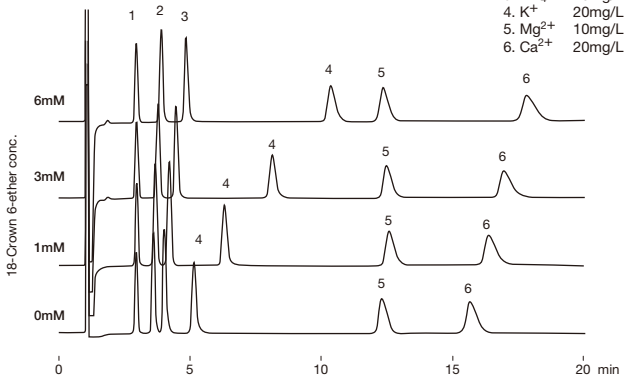
Column : **Shodex IC YS-50**
Eluent : 4mM Methanesulfonic acid aq.
Flow rate : 1.0mL/min
Detector : Non-suppressed conductivity
Column temp. : 40℃

Column : **Shodex IC YK-421**
Eluent : 5mM Tartaric acid + 1mM Dipicolinic acid + 1.5g/L Boric acid aq.
Flow rate : 1.0mL/min
Detector : Non-suppressed conductivity
Column temp. : 40℃

Effect of adding crown ether to eluent

A crown ether molecule forms complex with cations.
The elution of cations (in particular, K^+) can be controlled by the difference in the ability of complex formation

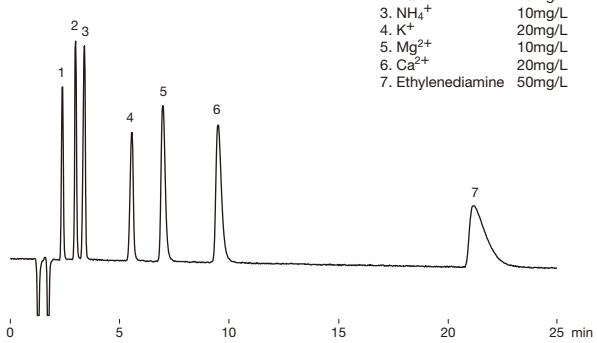
Sample : 10μL
1. Li^+ 2mg/L
2. Na^+ 10mg/L
3. NH_4^+ 10mg/L
4. K^+ 20mg/L
5. Mg^{2+} 10mg/L
6. Ca^{2+} 20mg/L



Column : **Shodex IC YS-50**
Eluent : 4mM Methanesulfonic acid + 18-Crown 6-ether aq.
Flow rate : 1.0mL/min
Detector : Non-suppressed conductivity
Column temp. : 40℃

Simultaneous analysis for cations and ethylenediamine

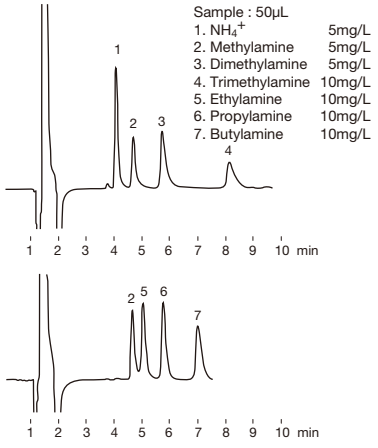
Sample : 10μL
1. Li^+ 2mg/L
2. Na^+ 10mg/L
3. NH_4^+ 10mg/L
4. K^+ 20mg/L
5. Mg^{2+} 10mg/L
6. Ca^{2+} 20mg/L
7. Ethylenediamine 50mg/L



Column : **Shodex IC YS-50**
Eluent : 4mM Nitric acid + 1.5mM 18-Crown 6-ether aq. /CH_3CN=90/10
Flow rate : 1.0mL/min
Detector : Non-suppressed conductivity
Column temp. : 40℃

Alkylamines

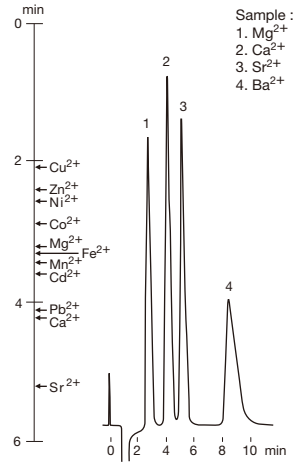
Sample : 50μL
1. NH_4^+ 5mg/L
2. Methylamine 5mg/L
3. Dimethylamine 5mg/L
4. Trimethylamine 10mg/L
5. Ethylamine 10mg/L
6. Propylamine 10mg/L
7. Butylamine 10mg/L



Column : **Shodex IC YK-421**
Eluent : 4mM Phosphoric acid aq. + 10% CH_3CN
Flow rate : 1.0mL/min
Detector : Non-suppressed conductivity
Column temp. : 25℃

Alkaline earth metal ions

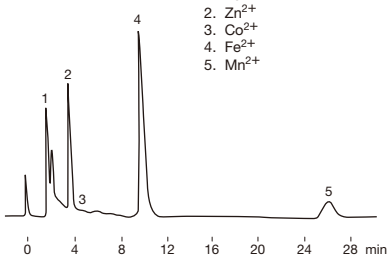
Sample : 100μL
1. Mg^{2+} 20mg/L
2. Ca^{2+} 50mg/L
3. Sr^{2+} 100mg/L
4. Ba^{2+} 200mg/L



Column : **Shodex IC Y-521**
Eluent : 4mM Tartaric acid + 2mM Ethylenediamine aq.
Flow rate : 1.0mL/min
Detector : Non-suppressed conductivity
Column temp. : 40℃

Transition metal ions in red wine

Sample : Red wine (diluted 2-fold followed by addition of 40mL HCl), 70μL
1. Fe^{3+}
2. Zn^{2+}
3. Co^{2+}
4. Fe^{2+}
5. Mn^{2+}



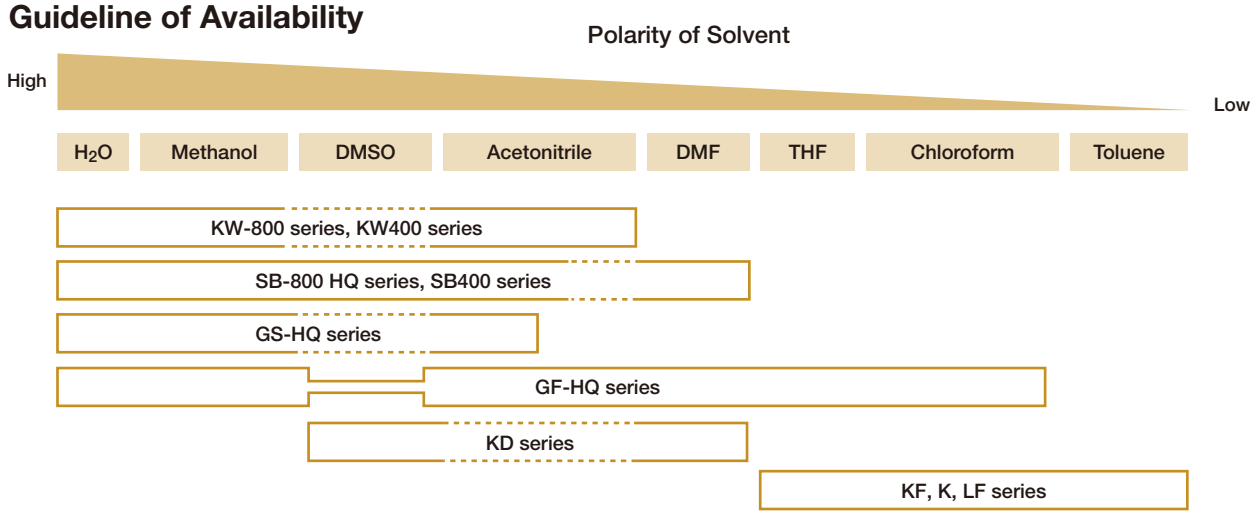
Column : **Shodex IC T-521**
Eluent : 6mM Oxalic acid + 3mM Citric acid (pH4.1 adjusted by KOH) + 0.1mM NaN_3 + 0.1mM $NaHSO_3$ aq.
Reagent : 0.2mM *PAR + 3M NH_4OH + 1M Acetic acid aq. [Mixing coil(0.5mm I.D. x 1m)]
Flow rate : 1.0mL/min
Detector : VIS(530nm)
Column temp. : 40℃

*PAR : 4-(2-Pyridylazo)resorcinol

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.

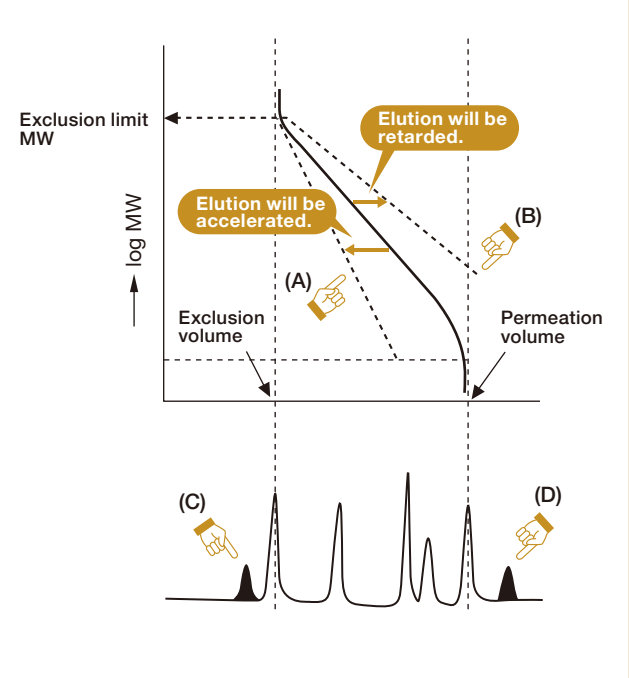
Precautions for polar polymer analysis

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 (Pullulan)	Exclusion Limit (Protein)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
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

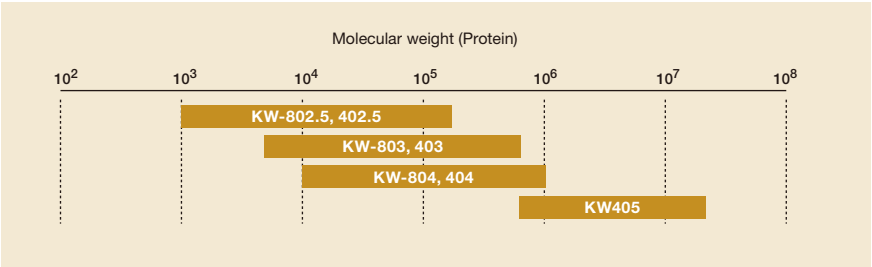
Base Material : Silica
Usable pH range : pH3.0-7.5
The maximum usable concentration is 100% for methanol and acetonitrile.
* Estimated value within parenthesis

High performance semi-micro columns

Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (Pullulan)	Exclusion Limit (Protein)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L	Shipping Solvent
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

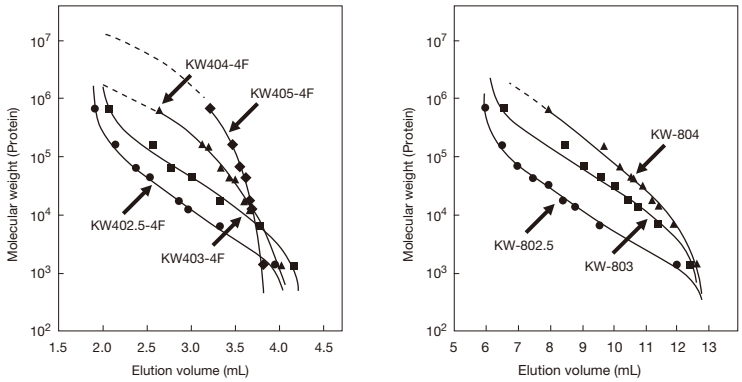
Molecular weight range with protein (eluent : phosphate buffer)



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

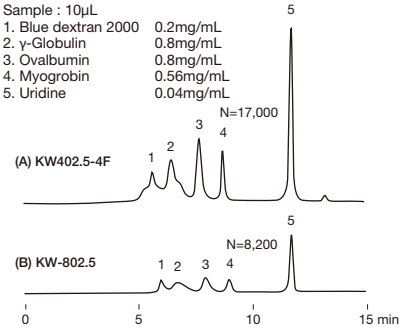
Protein	Recovery (%)	
	KW402.5-4F	KW403-4F
γ- Globulin	98	96
Bovine serum albumin	89	96
Ovalbumin	89	97
Myoglobin	90	89
Cytochrome c	92	92
Lysozyme	87	98
α-Chymotrypsinogen A	95	94

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.

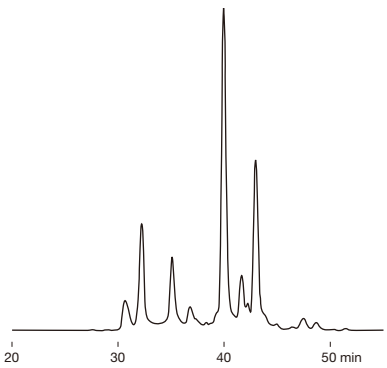
Sample : 10μL
1. Blue dextran 2000 0.2mg/mL
2. γ-Globulin 0.8mg/mL
3. Ovalbumin 0.8mg/mL
4. Myogrobin 0.56mg/mL
5. Uridine 0.04mg/mL



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

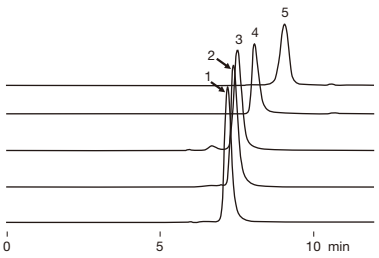
Sample : Whey, 5μL



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

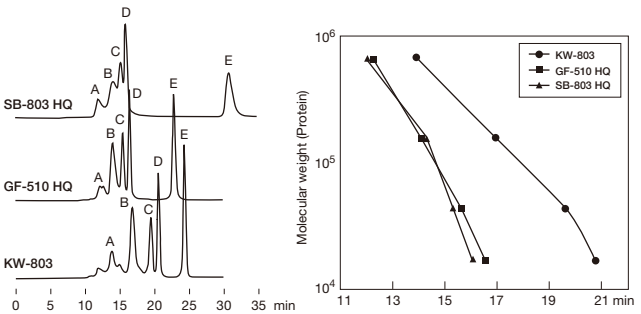


Column : **Shodex KW402.5-4F**
Eluent : 50mM Sodium phosphate buffer + 0.3M NaCl(pH7.0)
Flow rate : 0.33mL/min
Detector : UV(220nm) (small cell volume)
Column temp. : 30℃

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

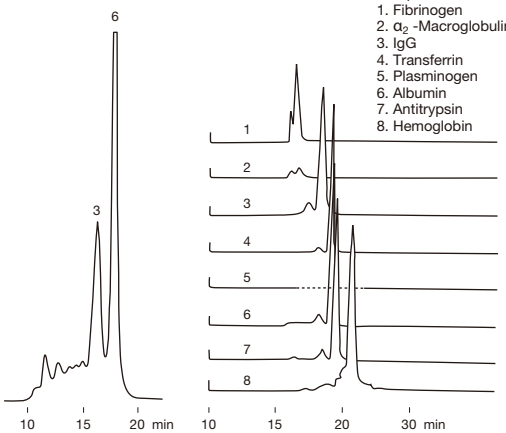
SEC columns for an aqueous system, i.e., SB-803 HQ, GF-510 HQ and KW-803, were compared with each other in terms of the separation of standard proteins. The result demonstrates that the KW-803, a silica-based column, is the most suitable for such an application.



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

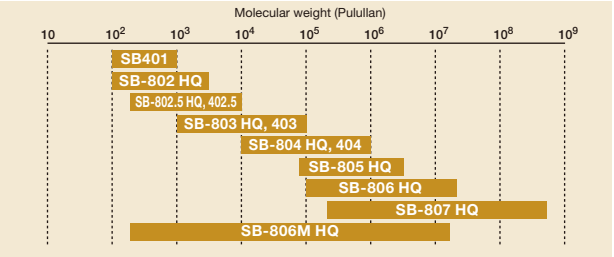
Product Name	The maximum usable concentration (%)		
	Methanol	Acetonitrile	DMF
SB401-4E	0	10	0
SB-802 HQ	0	0	0
SB-802.5 HQ, SB-803 HQ SB402.5-4E, SB403-4E	100	75	100
SB-804 HQ~SB-806M HQ, SB404-4E	75	75	100
SB-G, SB400G-4A	75	75	100
SB-807 HQ, SB-807G	30	30	0

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.)

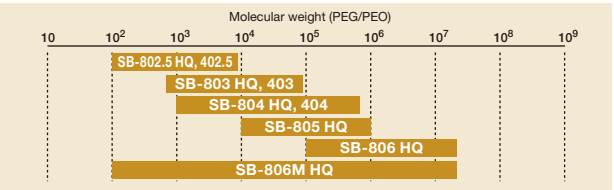
Calibration Standards See page 63 for Calibration Standards

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

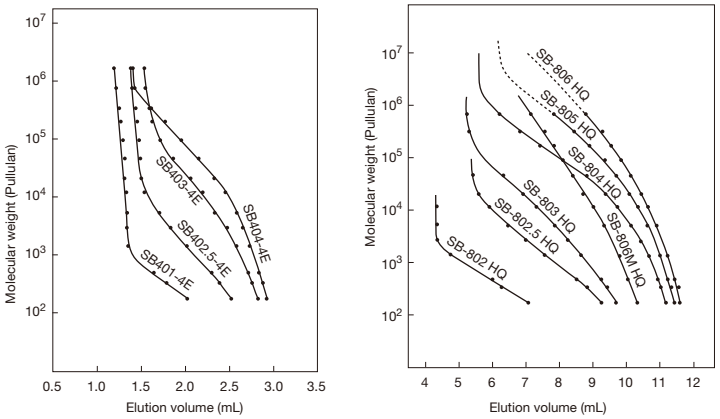
Molecular weight range with pullulan (eluent : ultrapure water)



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

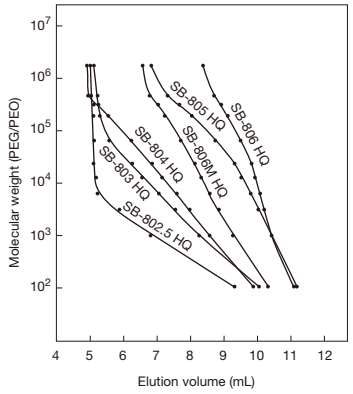


Calibration curves for SB400 series and SB-800 HQ series using pullulan (H_2O)



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.

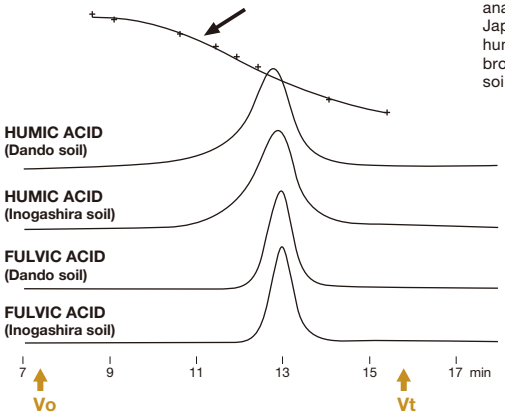
Calibration curves for SB-800 HQ series using PEG and PEO (DMF)



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

Calibration curve of Sodium polystyrene sulfonate



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

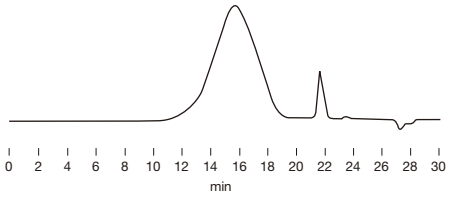
Column : **Shodex OHpak SB-G + SB-805 HQ**
Eluent : 10mM NaH_2PO_4 + 10mM Na_2HPO_4(pH7.0) + 25% CH_3CN
Flow rate : 0.8mL/min
Detector : UV(260nm)
Column temp. : 40℃

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

Carboxymethylcellulose

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

Mw=101 x 10^4
Mn=10.5 x 10^4
Mw/Mn=9.6

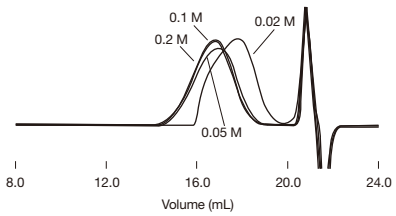


Column : **Shodex OHpak SB-806M HQ x 2**
Eluent : 0.1M NaCl aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

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.

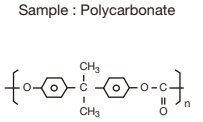
Sample : Polyallylamine 0.2%, 100µL

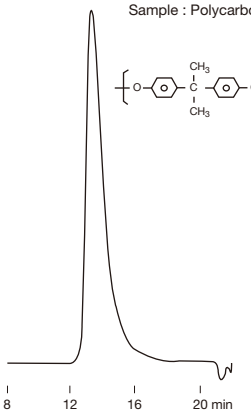


Column : **Shodex OHpak SB-806M HQ x 2**
Eluent : 0.5M Acetic acid + $NaNO_3$ aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

Polycarbonate

Sample : Polycarbonate

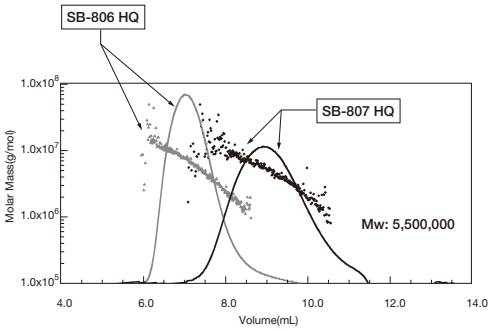




Column : **Shodex OHpak**
SB-805 HQ + SB-802.5 HQ
Eluent : 5mM LiBr in DMF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40℃

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

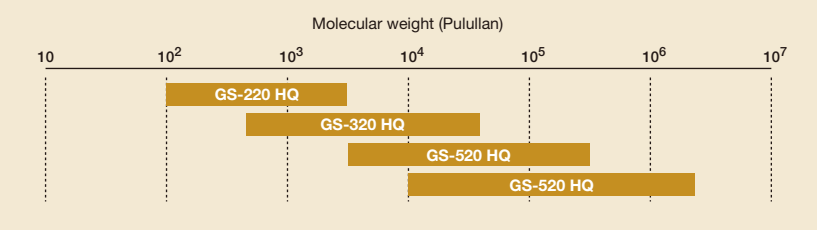
News No.2

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

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

Molecular weight range with Pullulan (eluent : ultrapure water)



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” (taste 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

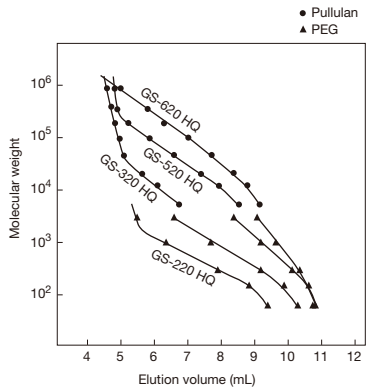
Semi-micro columns

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

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

Calibration Standards See page 63 for Calibration Standards

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°C

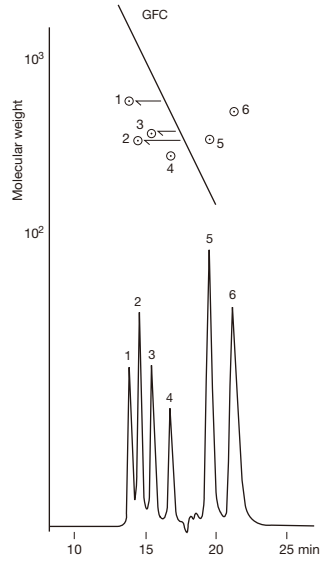
Peptides

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

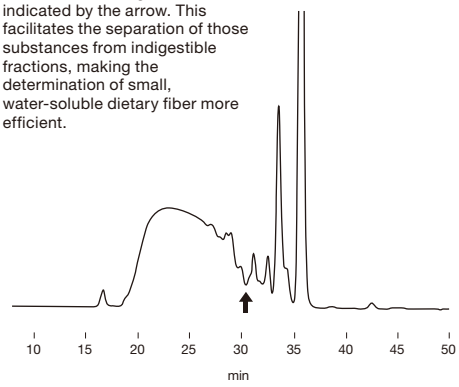
Σf : Hydrophobic parameter
pI : Isoelectric point



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

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.

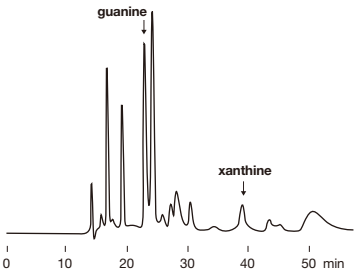


Column : Shodex Asahipak GS-220 HQ x 2
Eluent : H_2O
Flow rate : 0.5mL/min
Detector : RI
Column temp. : 60°C

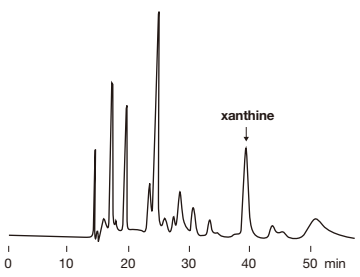
Analysis of the purine base in beers

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



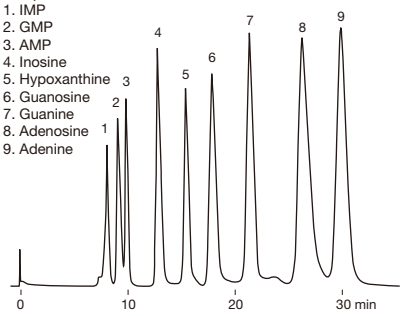
Column : Shodex Asahipak GS-320 HQ
Eluent : 150mM Sodium phosphate buffer(pH2.5)
Flow rate : 0.6mL/min
Detector : UV(260nm)
Column temp. : 35°C

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.

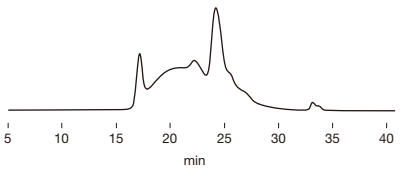
Sample :
1. IMP
2. GMP
3. AMP
4. Inosine
5. Hypoxanthine
6. Guanosine
7. Guanine
8. Adenosine
9. Adenine



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

Gelatin analysis with PAGI method

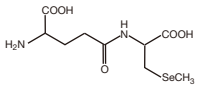
Sample : 100µL
Gelatin(Koepff 16922), 0.2%



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°C

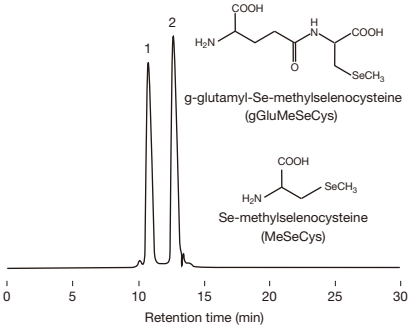
High sensitivity analysis of metal-binding amino acids

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

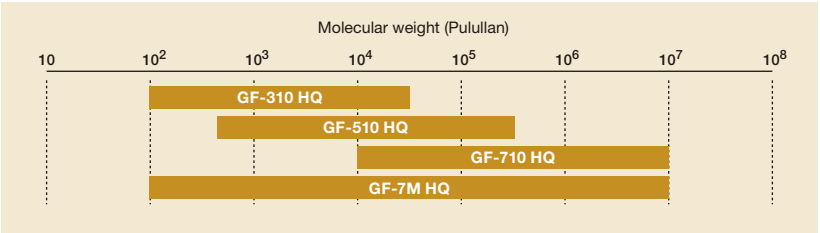
GF-7M HQ is a mixed-gel column capable of analysis of samples over a wide range of molecular weight distribution.

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

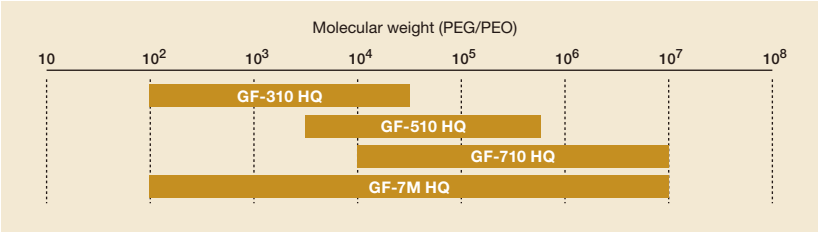
Usable solvents

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.

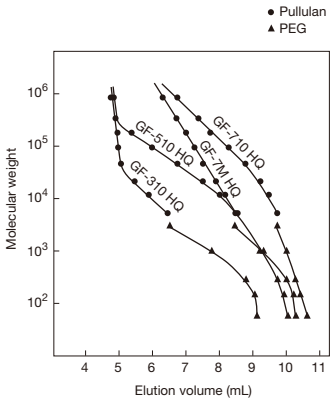
Semi-micro columns

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

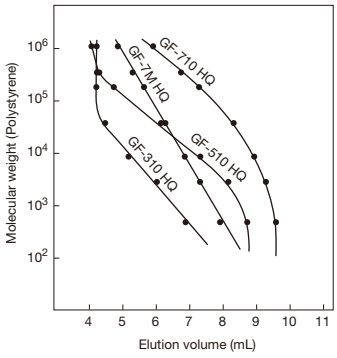
*Contact Shodex or our distributors near you for customized columns.

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℃

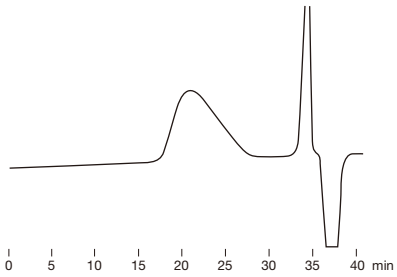
Calibration curves for GF-HQ series using polystyrene



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

Polyacrylonitrile

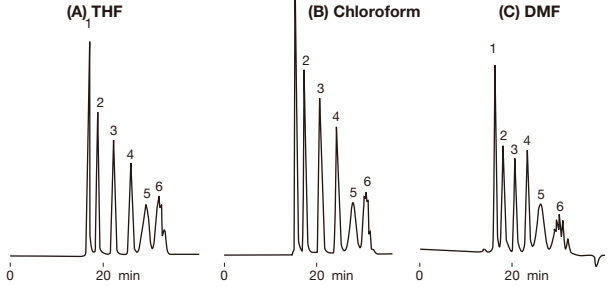
Sample : Polyacrylonitrile 0.1% (w/v), 100µL



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

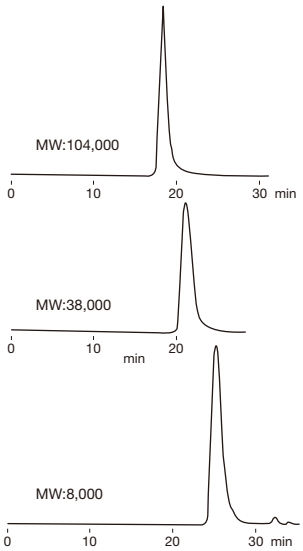
Comparison of standard polystyrene separation using various solvent

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



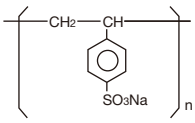
Column : Shodex Asahipak GF-310 HQ + GF-510 HQ
Eluent : (A); THF, (B); Chloroform, (C); DMF
Flow rate : 0.5mL/min
Detector : (A),(B) UV(254nm), (C) UV(270nm)
Column temp. : 30℃

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.

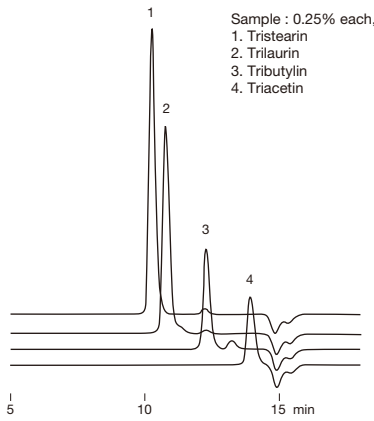
Sample : 1mg/mL each, 50µL
Sodium polystylene sulfonate



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℃

Triglycerides

Sample : 0.25% each, 20µL
1. Tristearin
2. Trilaurin
3. Tributylin
4. Triacetin



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

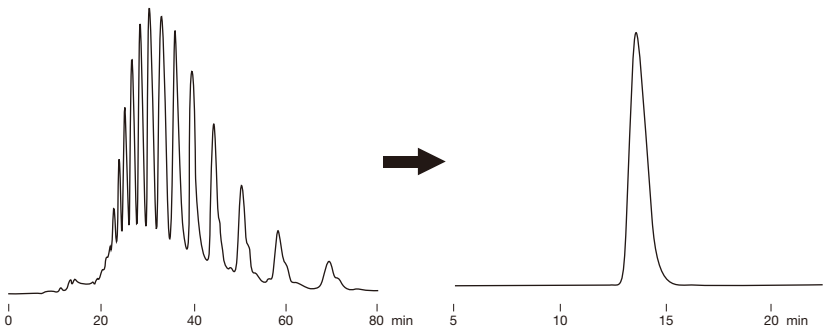
Nonylphenol ethoxylate

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℃

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

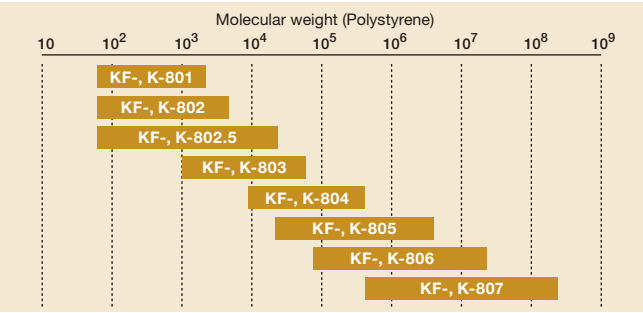
K-800 series : Shipping solvent chloroform

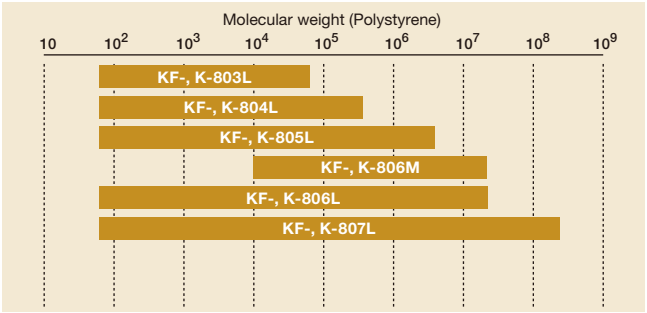
Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PS)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028110	GPC K-801	≥ 18,000	1,500	6	50	8.0 × 300
F6028120	GPC K-802	≥ 18,000	5,000	6	150	8.0 × 300
F6028125	GPC K-802.5	≥ 18,000	20,000	6	300	8.0 × 300
F6028130	GPC 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

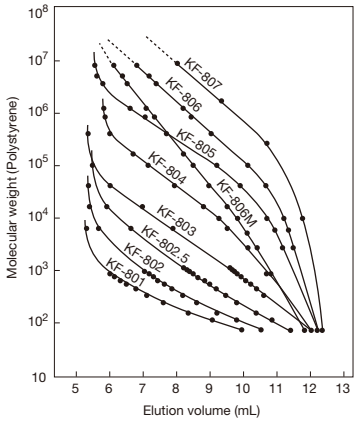
Molecular weight range with polystyrene (eluent KF-800 series : THF, K-800 series : chloroform)





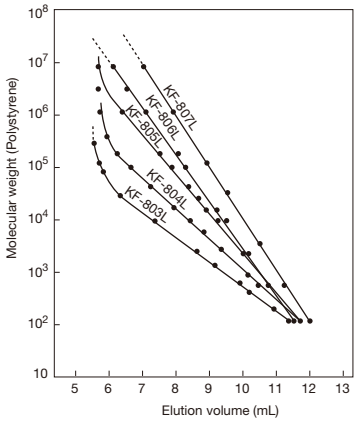
*Contact Shodex or our distributors near you for customized columns.

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.

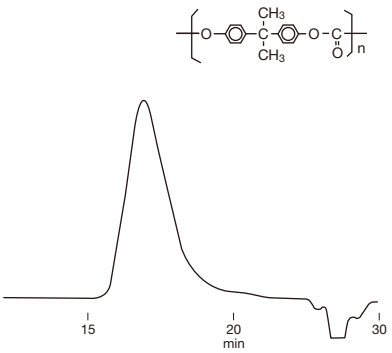
Calibration curves for KF-800L (linear type) series using PS standard



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

Polycarbonate resin

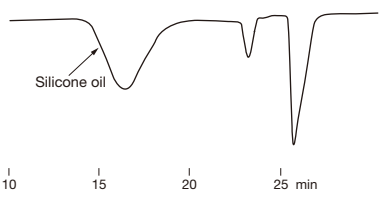
Sample : Polycarbonate resin 0.1%, 100μL



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

Silicon oil

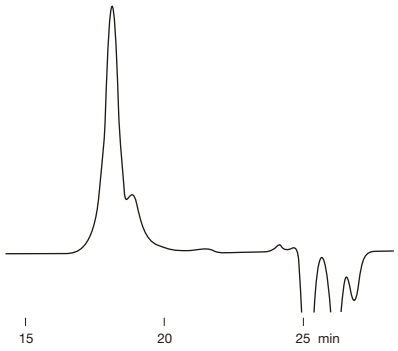
Sample : Silicone oil 0.1%, 200μL



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

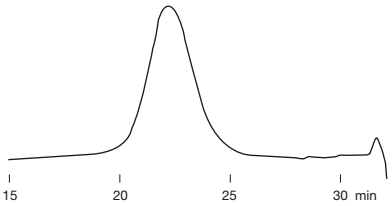
Sample : Styrene isoprene ABA block copolymer



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

Bionolle™ (Polybutylene succinate/adipate)

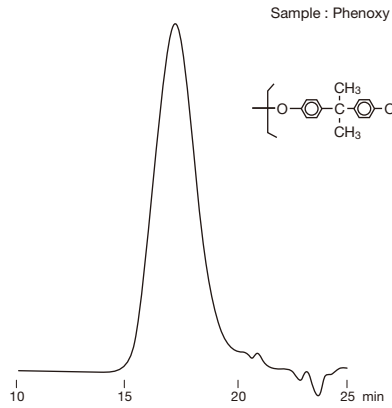
Sample : 100μL
Polybutylene succinate/adipate 0.2%



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

Phenoxy resin

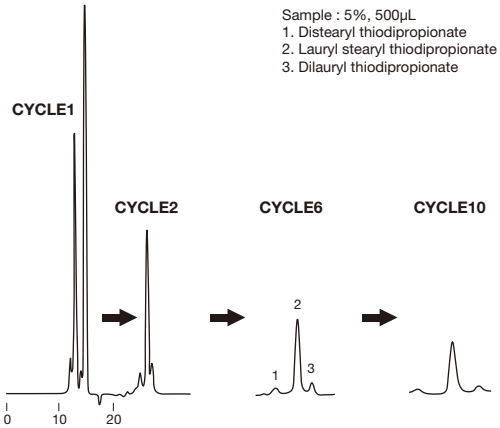
Sample : Phenoxy resin 0.1%, 100μL



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

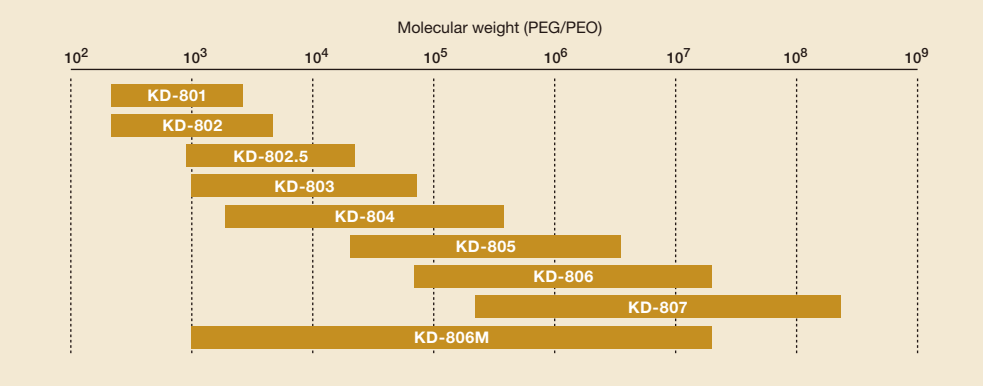
KD-800 series : Shipping solvent dimethylformamide(DMF)

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

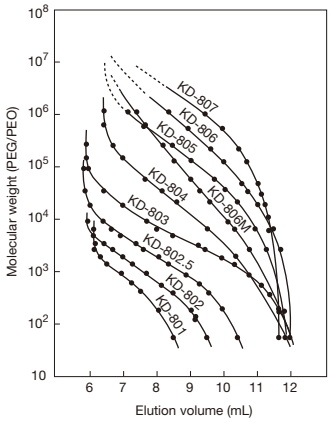
Solvent-peak separation columns

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

Calibration Standards
See page 63 for Calibration Standards

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

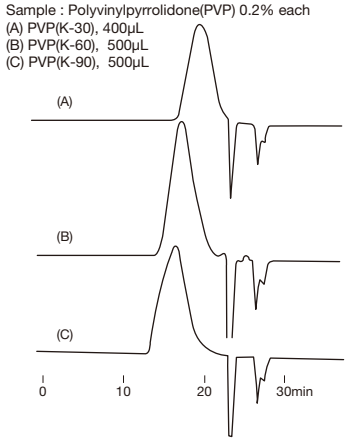
Calibration curves for KD-800 series using PEG/PEO standard



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

Polyvinylpyrrolidone

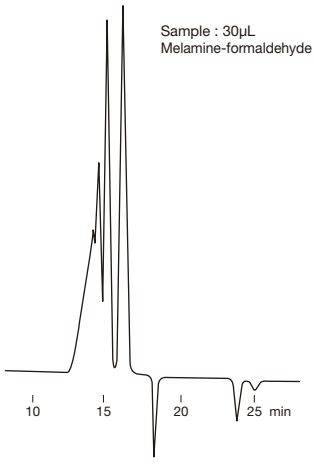
Sample : Polyvinylpyrrolidone(PVP) 0.2% each
(A) PVP(K-30), 400µL
(B) PVP(K-60), 500µL
(C) PVP(K-90), 500µL



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

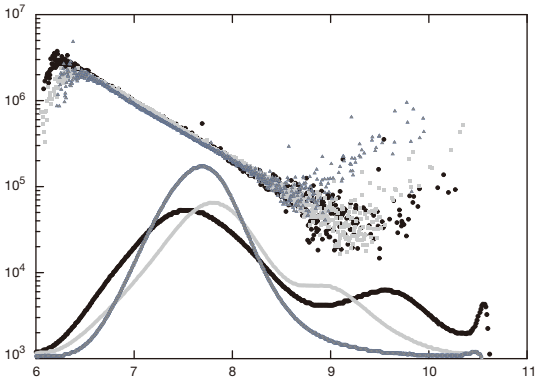
Melamine formaldehyde resin

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˚C

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.

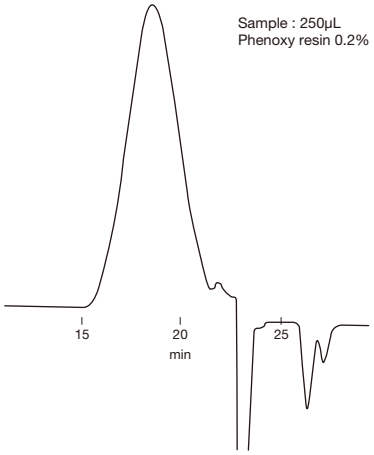
Column : Shodex GPC KD-806M
Eluent : 1% LiCl in DMI
Flow rate : 0.5mL/min
Detector : MALS, RI
Column temp. : 60˚C

* 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

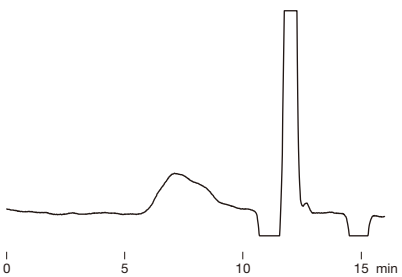
Sample : 250µL
Phenoxy resin 0.2%



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

Potato starch

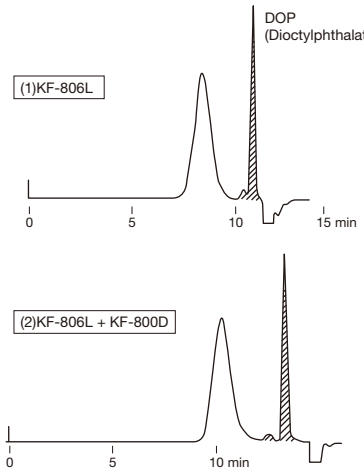
Sample : 100µL
Potato starch in DMSO 0.1%
* solved at 80˚C

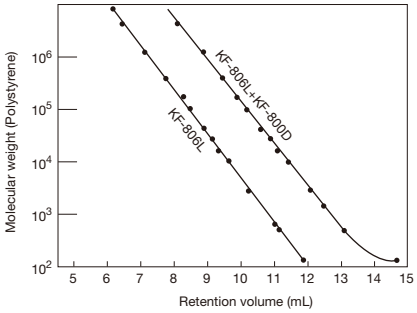


Column : Shodex GPC KD-806M
Eluent : 10mM LiBr in DMSO/DMF=75/25
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 50˚C

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

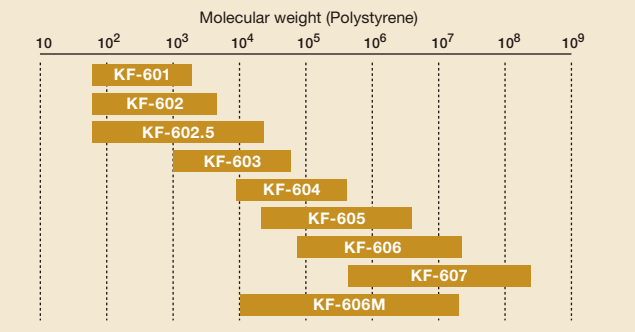
◎ Use of the KF-400HQ series with semi-micro type devices is recommended.

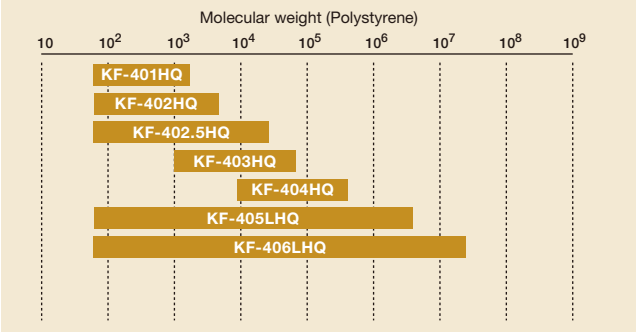
Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit (PS)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6028111	GPC KF-401HQ	≥ 25,000	1,500	3	50	4.6 × 250
F6028112	GPC KF-402HQ	≥ 25,000	5,000	3	150	4.6 × 250
F6028114	GPC KF-402.5HQ	≥ 25,000	20,000	3	300	4.6 × 250
F6028116	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)

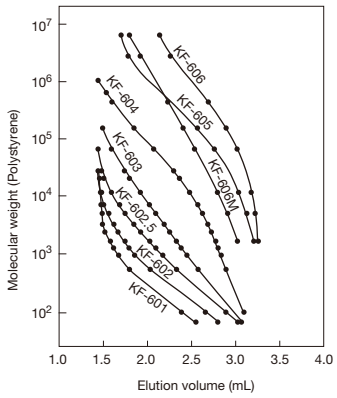




Calibration Standards See page 63 for Calibration Standards

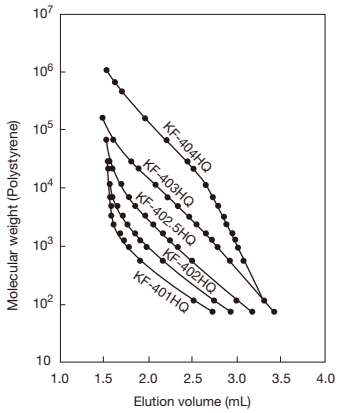
*Contact Shodex or our distributors near you for customized columns.

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.

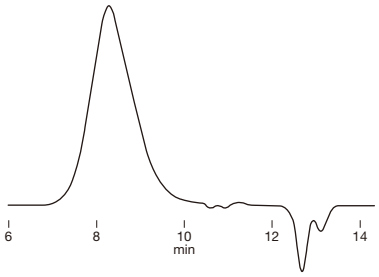
Calibration curves for KF-400HQ series using PS standard



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

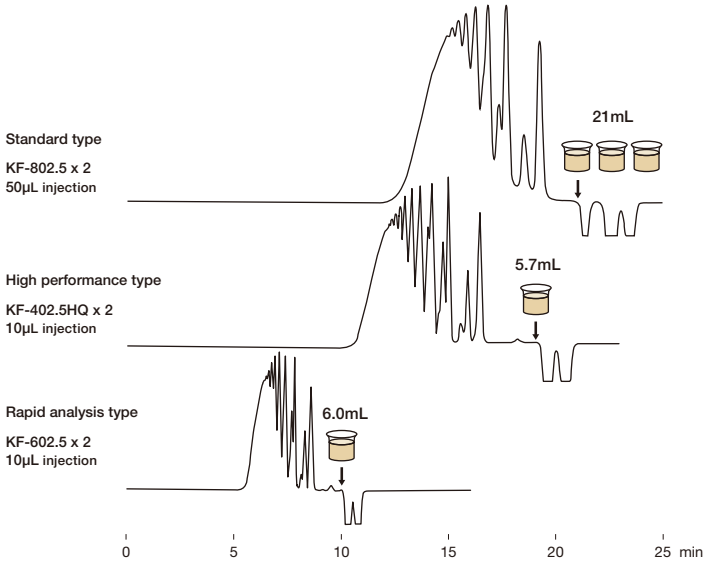
Styrene-Acrylonitrile copolymer

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%

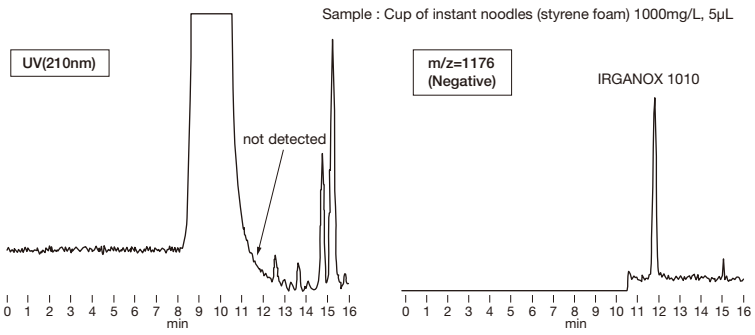
Reducing the analysis time to less than half of that for the standard column (KF-802.5) requires KF-602.5 which enables high-speed analysis. On the other hand, KF-402.5HQ has a number of theoretical plates 1.5 times larger than that of the standard column, thereby improving resolution especially in the 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.

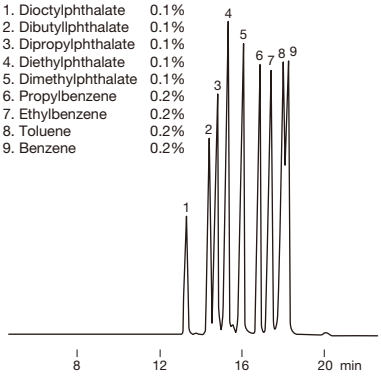
Sample : Cup of instant noodles (styrene foam) 1000mg/L, 5µL



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)

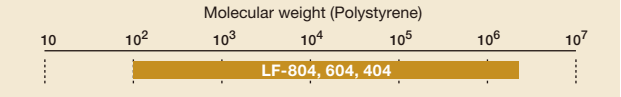
High-performance semi-micro column

◎ 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

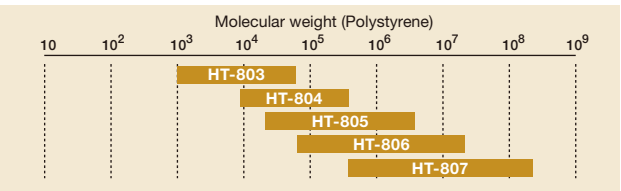
Standard columns

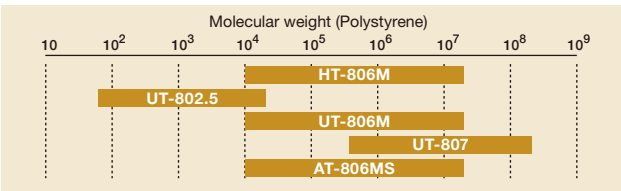
Product Code	Product Name	Plate Number (TP/column)	Exclusion Limit * (PS)	Usable Temperature (˚C)	Particle Size (μm)	Maximum Pore Size (Å)	Column Size (mm) I.D. x L
F6208700	**GPC HT-803**	≥ 7,000	70,000	100–150	13	500	**8.0 × 300**
F6208710	**GPC HT-804**	≥ 7,000	400,000	100–150	13	1,500	**8.0 × 300**
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

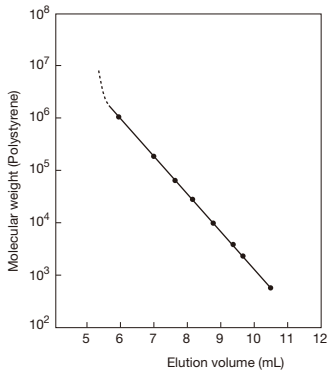
Molecular weight range with polystyrene (eluent : THF)





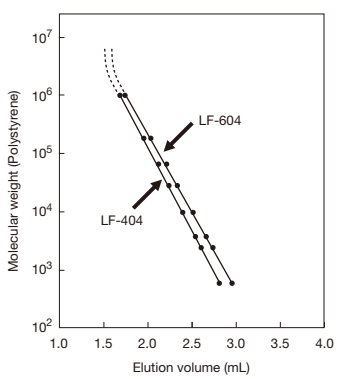
*Contact Shodex or our distributors near you for customized columns.

Calibration curve for LF-804 using PS standard



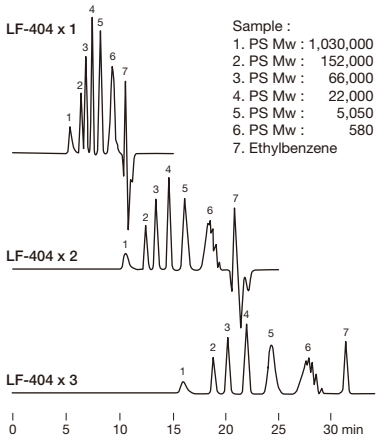
Column : Shodex GPC LF-804
Eluent : THF
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

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°C

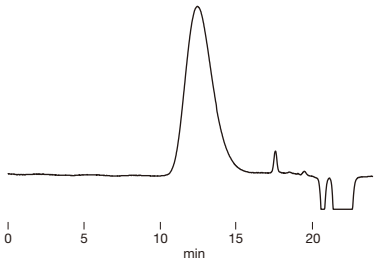
Comparison of polystyrene separation with different numbers of LF-404



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

Polyurethane

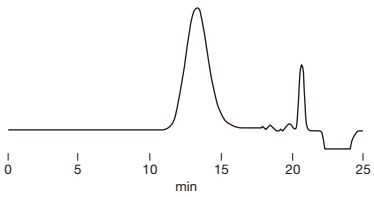
Sample : Polyurethane 0.1%, 20µL



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

Polyamide (Nylon6/6)

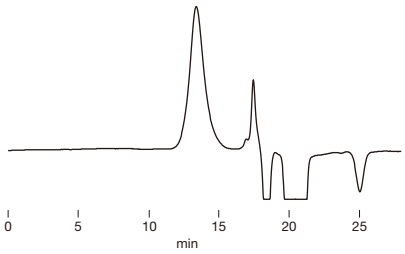
Sample : Nylon™ 6/6 0.1%, 20µL



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

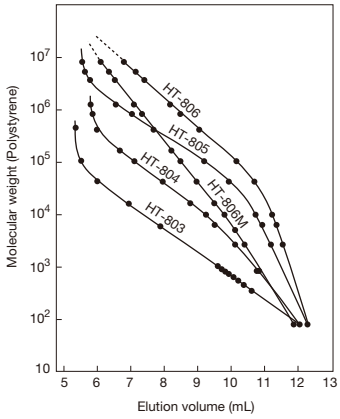
Xylan

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°C

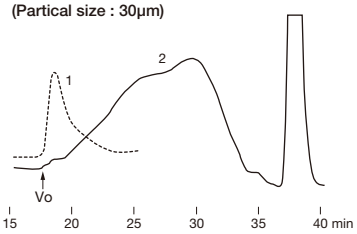
Calibration curves for HT-800 series using PS



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)

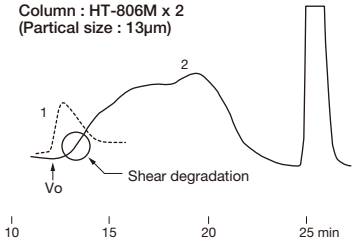


Sample :
1. Polystyrene
(MW : 20,000,000)
2. HDPE-A

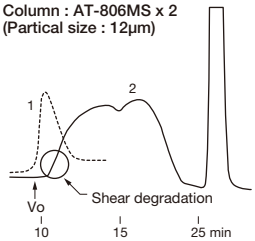
For the analysis of samples containing macromolecules, GPC UT columns are recommended because of their ability to prevent the breakage of molecular chains. High temperature SEC columns are suitable for the analysis of insoluble polymers, such as polyethylene and polypropylene.

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°C

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

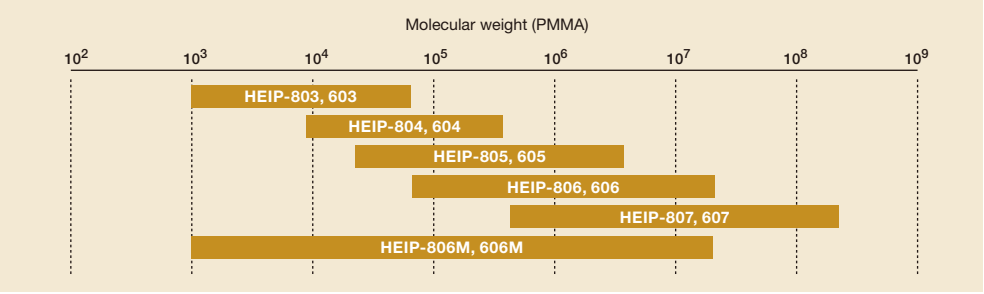
◎ Use of the HFIP-600 series with semi-micro type devices is recommended.

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.

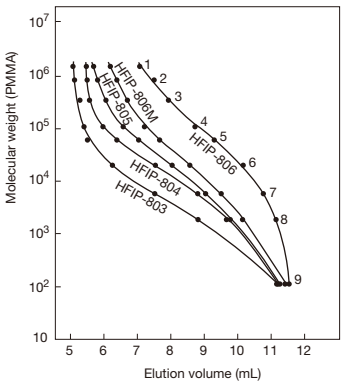
Shipping solvent : hexafluoroisopropanol (HFIP)
*PMMA : polymethylmethacrylate
**( )Estimated value

Molecular weight range with PMMA (eluent : HFIP)



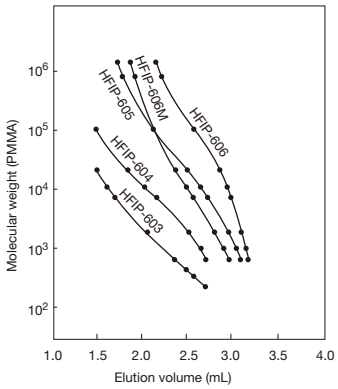
*Contact Shodex or our distributors near you for customized columns.

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.

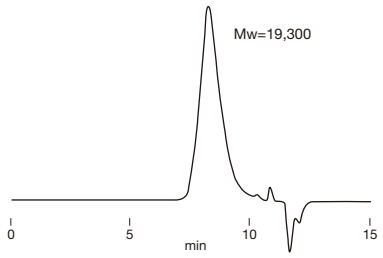
Calibration curves for HFIP-600 series using polymethylmethacrylate (PMMA)



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

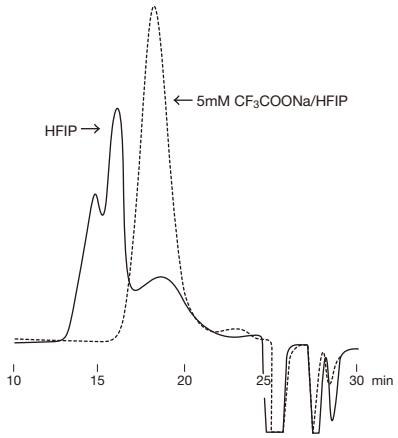
Polyethylene terephthalate (PET)

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)



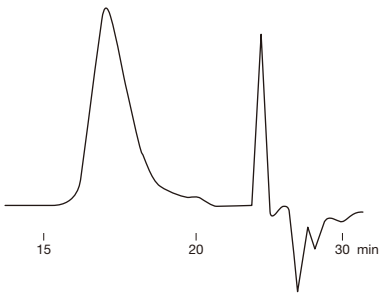
Sample : Polycaprolactum (Nylon™ 6)

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)

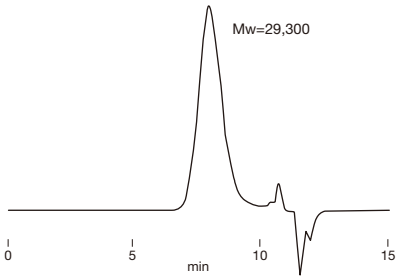
Sample : PBT 0.05%, 500μL



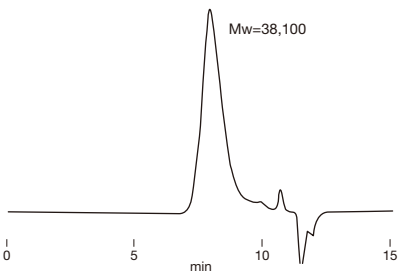
Column : Shodex GPC HFIP-805 + HFIP-803
Eluent : 5mM CF_3COONa in HFIP
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Polyamides (Nylon 6/10 and Nylon 6)

Sample : Nylon™ 6/10 0.2%, 20μL



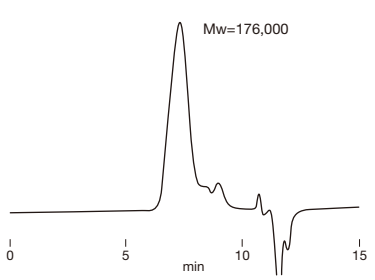
Sample : Nylon™ 6 0.2%, 20μL



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)]

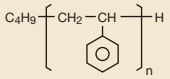
Features

- 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

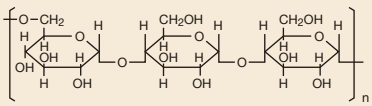
Single type

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
IC YS-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
IC YS-50	IC	40
IC YK-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		Page
IC YS-50	IC	40

[Fatty acid glycerides]

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

[Fatty acid methyl esters]

Product Name		Page
RSpak DS series	RPC	11

[Organic acids]

Product Name		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
IC T-521	IC	40
IC Y-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 Micro Columns

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 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.

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.

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.

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.

Semi-micro and micro 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 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 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 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 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 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 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 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.

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.

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.

Preparative columns (I.D. 10mm~50mm)

Polymer-based Packed Columns for Reversed Phase Chromatography

Asahipak ODP-50 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6820001	**Asahipak ODP-50 10E**	≥ 10,000	Octadecyl	5	**10.0 x 250**
F6820035	**Asahipak ODP-90 20F**	≥ 9,000	Octadecyl	9	**20.0 x 300**
F6820019	**Asahipak ODP-130 28F**	≥ 9,000	Octadecyl	13	**28.0 x 300**
F6710004	**Asahipak ODP-130G 7B**	(guard column)	Octadecyl	13	**7.5 x 50**
F6714029	**Asahipak ODP-130G 20C**	(guard column)	Octadecyl	13	**20.0 x 100**

* See page 10 for Asahipak ODP-50.
Base Material : Polyvinyl alcohol
* See page 70 for semi-micro columns and micro columns.

Asahipak C8P-50 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6820003	**Asahipak C8P-50 10E**	≥ 8,000	Octyl	5	**10.0 × 250**
F6714004	**Asahipak C8P-50G 7B**	(guard column)	Octyl	5	**7.5 × 50**

* See page 10 for Asahipak C8P-50.
Base Material : Polyvinyl alcohol

Asahipak C4P-50 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6820005	**Asahipak C4P-50 10E**	≥ 7,000	Butyl	5	**10.0 × 250**
F6714005	**Asahipak C4P-50G 7B**	(guard column)	Butyl	5	**7.5 × 50**

* See page 10 for Asahipak C4P-50.
Base Material : Polyvinyl alcohol

RSpak DE-613 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6513013	**RSpak DE-2013**	≥ 10,000	–	12	**20.0 × 300**
F6700190	**RSpak DE-LG**	(guard column)	–	12	**8.0 × 50**
F6513015	**RSpak DE-5013**	–	–	12	**50.0 × 300**
F6700191	**RSpak DE-LLG**	(guard column)	–	12	**20.0 × 100**

* See page 11 for RSpak DE-613.
Base Material : Polymethacrylate
* See page 70 for semi-micro columns and micro columns.

RSpak DM-614 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6514014	**RSpak DM-2014**	≥ 5,000	–	12	**20.0 × 300**
F6700404	**RSpak DM-LG**	(guard column)	–	12	**8.0 × 50**
F6514022	**RSpak DM-5014**	–	–	12	**50.0 × 300**
F6700162	**RSpak DM-LLG**	(guard column)	–	12	**20.0 × 100**

* See page 11 for RSpak DM-614.
Base Material : Polyhydroxymethacrylate

*Contact Shodex or our distributors near you for larger preparative columns.

Preparative columns

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

Asahipak NH2P Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6830001	**Asahipak NH2P-50 10E**	≥ 10,000	Amino	5	**10.0 × 250**
F6830031	**Asahipak NH2P-90 20F**	≥ 9,000	Amino	9	**20.0 × 300**
F6830007	**Asahipak NH2P-130 28F**	≥ 1,000	Amino	13	**28.0 × 300**
F6710017	**Asahipak NH2P-130G 7B**	(guard column)	Amino	13	**7.5 × 50**

* See page 13 for Asahipak NH2P-50.
Base Material : Polyvinyl alcohol
* See page 70 for semi-micro columns and micro columns.

Silica-based Packed Columns for Reversed Phase Chromatography

Silica C18M Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F7560040	**Silica C18M 10E**	≥ 16,000	Octadecyl	5	**10.0 × 250**
F7560041	**Silica C18M 20E**	≥ 16,000	Octadecyl	5	**20.0 × 250**

* See page 20 for Silica C18M.
Base Material : Silica

Silica 5C8 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F7560062	**Silica 5C8 10E**	≥ 15,000	Octyl	5	**10.0 × 250**
F7560063	**Silica 5C8 20E**	≥ 15,000	Octyl	5	**20.0 × 250**

* See page 20 for Silica 5C8.
Base Material : Silica

Silica 5C4 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F7560054	**Silica 5C4 10E**	≥ 15,000	Butyl	5	**10.0 × 250**
F7560055	**Silica 5C4 20E**	≥ 15,000	Butyl	5	**20.0 × 250**

* See page 20 for Silica 5C4.
Base Material : Silica

Silica-based Packed Columns for Normal Phase and Hydrophilic Interaction Chromatography (HILIC)

Silica 5SIL Preparative type [Columns for Normal Phase Chromatography]

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F7560050	**Silica 5SIL 10E**	≥ 15,000	–	5	**10.0 × 250**
F7560051	**Silica 5SIL 20E**	≥ 15,000	–	5	**20.0 × 250**

* See page 20 for Silica 5SIL
Base Material : Silica

Silica 5NH Preparative type [Columns for Normal Phase and Hydrophilic Interaction Chromatography (HILIC)]

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F7560060	**Silica 5NH 10E**	≥ 8,000	Aminopropyl	5	**10.0 × 250**
F7560061	**Silica 5NH 20E**	≥ 8,000	Aminopropyl	5	**20.0 × 250**

* See page 20 for Silica 5NH.
Base Material : Silica

*Contact Shodex or our distributors near you for larger preparative columns.

Preparative columns

Columns for Anion Exchange Chromatography

IEC QA-825 Preparative type

Product Code	Product Name	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6548000	IEC QA-2025	Quaternary ammonium	20	20.0 × 150
F6548020	IEC QA-2825	Quaternary ammonium	37	28.0 × 300
F6548050	IEC QA-5025	Quaternary ammonium	37	50.0 × 300
F6709602	IEC QA-LG	(guard column)	20	8.0 × 50

Base Material : Polyhydroxymethacrylate

* See page 24 for IEC QA-825.
* See page 71 for semi-micro columns and micro columns.

IEC DEAE-825 Preparative type

Product Code	Product Name	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6548001	IEC DEAE-2025	Diethylaminoethyl	20	20.0 × 150
F6548021	IEC DEAE-2825	Diethylaminoethyl	37	28.0 × 300
F6598051	IEC DEAE-5025	Diethylaminoethyl	37	50.0 × 300
F6709603	IEC DEAE-LG	(guard column)	20	8.0 × 50

Base Material : Polyhydroxymethacrylate

* See page 24 for IEC DEAE-825.
* See page 71 for semi-micro columns and micro columns.

Asahipak ES-502N Preparative type

Product Code	Product Name	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6840004	Asahipak ES-502N 20C	Diethylaminoethyl	13	20.0 × 100
F6710021	Asahipak GS-20G 7B	(guard column)	20	7.5 × 50

Base Material : Polyvinyl alcohol

* See page 24 for Asahipak ES-502N.
* See page 71 for semi-micro columns and micro columns.

Columns for Cation Exchange Chromatography

IEC SP-825 Preparative type

Product Code	Product Name	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6548002	IEC SP-2025	Sulfopropyl	20	20.0 × 150
F6548022	IEC SP-2825	Sulfopropyl	37	28.0 × 300
F6548052	IEC SP-5025	Sulfopropyl	37	50.0 × 300
F6709604	IEC SP-LG	(guard column)	20	8.0 × 50

Base Material : Polyhydroxymethacrylate

* See page 26 for IEC SP-825.
* See page 72 for semi-micro columns and micro columns.

IEC CM-825 Preparative type

Product Code	Product Name	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6548003	IEC CM-2025	Carboxymethyl	20	20.0 × 150
F6548023	IEC CM-2825	Carboxymethyl	37	28.0 × 300
F6548053	IEC CM-5025	Carboxymethyl	37	50.0 × 300
F6709605	IEC CM-LG	(guard column)	20	8.0 × 50

Base Material : Polyhydroxymethacrylate

* See page 26 for IEC CM-825.
* See page 72 for semi-micro columns and micro columns.

Asahipak ES-502C Preparative type

Product Code	Product Name	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6840003	Asahipak ES-502C 20C	Carboxymethyl	13	20.0 × 100
F6710021	Asahipak GS-20G 7B	(guard column)	20	7.5 × 50

Base Material : Polyvinyl alcohol

* See page 26 for Asahipak ES-502C.
* See page 72 for semi-micro columns and micro columns.

*Contact Shodex or our distributors near you for larger preparative columns.

Columns for Ligand Exchange Chromatography

SUGAR KS-800 series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Counter Ion	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6502007	**SUGAR KS-2001**	≥ 7,000	Sulfo(Na^+)	13	**20.0 × 300**	KS-801
F6502008	**SUGAR KS-2002**	≥ 7,000	Sulfo(Na^+)	13	**20.0 × 300**	KS-802
F6502009	**SUGAR KS-2003**	≥ 8,000	Sulfo(Na^+)	13	**20.0 × 300**	KS-803
F6502010	**SUGAR KS-2004**	≥ 6,000	Sulfo(Na^+)	18	**20.0 × 300**	KS-804
F6502011	**SUGAR KS-2005**	≥ 6,000	Sulfo(Na^+)	18	**20.0 × 300**	KS-805
F6502012	**SUGAR KS-2006**	≥ 6,000	Sulfo(Na^+)	18	**20.0 × 300**	KS-806
F6700002	**SUGAR KS-LG**	(guard column)	Sulfo(Na^+)	13	**8.0 × 50**	(guard column)

* See page 32 for SUGAR KS-800.

Base Material : Styrene divinylbenzene copolymer

RSpak DC-613 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Counter Ion	Particle Size (μm)	Column Size (mm) I.D. x L
F6514013	**RSpak DC-2013**	≥ 6,000	Sulfo(Na^+)	10	**20.0 × 300**
F6700402	**RSpak DC-LG**	(guard column)	Sulfo(Na^+)	10	**8.0 × 50**
F6514021	**RSpak DC-5013**	–	Sulfo(Na^+)	10	**50.0 × 300**
F6700172	**RSpak DC-LLG**	(guard column)	Sulfo(Na^+)	10	**20.0 × 100**

* See page 33 for RSpak DC-613.

Base Material : Styrene divinylbenzene copolymer

Columns for Ion-exclusion Chromatography

RSpak KC-811 Preparative type

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (μm)	Column Size (mm) I.D. x L
F6505012	**RSpak KC-2011**	≥ 8,000	Sulfo	13	**20.0 × 300**
F6700010	**RSpak KC-LG**	(guard column)	Sulfo	13	**8.0 × 50**

* See page 36 for RSpak KC-811.

Base Material : Styrene divinylbenzene copolymer

Aqueous SEC(GFC) columns : Silica-based

PROTEIN KW-800 series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6505020	**PROTEIN KW-2002.5**	≥ 17,000	5	**20.0 × 300**	KW-802.5
F6505021	**PROTEIN KW-2003**	≥ 17,000	5	**20.0 × 300**	KW-803
F6505022	**PROTEIN KW-2004**	≥ 14,000	7	**20.0 × 300**	KW-804
F6709556	**PROTEIN KW-LG**	(guard column)	7	**8.0 × 50**	(guard column)

* See page 44 for PROTEIN KW-800.
* See page 77 for semi-micro columns and micro columns.

Base Material : Silica

Aqueous SEC(GFC) columns : Polymer-based

OHpak SB-800 HQ series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6516011	**OHpak SB-2002**	≥ 9,000	15	**20.0 × 300**	SB-802 HQ
F6516012	**OHpak SB-2002.5**	≥ 12,000	10	**20.0 × 300**	SB-802.5 HQ
F6516013	**OHpak SB-2003**	≥ 12,000	10	**20.0 × 300**	SB-803 HQ
F6516014	**OHpak SB-2004**	≥ 12,000	18	**20.0 × 300**	SB-804 HQ
F6516015	**OHpak SB-2005**	≥ 12,000	20	**20.0 × 300**	SB-805 HQ
F6516016	**OHpak SB-2006**	≥ 12,000	20	**20.0 × 300**	SB-806 HQ
F6516017	**OHpak SB-2006M**	≥ 12,000	13	**20.0 × 300**	SB-806M HQ
F6709555	**OHpak SB-LG**	(guard column)	18	**8.0 × 50**	(guard column)

* See page 46 for OHpak SB-800 HQ.
* See page 78, 79 for semi-micro columns and micro columns.

Base Material : Polyhydroxymethacrylate

(Note) The maximum solvent tolerance of the SB-2000 series for methanol, acetonitrile, and DMF is 50%. Solvent tolerance differs from that of the standard SB-800 HQ columns.

*Contact Shodex or our distributors near you for larger preparative columns.

Preparative columns

Multimode columns

Asahipak GS-HQ series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6810017	**Asahipak GS-220 20F**	≥ 8,000	13	**20.0 × 300**	GS-220 HQ
F6810018	**Asahipak GS-320 20F**	≥ 8,000	13	**20.0 × 300**	GS-320 HQ
F6810019	**Asahipak GS-520 20F**	≥ 8,000	13	**20.0 × 300**	GS-520 HQ
F6810020	**Asahipak GS-620 20F**	≥ 8,000	13	**20.0 × 300**	GS-620 HQ
F6810034	**Asahipak GS-220 20G**	≥ 14,000	13	**20.0 × 500**	GS-220 HQ
F6810035	**Asahipak GS-320 20G**	≥ 14,000	13	**20.0 × 500**	GS-320 HQ
F6810036	**Asahipak GS-520 20G**	≥ 14,000	13	**20.0 × 500**	GS-520 HQ
F6810037	**Asahipak GS-620 20G**	≥ 14,000	13	**20.0 × 500**	GS-620 HQ
F6710021	**Asahipak GS-20G 7B**	(guard column)	20	**7.5 × 50**	(guard column)

* See page 48 for Asahipak GS-HQ.
* See page 80 for semi-micro columns and micro columns.

Base Material : Polyvinyl alcohol

Aqueous/Organic SEC columns

Asahipak GF-HQ series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6810030	**Asahipak GS-310 20F**	≥ 8,000	13	**20.0 × 300**	GF-310 HQ
F6810031	**Asahipak GS-510 20F**	≥ 8,000	13	**20.0 × 300**	GF-510 HQ
F6810032	**Asahipak GS-710 20F**	≥ 8,000	13	**20.0 × 300**	GF-710 HQ
F6810033	**Asahipak GSM-700 20F**	≥ 8,000	13	**20.0 × 300**	GF-7M HQ
F6810038	**Asahipak GS-310 20G**	≥ 14,000	13	**20.0 × 500**	GF-310 HQ
F6810039	**Asahipak GS-510 20G**	≥ 14,000	13	**20.0 × 500**	GF-510 HQ
F6810040	**Asahipak GS-710 20G**	≥ 14,000	13	**20.0 × 500**	GF-710 HQ
F6810041	**Asahipak GSM-700 20G**	≥ 14,000	13	**20.0 × 500**	GF-7M HQ
F6710020	**Asahipak GS-10G 7B**	(guard column)	20	**7.5 × 50**	(guard column)

* See page 50 for Asahipak GF-HQ.
* See page 81 for semi-micro columns and micro columns.

Base Material : Polyvinyl alcohol

(Note) The solvents, usable for GS-710 20F and 20G are water and methanol.
Solvent tolerance differs from the standard GF-710 HQ column.
Selection of GSM-700 20F or 20G is recommended in case of use of other solvents for scale-up testing with GF-710 HQ.

Organic SEC (GPC) columns

GPC KF-800 series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6102401	**GPC KF-2001**	≥ 18,000	6	**20.0 × 300**	KF-801
F6102402	**GPC KF-2002**	≥ 18,000	6	**20.0 × 300**	KF-802
F6102425	**GPC KF-2002.5**	≥ 18,000	6	**20.0 × 300**	KF-802.5
F6102403	**GPC KF-2003**	≥ 18,000	6	**20.0 × 300**	KF-803
F6102404	**GPC KF-2004**	≥ 14,000	7	**20.0 × 300**	KF-804
F6102405	**GPC KF-2005**	≥ 10,000	10	**20.0 × 300**	KF-805
F6102406	**GPC KF-2006**	≥ 10,000	10	**20.0 × 300**	KF-806
F6102409	**GPC KF-2006M**	≥ 10,000	10	**20.0 × 300**	KF-806M
F6700406	**GPC KF-LG**	(guard column)	15	**8.0 × 50**	(guard column)

* See page 52 for GPC KF-800.

Base Material : Styrene divinylbenzene copolymer

*Contact Shodex or our distributors near you for larger preparative columns.

Organic SEC (GPC) columns

GPC K-800 series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6102301	GPC K-2001	≥ 18,000	6	20.0 × 300	K-801
F6102312	GPC K-2002	≥ 18,000	6	20.0 × 300	K-802
F6102315	GPC K-2002.5	≥ 18,000	6	20.0 × 300	K-802.5
F6102303	GPC K-2003	≥ 18,000	6	20.0 × 300	K-803
F6102304	GPC K-2004	≥ 14,000	7	20.0 × 300	K-804
F6102305	GPC K-2005	≥ 10,000	10	20.0 × 300	K-805
F6102306	GPC K-2006	≥ 10,000	10	20.0 × 300	K-806
F6102309	GPC K-2006M	≥ 10,000	10	20.0 × 300	K-806M
F6700407	GPC K-LG	(guard column)	15	8.0 × 50	(guard column)

* See page 52 for GPC K-800.

Base Material : Styrene divinylbenzene copolymer

Custom-made Preparative Columns

Organic SEC (GPC) columns

GPC K-800 series Preparative type

Product Code	Product Name	Plate Number (TP/column)	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6102001	GPC H-2001	≥ 13,000	15	20.0 × 500	K-801
F6102002	GPC H-2002	≥ 13,000	15	20.0 × 500	K-802
F6102025	GPC H-2002.5	≥ 13,000	15	20.0 × 500	K-802.5
F6102003	GPC H-2003	≥ 13,000	15	20.0 × 500	K-803
F6102004	GPC H-2004	≥ 13,000	15	20.0 × 500	K-804
F6102005	GPC H-2005	≥ 13,000	15	20.0 × 500	K-805
F6102006	GPC H-2006	≥ 13,000	15	20.0 × 500	K-806
F6102009	GPC H-2006M	≥ 12,000	15	20.0 × 500	K-806M
F6700310	GPC H-G	(guard column)	15	8.0 × 50	(guard column)

* See page 52 for GPC K-800.

Base Material : Styrene divinylbenzene copolymer

GPC KF-800 series Preparative type

Product Code	Product Name	Particle Size (μm)	Column Size (mm) I.D. x L	Standard Column
F6108010	GPC KF-5001	15	50.0 × 300	KF-801
F6108020	GPC KF-5002	15	50.0 × 300	KF-802
F6108025	GPC KF-5002.5	15	50.0 × 300	KF-802.5
F6108030	GPC KF-5003	15	50.0 × 300	KF-803
F6108040	GPC KF-5004	15	50.0 × 300	KF-804
F6700408	GPC KF-LLG	15	20.0 × 100	(guard column)

* See page 52 for GPC KF-800.

Base Material : Styrene divinylbenzene copolymer

*Contact Shodex or our distributors near you for larger preparative columns.

Column Cleaning Procedures

Change in peak shapes, elution timing, and the elevated column pressure may be resolved by cleaning the column. This section describes general indications of column deterioration and column cleaning procedures. The details of column cleaning procedures should be referred to each column's operation manual.

Typical indicators of column deterioration

1. Elevated column pressure
2. Abnormal peak shapes (broad, leading, or tailing) and split peaks
3. Change in retention time
4. Unstable baseline

Selection guide to the cleaning solvent

Choose a solvent capable of dissolving the adsorbed substances.

Choose the strong eluent for the choice of column.

*Use the solvent specified in the operation manual

Standard cleaning procedures

For an efficient cleaning, reverse the direction and reduce the flow to 1/3 of the regular flow rate.

Reversed phase columns	Clean the columns with solvent containing higher concentration of organic solvent such as methanol, acetonitrile, or THF. (In case of using buffer as a mobile phase, miscibility of the buffer solution and the organic solvents need to be checked)
Ion exchange chromatography	• **Contamination caused by ionic adsorption** Use solvent with higher salt concentration or solvent with different pH from the mobile phase. • **Contamination caused by hydrophobic adsorption** Use solvent containing small percentage of organic solvent. (In case of using buffer as a mobile phase, miscibility of the buffer solution and the organic solvents need to be checked)
	• **Contamination caused by proteins** Inject 1-2 mL of 0.1 M NaOH (aq) or 30% (v/v) acetic acid several times.
Sugar analysis columns	**[Ligand exchange columns (SUGAR series)]** • **In case of counter-ion detachment** Flush or inject solvent containing the salt corresponding to the modified counter-ligand. **[Polymer-base amino columns (NH2P series)]** • **To neutralize the acidic form of amino function group** Flush with solvents in the following sequence: water, 0.1M perchloric acid, water, 0.1M NaOH (aq), water, and mobile phase.
Hydrophobic interaction columns	• **Contamination caused by proteins** Inject 1-2 mL of 0.1 M NaOH (aq) or 30% (v/v) acetic acid several times.
Aqueous SEC(GFC) columns	• **Contamination caused by ionic adsorption** Use solvent with higher salt concentration or solvent with different pH from the mobile phase. • **Contamination caused by hydrophobic adsorption** Use solvent containing small percentage of organic solvent. (In case of using buffer as a mobile phase, miscibility of the buffer solution and the organic solvents need to be checked)

*The volume of the cleaning solvent required is 5-10 times the column volume.
*Avoid pressure elevation during the cleaning
*The cleaning is limited and does not guarantee the full regeneration of the column to its original condition.

For your information

One typical cause of the column pressure elevation is the clogging of solid substances at the inlet filter of the column. In this case, reverse the direction and reduce the flow to 1/3 of the regular flow rate. This may remove the solid substance causing the elevated pressure.

*Use the solvent specified in the operation manual

General precautions for column handling

For the best performance of the column, please follow the instructions given below.

Column mounting

- Before mounting the column, replace the eluent within all the HPLC system with the mobile phase used for the analysis. *If the mobile phase of the choice is not miscible with the eluent already in the system, use solvent that is miscible with both solvents first to clean the system. *Buffer or salt solution may precipitate when mixed with organic solvent of different concentrations.
- Attach the column in the direction as indicated by arrow marked on the column. Gradually increase the flow rate of the solvent introduced to the column.
- When heating the column, use low flow rate until the temperature reaches the desired level, and then gradually increase the flow rate up to the requirement.

Column dismounting

- When column was heated, turn off the heater while keeping the flow rate at 1/3 of the regular flow.
- Turn off the pump when the column is cooled to room temperature.

Column storage

- For long-term storage, replace the solvent with shipping solution and keep the end caps tight.
- Store the column in a location with stable temperature.
- For the long-term storage of SEC columns, immersion method is recommended.
  *Please refer to the immersion method on the operation manual.

Other

- Avoid physical shock on the column. Be cautious not to drop the column from a high position.
- Do not bend the column.
- Avoid opening the column's end-fitting, it can cause alteration of column's performance.

* Read the operating manual before using the column.

Refractive Index Detector

Shodex RI–201

The RI-201 is a highly sensitive RI detector incorporating a three-chamber flow cell.

⟨Features⟩

- A novel optical system (three-chamber flow cell) provides at least twice the sensitivity of our previous detectors.
- The double temperature control method significantly reduces drift caused by room temperature fluctuations.
- The limit of detection for saccharides is approximately 2ng.

Refractive Index Detector

Shodex RI–201H

⟨Features⟩

- Uses the same optical system as that of RI-101.
- Reasonable price

Product Code		F4010105	F4010106
Model		**RI-201**	**RI-201H**
		Analysis	
Flow cell type		3 chamber-type	2 chamber-type
Measurement method		Deflection type	
Refractive Index range		1.00~1.75	
Measurement range		0.125~256RIU	0.25~512RIU
Drift *		0.1μRIU/h	0.2μRIU/h
Linearity range		≥ 300μRIU	≥ 600μRIU
Noise **		≤ 1nRIU	≤ 2.5nRIU
Response		0.1, 0.25, 0.5, 1, 1.5, 2, 3, 6sec	
Auto zero		Full auto zero	
Auto zero range		All range	
Off-set range		5μRIU	10μRIU
Off-set resolution		25nRIU	50nRIU
Integrator output (Sensitivity)		DC 0~1V (4mV/μRIU, 16mV/μRIU)	DC 0~1V (2mV/μRIU, 8mV/μRIU)
Cell volume		8μL	
Flow rate	(Usual)	0.2~3.0mL/min	
	(Max.)	10mL/min (solvent ; pure water)	
Maximum back pressure		50kPa	
Internal volume		IN→Cell ; 80μL Cell→OUT ; 600μL All (Cell→OUT) ; 690μL	IN→Cell ; 60μL Cell→OUT ; 600μL All (Cell→OUT) ; 670μL
Recorder output		0~10mV/FS	
External input		—	
External Output		① READY (temperature control) ② LEAK ③ ERROR (ROM, RAM, PARAMETER, HOME-POSITION, OVER-HEAT, OPT.-BALANCE, INTENSITY)	
Temperature control		OFF, 30~55°C (1°C step), 77°C Temp. fuse (Double Temperature control)	
Communication port		USB	
Operator support function		None	
Wetted materials		Stainless steel 316, Teflon, Quartz Glass	
Power source, Power consumption		AC100~240V±10%, 50/60Hz, 150VA max	
Dimension, Weight		W260 x D400 x H150 (mm), ca. 12kg	
Accessories		Power cable, signal cable, connector tube, fuse, operation manual	

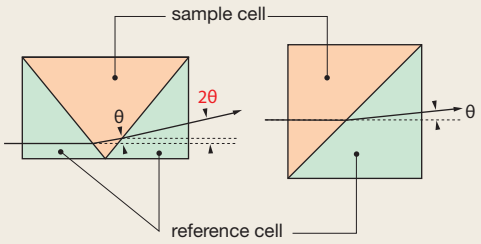
*Pure water 1mL/min, PURGE OFF **Pure water, response : 1.5sec

Principle of new optical system measurement

In our previous optical system, the measurement light passing through the flow cell was refracted only once. The new three-chamber flow cell allows the light to be refracted twice, thereby increasing sensitivity at least two-times at the same optical path length. This doubles the defection degree and results in not only reduces the noise half, but reduces the drift caused by optical systems half.

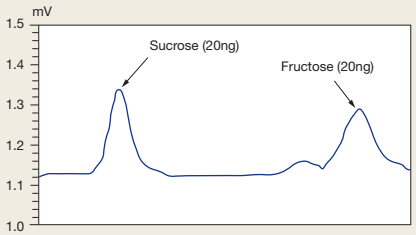
3 chamber-type flow cell
RI-201

Current 2 chamber-type flow cell
RI-100 series, RI-201H

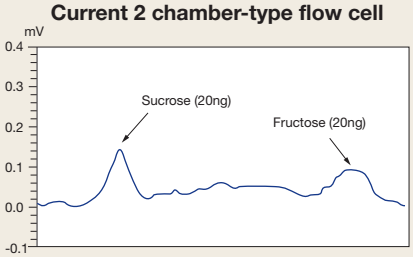


Application

3 chamber-type flow cell



Current 2 chamber-type flow cell



Refractive Index Detector

Shodex RI–101, 102, 104

The Shodex RI-100 series is a versatile and high sensitive RI detectors that can be used with various manufactures' HPLC systems. It consists of a color-LCD, an automatic start-up function, and a validation wizard.

⟨Features⟩

- Equipped with a color liquid crystal display, the detector monitors analytical status in real time.
- The automatic start-up function controls the complicated operations such as blank substitution and baseline stabilization automatically.
- The validation wizard enables easy component validation.
- Improved temparature control system shortens the required warm-up time and provides stable background.
- The leak sensor automatically stops the pump in case of solvent leakage.
- External input and output terminals and RS232C communication ports can be used to connect various HPLC systems for an advanced automation.

Product Code		F4010101	F4010104	F4010102
Model		**RI-101**	**RI-104**	**RI-102**
		Analysis	**Semi-micro**	**Preparative**
Flow cell type		2 chamber-type		
Measuring method		Deflection type		
Refractive Index range		1.00~1.75		
Measurement range		0.25~512μRIU	0.25~512μRIU	2.5~5120μRIU
Drift *		0.2μRIU/h	0.2μRIU/h	2μRIU/h
Linearity range		≥ 600μRIU	≥ 600μRIU	≥ 6000μRIU
Noise **		≤ 2.5nRIU	≤ 5nRIU	≤ 25nRIU
Response		0.1, 0.25, 0.5, 1, 1.5, 2, 3, 6sec		
Auto zero		Full auto zero		
Auto zero range		All range		
Off-set range		0~500mV (Same as integrator output)		
Off-set resolution		10mV (Same as integrator output)		
Integrator output (Sensitivity)		DC 0~1V (2mV/μRIU, 8mV/μRIU)	DC 0~1V (2mV/μRIU, 8mV/μRIU)	DC 0~1V (0.2mV/μRIU, 0.8mV/μRIU)
Cell volume		8μL	2.5μL	8μL
Flow rate	(Usual)	0.2~3.0mL/min	0.2~1.0mL/min	1.0~50mL/min
	(Max.)	10mL/min (solvent ; pure water)	1.0mL/min (solvent ; pure water)	100mL/min (solvent ; pure water)
Maximum back pressure		50kPa		
Internal volume		IN → Cell : ca. 60μL Cell → OUT : ca. 600μL All (Cell → OUT) : ca. 670μL	IN → Cell : ca. 10μL Cell → OUT : ca. 355μL All (Cell → OUT) : ca. 370μL	IN → Cell : ca. 120μL Cell → OUT : ca. 510μL All (Cell → OUT) : ca. 640μL
Recorder output		0~10mV/FS		
External input		Purge On/Off, Auto Zero, Marker		
External output		① READY (Automatic start-up) ② LEAK ③ ERROR (OVER HEAT/LOW LIGHT INTENSITY/NULL GLASS HOME POSITION/LOST PARAMETERS/ OPTICAL BALANCE) (Contact capacity : DC24V 0.1A max.)		
Temperature control		OFF, 30~55℃ (1℃ step), 77℃ Temp. fuse		
Communication port		RS232C		
Operational support functions		① Automatic start-up (Start Up Sequence) ② Span/Validation Guide ③ Real Time Baseline Monitor		
Wetted materials		Stainless steel 316, Teflon, Quartz glass		
Power source, Power consumption		AC100~240±10%, 50/60Hz, 150VA max		
Dimensions, Weight		W260 x D400 x H200 (mm), ca.13kg		
Accessories		Power cable, signal cable, connector tube, fuse, operation manual		

*Pure water 1mL/min, PURGE OFF **Pure water, response : 1.5sec

NEW

Electric Conductivity Detector
Shodex CD-200

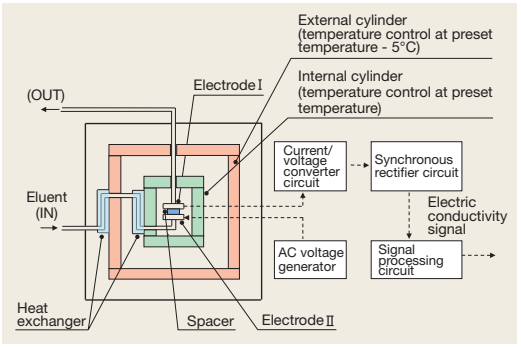
The electric conductivity detector is designed for ion chromatography. It is recommended for anion or cation analysis in aqueous solution.

⟨Features⟩

- With use of the built-in double temperature control cell, this detector enables highly sensitive measurement.
- The detector supports a wide range of measurement and is usable for ion chromatography with or without suppressor method.

Product Code	F5515010
Model	**CD-200**
Measurement method	Two-electorode system
Measurement limit	0~600mS/m (0~6mS/cm)
Measurement range	0.0025~5.12mS/m, 0.025~51.2mS/m, 0.25~512mS/m
Linearity range	600mS/m
Response	0.1, 0.25, 0.5, 1.0, 1.5, 2, 3, 6sec
Auto zero limit	Same as measurement limit
Baseline shift	Range;0~2mS/m, Resolution;0.01mS/m
Integrator output	0~1V (Sensitivity:200, 20, 2mV/mS/m)
Recorder output	0~10mV/FS
External input	① ZERO IN ② MARKER IN
External Output	① READY(TEMPERATURE STABILIZED) ② LEAK ③ ERROR(ROM,RAM,PARAMETER,SENSOR,OVER HEAT,ZERO OVER) ④ MARKER OUT
Cell Temperature control	OFF, 30~50℃ (1℃ step), 77℃ Temp. fuse
Communication port	USB
Cell volume	2.5μL
Pressure rating	1MPa
Wetted materials	Stainless steel 316, Teflon, PEEK
Dimension, Weight	W260 x D400 x H150 (mm), ca. 8kg
Power source, Power consumption	AC 100~240V±10%,200VA max

■ Principle of measurement of the electric conductivity detector



Dissolved Gas Removal Devices
DEGASSER ERC-3215α, 3415α

The ERC-3000α series efficiently remove dissolved gases in the eluent.

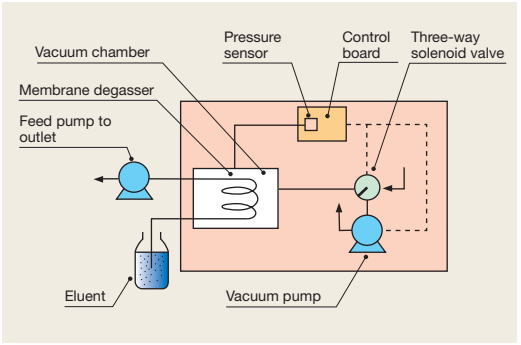
⟨Degassing principle⟩

A special synthetic resin membrane (degassing membrane) is used to selectively remove dissolved gasses ; using the charastaristics of the small molecular size of the dissolved gas with high mobility and affinity to the membrane.

⟨Features⟩

- Pressure sensor and leak monitor assure a high degree of safety.
- Dead volume is minimized to 7 ml/flow channel.
- Any pump can be used since differential pressure is low.
- Continuous degassing mode aids eluent preparation for high-sensitivity analysis.
- EMC and LVD compliance, with CE marking.

Product Code	Y4617000	Y4617004
Model	**ERC-3215α**	**ERC-3415α**
Solvent Channels	2 channels	4 channels
Degassing capacity	When ion-exchanged water saturated with air at 25℃ is put through at a flow rate of 3 mL/min, no bubble is observed at the outlet of the apparatus. (Measured dissolved oxygen level at the outlet: 2 ppm at flow rate of 3 mL/min)	
Internal volume	7mL/Channel	
Max. Flow Rate	20mL/min for each channel (Eluent : 25℃ Pure water)	
External output	An open connector signal is delivered to the external output signal terminal, when "PRES" and "LEAK" LEDs lights are on.	
Dimensions	W71 x D310 x H136 (mm)	
Power source	AC100V~AC240V, 50/60Hz	
Functions, Displays	• Power On/Off display : "POWER" LED lights, when the power is supplied. • Status monitoring function : "READY" LED lights, when the internal pressure in the vacuum chamber is below a predetermined limit. • Pressure monitoring function : "PRES" LED lights, when the internal pressure in the vacuum chamber does not reach a predetermined level within a predetermined time. • Leak monitor : "LEAK" LED lights, when the liquid leaks in the apparatus. • Self cleaning : The vacuum line is cleaned by air suction. • Vacuum pump operation switching function: NORM. : Controlled operation in normal run CONT. : Continuous operation in case of high degree of degassing	
Weight	ca. 5.1kg	ca. 5.5kg

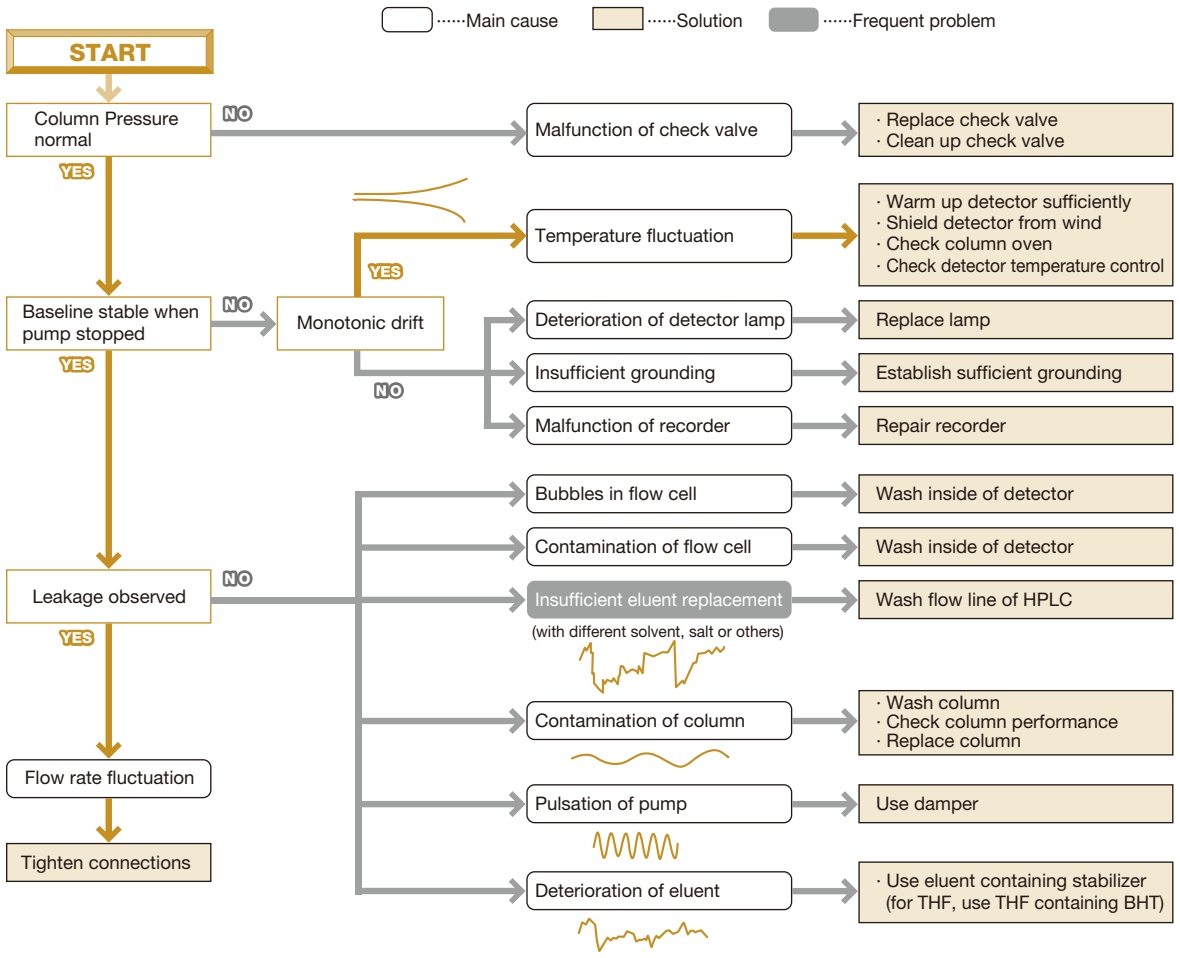


•In addition to this product, various degassers are available including the six-flow channel type and the high flow rate type. For details, please contact Shodex or our distributors near you.

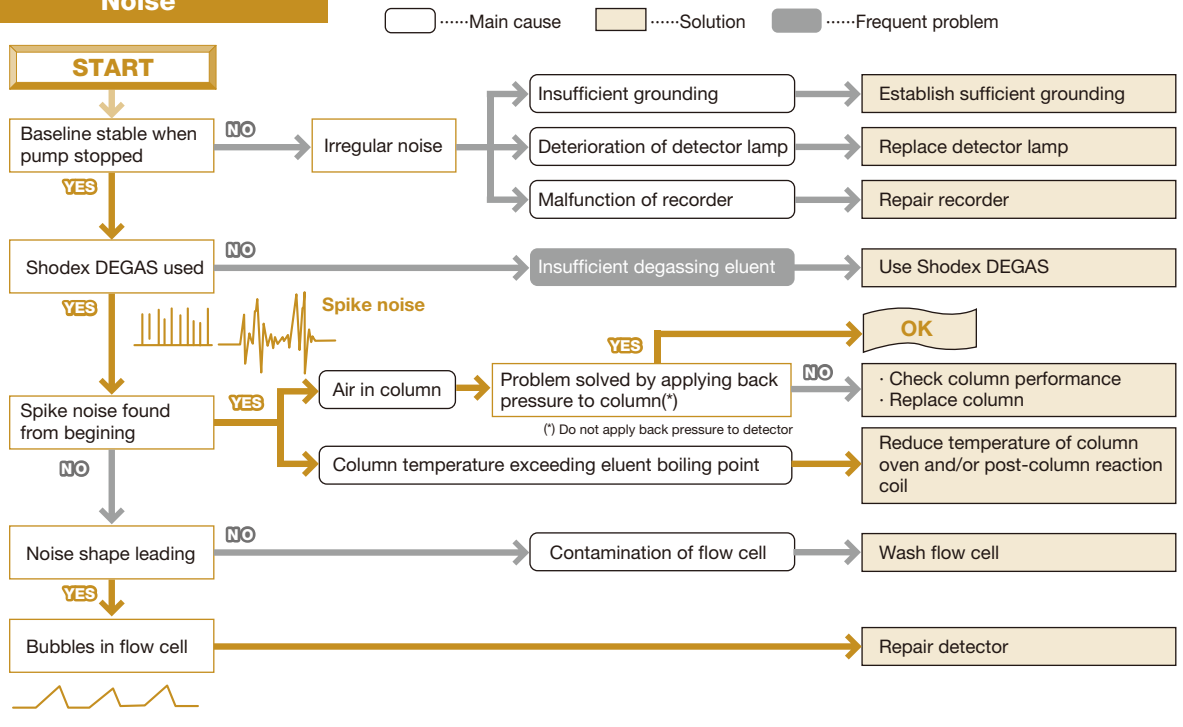
HPLC System Trouble Shooting

Common cause of abnormal chromatograms

Instable baseline values



Noise



Index

Columns are listed in alphabetical order under the product name excluding series name.
Instruments are indicated by bold letters.

[Series name]

AFpak	Asahipak	AXpak	CLNpak	CXpak	GPC	HIC	IC
IEC	MSpak	ODSpak	OHpak	ORpak	PIKESS	PROTEIN	RSpak
Silica	Silicapak	STANDARD	STD	SUGAR	USPpak	WINE	

A

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y

Technical Notebook, Chromato News

Technical Notebook

No.	Title
1	**Shodex GPC LF series columns** Linear calibration curves over a wide molecular weight range
2	**Shodex NH2P-50 series columns** Analysis of saccharides in food industry
3	**Food Analysis with Shodex columns** Saccharides, Organic acids, Vitamins, Fatty acids and Amino acids
4	**Shodex IC YS-50 column** Simultaneous analysis of monovalent and divalent cations at a higher sensitivity

No.	Title
5	**Shodex KW400 series columns** High performance and downsized column for protein analysis
6	**Shodex ODP2 HP series columns** Better retention of highly polar substances
7	**Protein & Peptide with Shodex columns**

Chromato News

No.	Title	Column
1	High performance reversed phase column; polymer-based column Asahipak ODP-40	Asahipak ODP-40 series
2	Direct analysis of medical compounds in serum without sample pretreatment	MSpak GF-310 series, MSpak GS-320 series
3	Semi-micro GPC columns with high resolution	GPC KF-400HQ series
4	Linear calibration curves by GPC LF-804	GPC LF-804
5	New IC columns for suppressed ion chromatography	IC SI-90 4E, SI-50 4E
6	Food additives	SUGAR SP0810, SC1011, Asahipak NH2P-50 4E, RSpak KC-811
7	Polymer based column with multimode of reversed phase and ionic interaction	RSpak NN series, RSpak JJ-50
8	Ultra-high molecular weight and water-soluble polymer with Shodex SUGAR KS-807	SUGAR KS-807, KS-800 series
9	Direct analysis of proteins and peptides in surfactants using surfactant removal column MSpak PK series	MSpak PK series, MSpak GF-4A
10	Direct analysis of additives in polymer with SEC/MS	GPC KF-400HQ series
11	Concentration of the hydrophilic medical compounds existing with proteins	MSpak PK series
12	Column selection for proteins and peptides analysis	SEC, Reversed phase, Ion exchange, Affinity columns
13	Analysis of Hyaluronic acid with ultra-high molecular weight in serum	SUGAR KS-807, Asahipak GS-620HQ
14	Water-soluble vitamins	Asahipak NH2P 50 4E, RSpak DE-413
15	Anion analysis with non-suppressor method	IC NI-424
16	SEC analysis of proteins with PROTEIN KW-800 series	PROTEIN KW-800 series
17	Saccharides and sugar alcohols with Asahipak NH2P-50 column	Asahipak NH2P-50 series
18	Analysis of quite small amount of sample with micro-column	Shodex micro column series
19	New micro column series	GS320A-M5D, GS520A-M5D
20	New micro column series; similar separation with standard column and higher sensitivity	GS-320 HQ, GS320A-2E, GS320A-1E
21	Affinity column series	AFpak series
22	Online removal of surfactants in protein analysis	MSpak PK-2A, PROTEIN KW-604S
23	Various application with Repack DE series; high pH, 0% organic eluent	RSpak DE series
24	Analysis of amines and amides with RSpak DE series	RSpak DE-613, DE-413, AFpak ACH-494
25	Simultaneous analysis of monosaccharide and organic acid with SUGAR SH1011	SUGAR SH1011
26	ORpak CDBS-453; Chiral column for the analysis of drugs and their metabolites	ORpak CDBS-453
27	Analysis of chiral medicine warfarin and its metabolites with CDBS-453	ORpak CDBS-453
28	Cations analysis column IC YS-50 for Suppressor and Non-suppressor system	IC YS-50, IC YK-421
29	Water-soluble ultra-high Molecular compounds with OHpak SB-807HQ	OHpak SB-807HQ, SB-806HQ
30	New reversed phase column ODP2 HP	ODP2 HP series
31	New protein analysis column KW400	KW400 series
32	High sensitive analysis of pyridylaminated saccharides	Asahipak NH2P-50
33	New rapid cation exchange column; DEAR3N-4T with nonporous gel	IEC DEAE3N-4T
34	Oxyhalides and cyan in drinking waters	IC SI-52 4E, IC SI-91 4C, RSpak KC-811 6E
35	Shellfish poisoning and pesticides	RSpak DE413-2B, Asahipak ODP-50 4E
36	Suitable column for LC/MS application; ODP2 HP	ODP2 HP-LCMS
37	Ion chromatography for wine analysis	WINE VH-anion 4D
38	High performance SEC columns SB400 for water soluble polymer in small dimension	OHpak SB400 series
39	Ionic polymer analysis with SB series	SB400 series, OHpak SB-803 HQ
40	Analysis of sugars in bioethanol production	SUGAR SH1821, SUGAR KS-802, GPC LF-804
41	High-temperature reversed phase column in high temperature for rapid analysis	ET-RP1 4D
42	Ion Exchange columns for UHPLC	PIKESS series
43	Saccharides analysis with H_2O eluent	SP0810, SC1011, KS-801, SH1011
44	High resolution separation by NH2P-40 3E	NH2P-40 3E