Polymer-based Hydrophilic Interaction Chromatography (HILIC) Columns (HILICpak)

Features

VG-50
- Suitable for saccharides analysis using HILIC mode
- Recovers reducing saccharides with high ratio
- Polymer-based packing material provides excellent chemical stability and minimum deterioration over extended time period
- Easily regenerated by washing in an alkaline solution
- Appropriate for evaporative light scattering detector, corona charged aerosol detector, and LC/MS

VT-50
- Suitable for anionic substances analysis using HILIC mode
- Use of some eluents add ion exchange mode
- Polymer-based packing material provides excellent chemical stability and minimum deterioration over extended time period
- Suitable for LC/MS analysis

New VC-50
- Modified carboxyl group is suitable for cationic substance analysis including amines
- The dominant separation mode is RP or IEX rather than HILIC mode

New VN-50
- The modified diol groups on the packing material create the HILIC mode
- Suitable for oligosaccharide separation which is not possible by SEC column or conventional HILIC columns

Standard columns

MZ ANALYSENTECHNIK

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VG-50

(Housing Material: SUS)

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Pore Size (Å)	Column Size (mm) I.D. x Length	Shipping Solvent
F7630200	**HILICpak VG-50 4D**	≥ 5,500	Amino	5	100	**4.6 × 150**	H_2O/CH_3CN=20/80
F7630100	**HILICpak VG-50 4E**	≥ 7,500	Amino	5	100	**4.6 × 250**	H_2O/CH_3CN=20/80
F6711100	**HILICpak VG-50G 4A**	(guard column)	Amino	5	100	**4.6 × 10**	H_2O/CH_3CN=20/80

Base Material: Polyvinyl alcohol

(Housing Material: PEEK)

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Pore Size (Å)	Column Size (mm) I.D. x Length	Shipping Solvent
F7630300	**HILICpak VG-50 2D**	≥ 3,500	Amino	5	100	**2.0 × 150**	H_2O/CH_3CN=15/85
F6711200	**HILICpak VG-50G 2A**	(guard column)	Amino	5	100	**2.0 × 10**	H_2O/CH_3CN=15/85

Base Material: Polyvinyl alcohol

VT-50

(Housing Material: PEEK)

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Pore Size (Å)	Column Size (mm) I.D. x Length	Shipping Solvent
F7630400	**HILICpak VT-50 2D**	≥ 4,500	Quaternary ammonium	5	100	**2.0 × 150**	25mM $HCOONH_4$ aq. /CH_3CN=15/85
F6711300	**HILICpak VT-50G 2A**	(guard column)	Quaternary ammonium	5	100	**2.0 × 10**	25mM $HCOONH_4$ aq. /CH_3CN=15/85

Base Material: Polyvinyl alcohol

VC-50

(Housing Material: PEEK)

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Pore Size (Å)	Column Size (mm) I.D. x Length	Shipping Solvent
F7630700	New **HILICpak VC-50 2D**	≥ 3,500	Carboxyl	5	100	**2.0 × 150**	H_2O
F6711600	New **HILICpak VC-50G 2A**	(guard column)	Carboxyl	5	100	**2.0 × 10**	H_2O

Base Material: Polyvinyl alcohol

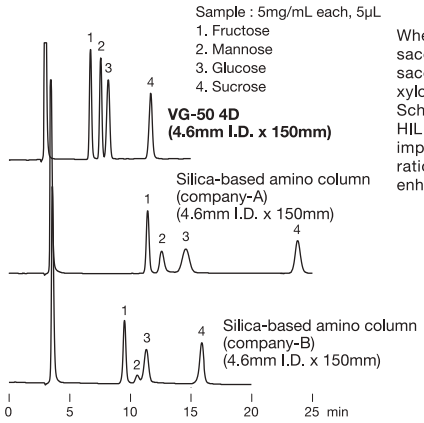
VN-50

(Housing Material: PEEK)

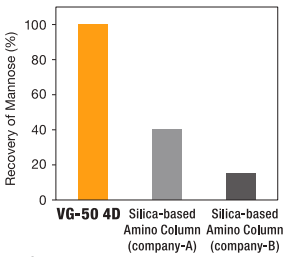
Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Pore Size (Å)	Column Size (mm) I.D. x Length	Shipping Solvent
F7630600	New **HILICpak VN-50 2D**	≥ 3,500	Diol	5	100	**2.0 × 150**	H_2O/CH_3CN=25/75
F6711500	New **HILICpak VN-50G 2A**	(guard column)	Diol	5	100	**2.0 × 10**	H_2O/CH_3CN=25/75
F7630500	New **HILICpak VN-50 4D**	≥ 10,000	Diol	5	100	**4.6 × 150**	H_2O/CH_3CN=25/75
F6711400	New **HILICpak VN-50G 4A**	(guard column)	Diol	5	100	**4.6 × 10**	H_2O/CH_3CN=25/75

Base Material: Polyvinyl alcohol

Recovery of reducing sugar

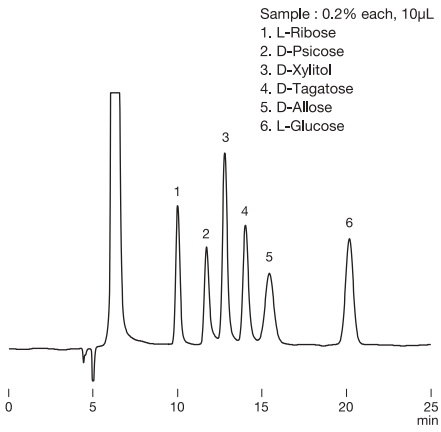


When an amino column is used for analyzing saccharides, the recovery ratio of reducing saccharides such as mannose, arabinose or xylose is low because the amino group forms Schiff base with reducing saccharides.
HILICpak VG-50 is an amino column with improved reducing saccharides' recovery ratios. Improved recovery ratio results in enhancing the sensitivity of the analysis.



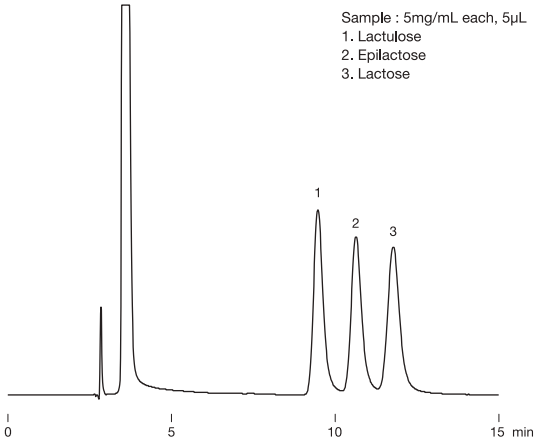
Column : **Shodex HILICpak VG-50 4D**
Silica based amino columns from other manufacturers
Eluent : H_2O/CH_3CN=20/80
Flow rate : 0.6mL/min (VG-50 4D)
1.0mL/min (Silica based amino column)
Detector : RI
Column temp. : 40°C

Rare sugar



Column : **Shodex HILICpak VG-50 4E**
Eluent : $H_2O/CH_3CN/CH_3OH$=5/85/10
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 50°C

Lactose, epilactose, and lactulose

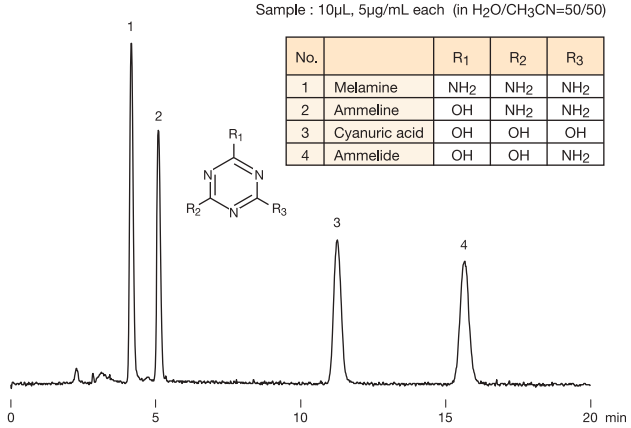


Column : **Shodex HILICpak VG-50 4E**
Eluent : $H_2O/CH_3CN/CH_3OH$=5/75/20
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Melamine and related substances

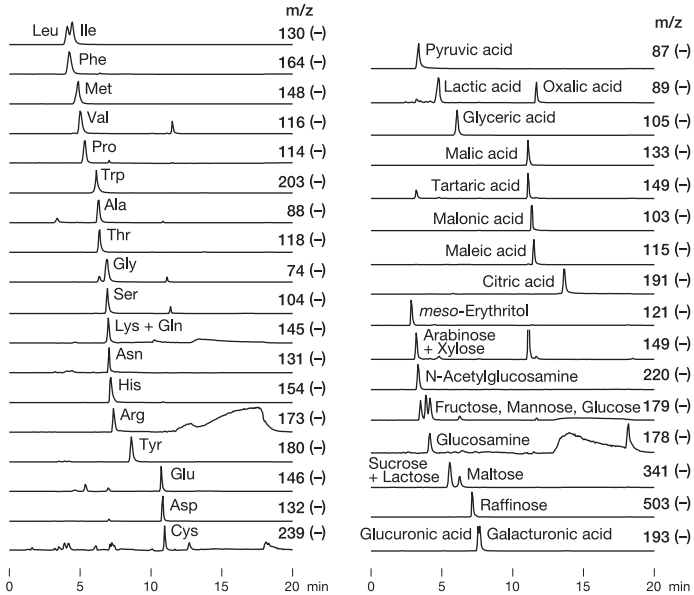
Sample : 10µL, 5µg/mL each (in H_2O/CH_3CN=50/50)

No.		R_1	R_2	R_3
1	Melamine	NH_2	NH_2	NH_2
2	Ammeline	OH	NH_2	NH_2
3	Cyanuric acid	OH	OH	OH
4	Ammelide	OH	OH	NH_2



Column : **Shodex HILICpak VG-50 4D**
Eluent : 30mM $HCOONH_4$ aq./CH_3CN=35/65
Flow rate : 0.6mL/min
Detector : Corona charged aerosol
Column temp. : 40°C

Simultaneous analysis of saccharides, organic acids and amino acids with LC/MS



Sample : 1µg/mL each (in H_2O/CH_3CN=1/4), 5µL

VG-50 2D allows simultaneous analysis of saccharides, organic acids and amino acids with LC/MS detection under alkaline conditions. High anionic substances elute under alkaline conditions. Furthermore, alkaline conditions promote the deprotonation of hydroxyl groups at the time of ionization. Therefore, alkaline conditions are suitable for high sensitive detection of substances with hydroxyl groups such as saccharides under the negative mode.

Column : **Shodex HILICpak VG-50 2D**
Eluent : (A); 0.5% NH_3 aq./(B); CH_3CN
Linear gradient (High pressure);
(B%) 80% (0 to 2min), 80% to 10% (2 to 12min), 10% (12 to 15min), 80% (15 to 20min)
Flow rate : 0.2mL/min
Detector : ESI-MS (SIM)
Column temp. : 40°C

Polymer-based Hydrophilic Interaction Chromatography (HILIC) Columns (Asahipak)

Features

NH2P

- Suitable for saccharides analysis using HILIC mode
- Polymer-based packing material provides excellent chemical stability and minimum deterioration over extended time period
- Easily regenerated by washing in an alkaline solution
- Appropriate for evaporative light scattering detector, corona charged aerosol detector, and LC/MS
- Fulfills USP L82 requirements

NH2P-40

- Provides higher theoretical plate number than NH2P-50 series

Standard columns

Product Code	Product Name	Plate Number (TP/column)	Functional Group	Particle Size (µm)	Pore Size (Å)	Column Size (mm) I.D. x Length	Shipping Solvent
F7630005	**Asahipak NH2P-50 4B**	≥ 1,500	Amino	5	100	**4.6 × 50**	CH_3CN
F7630002	**Asahipak NH2P-50 4D**	≥ 5,500	Amino	5	100	**4.6 × 150**	CH_3CN
F7630001	**Asahipak NH2P-50 4E**	≥ 7,500	Amino	5	100	**4.6 × 250**	CH_3CN
F6710016	**Asahipak NH2P-50G 4A**	(guard column)	Amino	5	–	**4.6 × 10**	CH_3CN
F7630006	**Asahipak NH2P-50 2D**	≥ 3,500	Amino	5	100	**2.0 × 150**	CH_3CN
F6713000	**Asahipak NH2P-50G 2A**	(guard column)	Amino	5	–	**2.0 × 10**	CH_3CN
F7630007	**Asahipak NH2P-40 3E**	≥ 8,500	Amino	4	100	**3.0 × 250**	CH_3CN
F6710030	**Asahipak NH2P-50G 3A**	(guard column)	Amino	5	–	**3.0 × 10**	CH_3CN
F7630008	**Asahipak NH2P-40 2B**	≥ 2,000	Amino	4	100	**2.0 × 50**	CH_3CN
F7630009	**Asahipak NH2P-40 2D**	≥ 5,500	Amino	4	100	**2.0 × 150**	CH_3CN
F7630010	**Asahipak NH2P-40 2E**	≥ 7,000	Amino	4	100	**2.0 × 250**	CH_3CN
F6710100	**Asahipak NH2P-LF**	(line filter)	Amino	–	–	**8.0 × 75**	CH_3CN

Base Material: Polyvinyl alcohol

3mm I.D columns [Customized columns]

Product Code	Product Name	Functional Group	Particle Size (µm)	Pore Size (Å)	Column Size (mm) I.D. x Length
F7630011	**Asahipak NH2P-40 3B**	Amino	4	100	**3.0 × 50**
F7630012	**Asahipak NH2P-40 3D**	Amino	4	100	**3.0 × 150**

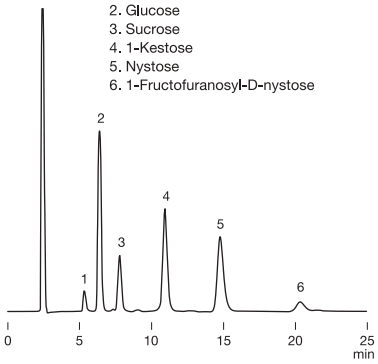
Base Material: Polyvinyl alcohol

Preparative columns *Preparative columns are made to order.

Product Code	Product Name	Plate Number (TP/column)	Particle Size (µm)	Column Size (mm) I.D. x Length	Standard Column
F6830001	**Asahipak NH2P-50 10E**	≥ 10,000	5	**10.0 × 250**	NH2P-50
F6710016	**Asahipak NH2P-50G 4A**	(guard column)	5	**4.6 × 10**	(guard column)
F6830031	**Asahipak NH2P-90 20F**	≥ 10,000	9	**20.0 × 300**	NH2P-50
F6710017	**Asahipak NH2P-130G 7B**	(guard column)	13	**7.5 × 50**	(guard column)

Fructooligosaccharide syrup

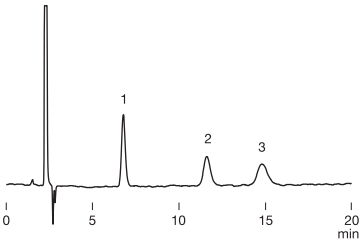
Sample :
Fructooligosaccharide syrup, 2.5%, 20µL
1. Fructose
2. Glucose
3. Sucrose
4. 1-Kestose
5. Nystose
6. 1-Fructofuranosyl-D-nystose



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

Cyclodextrins

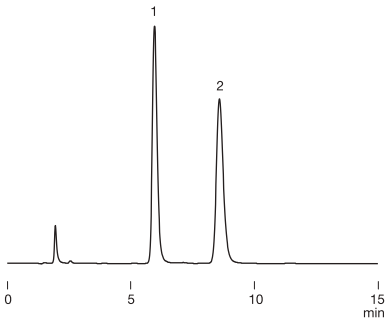
Sample : 250µg/mL each, 20µL
1. α-Cyclodextrin
2. γ-Cyclodextrin
3. β-Cyclodextrin



Column : **Shodex Asahipak NH2P-50 4E**
Eluent : H_2O/CH_3CN=40/60
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Stevioside and rebaudioside A

Sample : 0.05% each, 20µL
1. Stevioside
2. Rebaudioside A

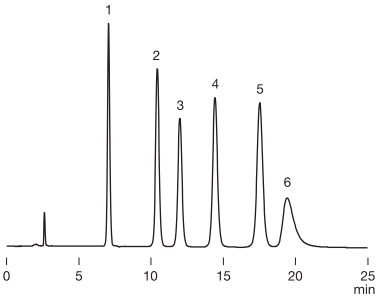


Column : **Shodex Asahipak NH2P-50 4E**
Eluent : H_2O/CH_3CN=25/75
Flow rate : 1.0mL/min
Detector : UV (210nm)
Column temp. : 30°C

Imidazole dipeptides

Sample : 20µL

1. β-Alanine	200µg/mL
2. 1-Methyl-L-histidine	2µg/mL
3. L-Anserine	5µg/mL
4. Histidine	5µg/mL
5. L-Carnosine	5µg/mL
6. Nitrate (derived from L-Anserine Nitrate)	

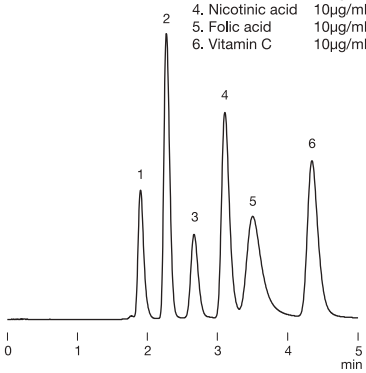


Column : **Shodex Asahipak NH2P-50 4E**
Eluent : 50mM NaH_2PO_4 aq./CH_3CN=40/60
Flow rate : 1.0mL/min
Detector : UV (210nm)
Column temp. : 40°C

Simultaneous analysis of water-soluble vitamins

Sample : 20µL

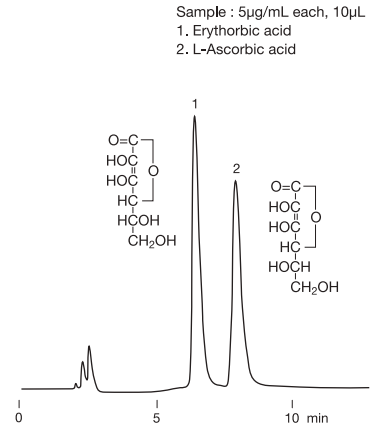
1. Vitamin B_6	50µg/mL
2. Nicotinamide	10µg/mL
3. Vitamin B_{12}	10µg/mL
4. Nicotinic acid	10µg/mL
5. Folic acid	10µg/mL
6. Vitamin C	10µg/mL



Column : **Shodex Asahipak NH2P-50 4E**
Eluent : 40mM H_3PO_4 aq./CH_3CN=45/55
Flow rate : 1.0mL/min
Detector : UV (254nm)
Column temp. : 40°C

Ascorbic acid and erythorbic acid

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



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

Comparison of saccharide analysis using corona charged aerosol detector

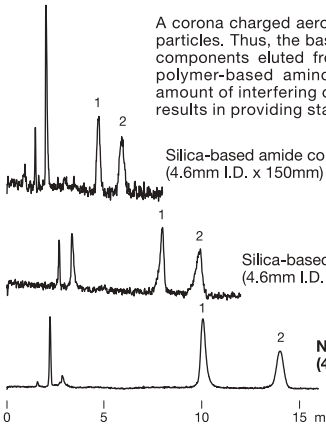
A corona charged aerosol detector measures effluents as particles. Thus, the baseline is significantly affected by all components eluted from the column. The NH2P series polymer-based amino column eliminates insignificant amount of interfering components from the column. This results in providing stable and low noise baseline.

Silica-based amide column (4.6mm I.D. x 150mm)

Sample : 40µg/mL each, 5µL
1. Fructose
2. Glucose

Silica-based amino column (4.6mm I.D. x 250mm)

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

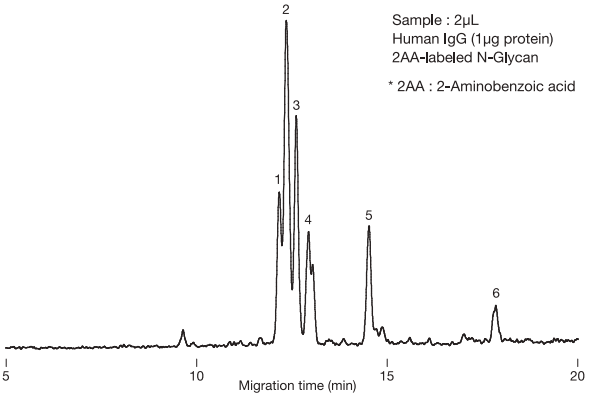


Column : **Shodex Asahipak NH2P-50 4E**
Silica based amino column from other manufacturer
Silica based amide column from other manufacturer
Eluent : H_2O/CH_3CN=20/80
Flow rate : 1.0mL/min
Detector : Corona charged aerosol
Column temp : 30°C (NH2P-50 4E, Silica based amino column)
80°C (Silica based amide column)

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

Sample : 2µL
Human IgG (1µg protein)
2AA-labeled N-Glycan

* 2AA : 2-Aminobenzoic acid



Column : **Shodex Asahipak NH2P-40 2D**
Eluent : (A); 95% CH_3CN/0.1% Formic acid aq.
(B); 5% CH_3CN/0.1% Formic acid aq.
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 temp. : 45°C

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

Ligand Exchange Chromatography Columns

Lists summarizing elution volumes of various saccharides using Shodex columns is available. Please refer to our website (http://www.shodex.com/en/) or technical notebook (No.2 and 3).

Features

SC1011
SC1821
SP0810
KS-801 to 802

- Separates saccharides by combination of ligand exchange and size exclusion modes
- Three types of counter ions are available: Ca^{2+}, Pb^{2+}, and Na^{+}
- Only water is required for the analysis of neutral sugars
- SC1011 and SC1821 fulfill USP L19 and L22 requirements
- SP0810 fulfills USP L22 and L34 requirements
- KS-801 and KS-802 fulfill USP L22 and L58 requirements

KS-803 to 806

- Suitable for separation of polysaccharides by size exclusion mode
- Can be used in combination with other columns e.g., KS-802 and KS-801
- Only water is required for the analysis of neutral sugars
- Fulfills USP L22 and L58 requirements

DC-613
SZ5532
SC1211

- Separates elements by combination of ligand exchange and HILIC modes
- DC-613 can analyze sugars without removing sodium salts in the sample
- SZ5532 is recommended for the separation of disaccharides or trisaccharides
- SC1211 is suitable for separating sugar alcohols
- DC-613 fulfills USP L22 and L58 requirements
- SZ5532 fulfills USP L22 requirements
- SC1211 fulfills USP L19 and L22 requirements

SC1011-7F

- Fulfills mannitol analysis requirements of JP, USP, and EP methods
- Ca^{2+} modified ligand exchange chromatography column
- Only water is required for the analysis of neutral sugars
- Fulfills USP L19 and L22 requirements

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 Length	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-G 6B (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 6B (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 6B (SUGAR KS-G)**	(guard column)	Sulfo (Na^{+})	–	10	**6.0 × 50**	H_2O

*( ) Estimated value Base Material: Styrene divinylbenzene copolymer

[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 Length	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 4A (RSpak DC-G)**	(guard column)	Sulfo (Na^{+})	10	–	**4.6 × 10**	H_2O/CH_3CN=30/70
F7001300	**SUGAR SZ5532**	≥ 5,500	Sulfo (Zn^{2+})	6	–	**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
F7001400	**SUGAR SC1211**	≥ 5,500	Sulfo (Ca^{2+})	6	50	**6.0 × 250**	H_2O/CH_3CN=75/25
F6700120	**SUGAR SC1211G 4A (SUGAR SC-G)**	(guard column)	Sulfo (Ca^{2+})	10	–	**4.6 × 10**	H_2O/CH_3CN=75/25

Base Material: Styrene divinylbenzene copolymer

For mannitol analysis following JP, USP, and EP methods

Product Code	Product Name	Functional Group (Counter Ion)	Particle Size (µm)	Column Size (mm) I.D. x Length	Shipping Solvent
F6379300	**EP SC1011-7F**	Sulfo (Ca^{2+})	8	**7.8 × 300**	H_2O
F6700090	**SUGAR SC-G 6B (SUGAR SC-LG)** (guard column)	Sulfo (Ca^{2+})	10	**6.0 × 50**	H_2O
F6379230	**USPpak MN-431**	Sulfo (Ca^{2+})	8	**4.0 × 250**	H_2O

*See page 79 for USP40-NF35 Column List.

Base Material: Styrene divinylbenzene copolymer

Preparative columns *Preparative columns are made to order.

[Ligand exchange and size exclusion]

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

[Ligand exchange and HILIC]

Product Code	Product Name	Plate Number (TP/column)	Particle Size (µm)	Column Size (mm) I.D. x Length	Standard Column
F6514013	**RSpak DC-2013**	≥ 6,000	10	**20.0 × 300**	DC-613
F6700402	**RSpak DC-G 8B (RSpak DC-LG)**	(guard column)	10	**8.0 × 50**	(guard column)

Elution volumes of saccharides analyzed by Shodex columns

[Partial list only; refer to our website for complete list]

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

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

(–)→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°C

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

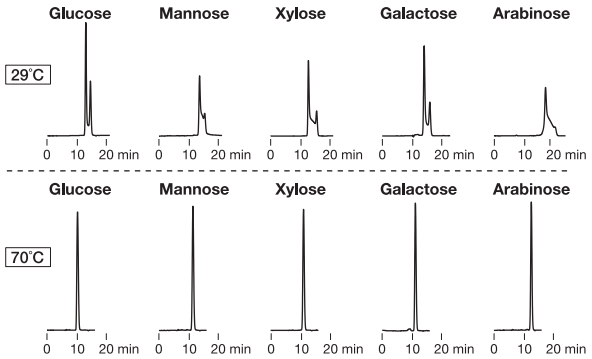
Column : **SUGAR SZ5532**
Eluent : H_2O/CH_3CN=25/75
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 60°C

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

Saccharides anomer separation

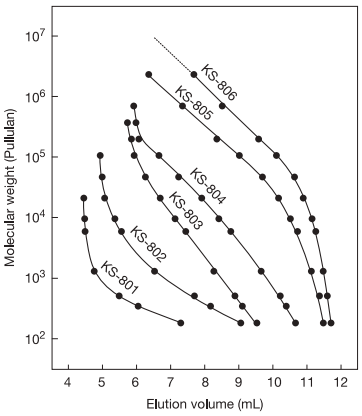
Saccharides may present their anomers at lower temperatures. By setting the SUGAR series columns at higher temperatures will prevent the anomer separation and this results in providing better chromatograms of each saccharide.

Sample :
0.5% each, 10µL



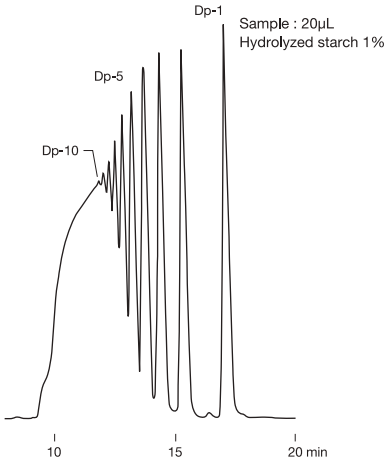
Column : Shodex SUGAR SC1011
Eluent : H_2O
Flow rate : 0.7mL/min
Detector : RI
Column temp. : 29°C, 70°C

Calibration curves for KS-800 series using pullulan



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

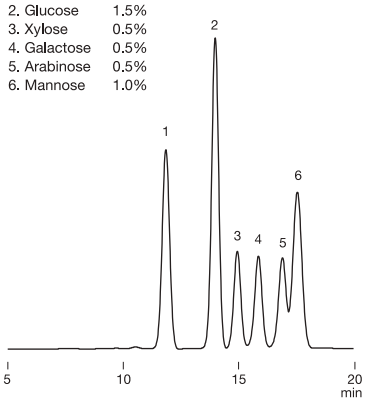
Hydrolyzed starch



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

Biomass sugars

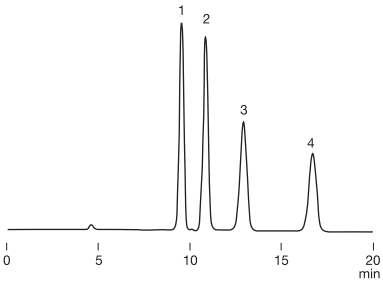
Sample : 5µL
1. Cellobiose 1.0%
2. Glucose 1.5%
3. Xylose 0.5%
4. Galactose 0.5%
5. Arabinose 0.5%
6. Mannose 1.0%



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

Ketohexoses

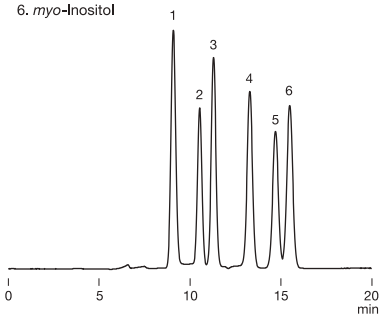
Sample : 0.025% each, 10µL
1. Sorbose
2. Fructose
3. Tagatose
4. Psicose



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

Pinitol

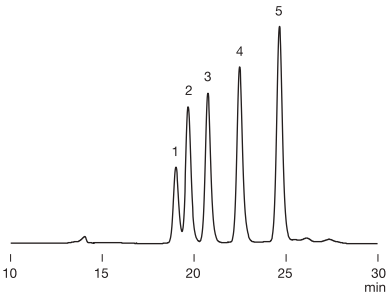
Sample : 0.1% each, 20µL
1. Sucrose
2. Glucose
3. Pinitol
4. Fructose
5. *chiro*-Inositol
6. *myo*-Inositol



Column : Shodex SUGAR SP0810
Eluent : H_2O
Flow rate : 0.8mL/min
Detector : RI
Column temp. : 85°C

Oligosaccharides in soybean

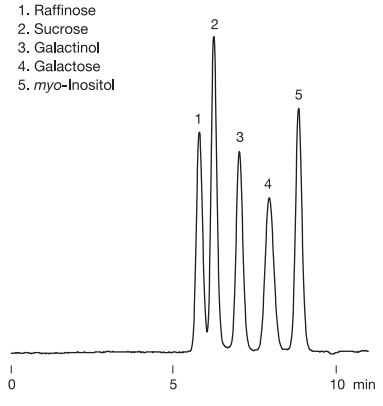
Sample : 0.1% each, 20µL
1. Verbascose
2. Stachyose
3. Raffinose
4. Sucrose
5. Pinitol



Column : Shodex SUGAR KS-802 + KS-801
Eluent : H_2O
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 85°C

Saccharides related to raffinose biosynthesis

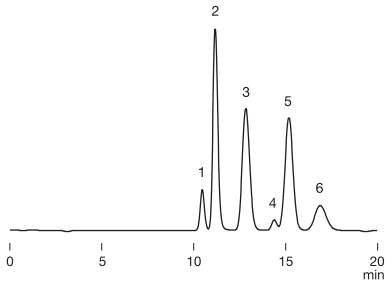
Sample : 0.1% each, 20µL
1. Raffinose
2. Sucrose
3. Galactinol
4. Galactose
5. *myo*-Inositol



Column : Shodex SUGAR SC1011
Eluent : H_2O
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 80°C

Acesulfame K and sucralose

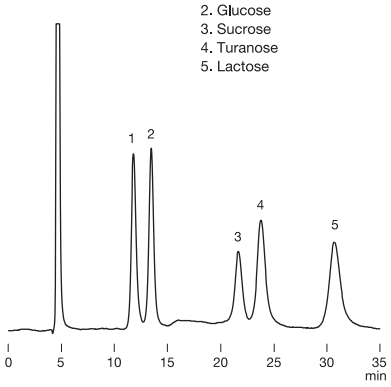
Sample : 20µL
1. Acesulfame K 0.1%
2. Sucrose 0.5%
3. Glucose 0.5%
4. Unknown from Acesulfame K
5. Fructose 0.5%
6. Sucralose 0.1%



Column : **Shodex SUGAR SC1011**
Eluent : 10mM $CaSO_4$ aq.
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 80°C

Sucrose and turanose

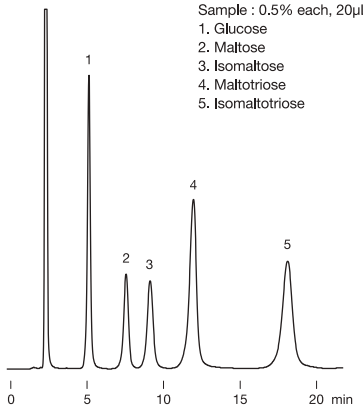
Sample : 0.5% each, 10µL
1. Fructose
2. Glucose
3. Sucrose
4. Turanose
5. Lactose



Column : **Shodex SUGAR SZ5532**
Eluent : H_2O/CH_3CN=20/80
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 60°C

Maltose and isomaltose

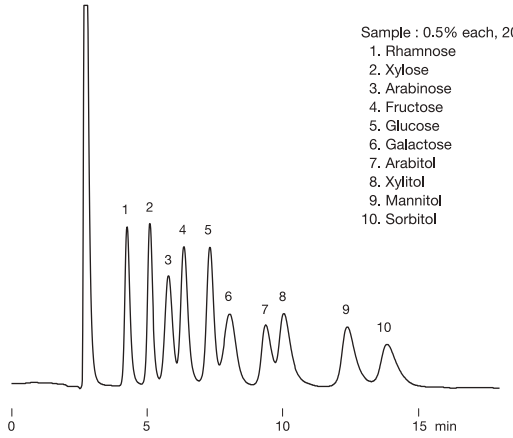
Sample : 0.5% each, 20µL
1. Glucose
2. Maltose
3. Isomaltose
4. Maltotriose
5. Isomaltotriose



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

Saccharides and sugar alcohols

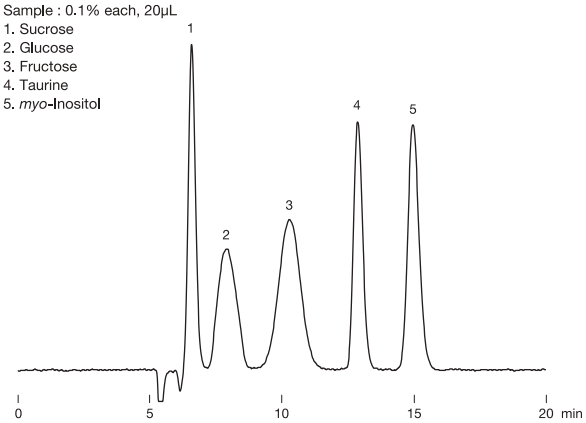
Sample : 0.5% each, 20µL
1. Rhamnose
2. Xylose
3. Arabinose
4. Fructose
5. Glucose
6. Galactose
7. Arabitol
8. Xylitol
9. Mannitol
10. Sorbitol



Column : **Shodex SUGAR SZ5532**
Eluent : H_2O/CH_3CN=20/80
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 65°C

Saccharides and taurine

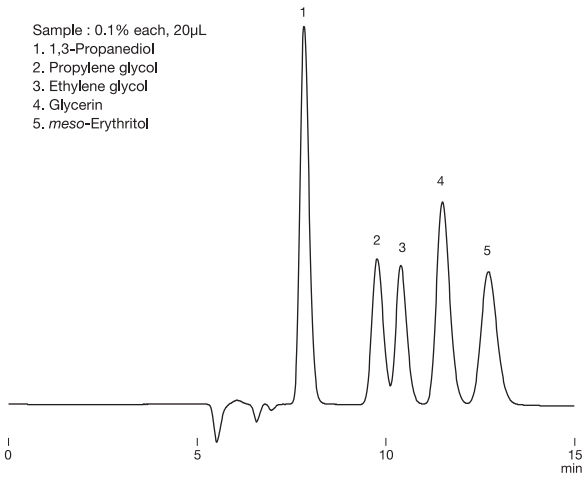
Sample : 0.1% each, 20µL
1. Sucrose
2. Glucose
3. Fructose
4. Taurine
5. *myo*-Inositol



Column : **Shodex SUGAR SC1211**
Eluent : H_2O/CH_3CN=60/40
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 70°C

Moisturizing components

Sample : 0.1% each, 20µL
1. 1,3-Propanediol
2. Propylene glycol
3. Ethylene glycol
4. Glycerin
5. *meso*-Erythritol



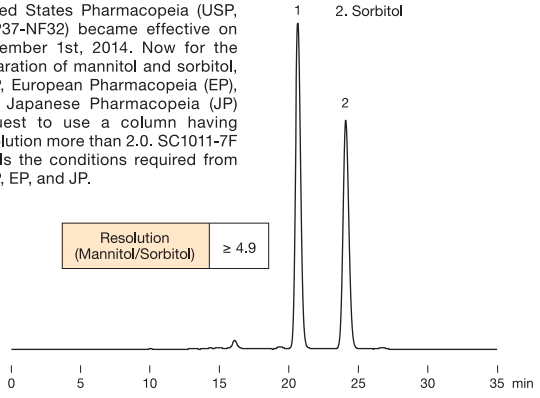
Column : **Shodex SUGAR SC1211**
Eluent : H_2O/CH_3CN=60/40
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 40°C

Mannitol and sorbitol

Partial modifications on the analytical conditions of mannitol stated in the United States Pharmacopeia (USP, USP37-NF32) became effective on December 1st, 2014. Now for the separation of mannitol and sorbitol, USP, European Pharmacopeia (EP), and Japanese Pharmacopeia (JP) request to use a column having resolution more than 2.0. SC1011-7F fulfills the conditions required from USP, EP, and JP.

Resolution (Mannitol/Sorbitol)	≥ 4.9

Sample : 25mg/mL each, 20µL
1. Mannitol
2. Sorbitol



Column : **Shodex EP SC1011-7F**
Eluent : H_2O
Flow rate : 0.5mL/min
Detector : RI
Column temp. : 85°C

Ion Exclusion Chromatography Columns

Features

SH1011
SH1821

- 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
- Fulfills USP L17 and L22 requirements

KC-811

- Columns suitable for the analysis of organic acids
- Separates compounds by ion exclusion mode and reversed phase mode
- Highly selective when used with post column method
- KC-811 6E is suitable for the analysis of cyanide ions and cyanogen chloride in accordance with the Japanese Water Supply Act
- Fulfills USP L17 and L22 requirements

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 Length	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 Length	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 6B (RSpak KC-G)**	(guard column)	Sulfo	10	**6.0 × 50**	0.1% H_3PO_4 aq.
F6700010	**RSpak KC-G 8B (RSpak KC-LG)**	(guard column)	Sulfo	13	**8.0 × 50**	0.1% H_3PO_4 aq.

*Use KC-G 8B for samples with relatively high impurity and KC-G 6B for samples with relatively low impurity.

Base Material: Styrene divinylbenzene copolymer

Preparative columns *Preparative columns are made to order.

Product Code	Product Name	Plate Number (TP/column)	Particle Size (µm)	Column Size (mm) I.D. x Length	Standard Column
F6505012	**RSpak KC-2011**	≥ 8,000	13	**20.0 × 300**	KC-811
F6700010	**RSpak KC-G 8B (RSpak KC-LG)**	(guard column)	13	**8.0 × 50**	(guard column)

MZ ANALYSENTECHNIK

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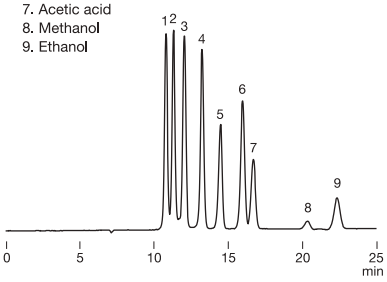
e-mail: info@mz-at.de, www.mz-at.de

Maltooligosaccharides, organic acids and ethanol

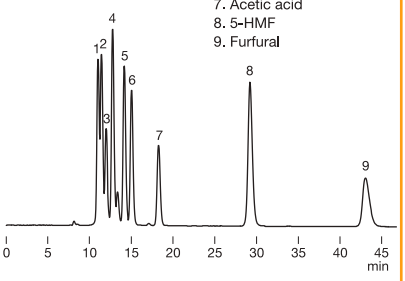
Sample : 0.05% each, 20µL
1. Maltotetraose
2. Maltotriose
3. Maltose
4. Glucose
5. Lactic acid
6. Glycerol
7. Acetic acid
8. Methanol
9. Ethanol



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

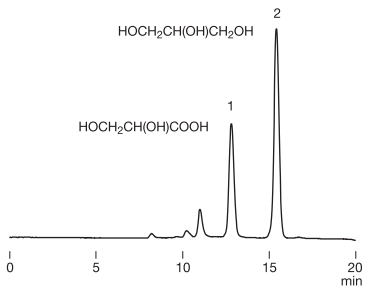
Sample : 0.1% each, 10µL
1. Cellopentaose
2. Cellotetraose
3. Cellotriose
4. Cellobiose
5. Glucose
6. Glyceric acid
7. Acetic acid
8. 5-HMF
9. Furfural



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

Glycerin and glyceric acid

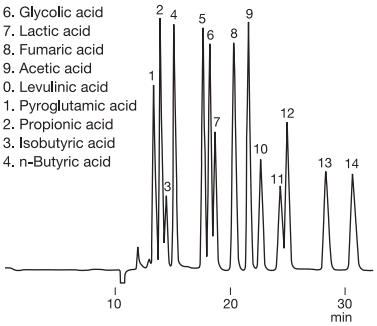
Sample : 0.1% each, 10µL
1. Glyceric acid
2. Glycerin



Column : **Shodex SUGAR SH1011**
Eluent : 2mM H_2SO_4 aq.
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 60°C

Common organic acids

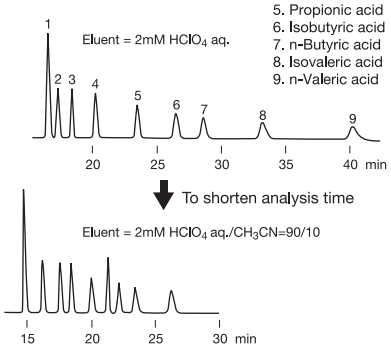
Sample :
1. Citric acid
2. Tartaric acid
3. Pyruvic acid
4. Malic acid
5. Succinic acid
6. Glycolic acid
7. Lactic acid
8. Fumaric acid
9. Acetic acid
10. Levulinic acid
11. Pyroglutamic acid
12. Propionic acid
13. Isobutyric acid
14. n-Butyric acid



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

Hydrophobic organic acids

Sample :
1. Succinic acid
2. Lactic acid
3. Formic acid
4. Acetic acid
5. Propionic acid
6. Isobutyric acid
7. n-Butyric acid
8. Isovaleric acid
9. n-Valeric acid

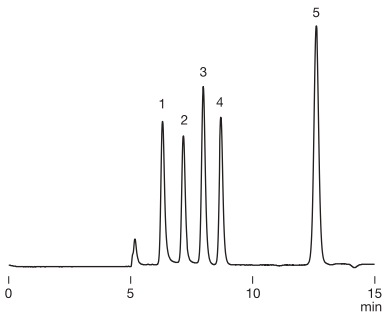


Column : **Shodex RSpak KC-LG + KC-811 x 2**
Flow rate : 1.0mL/min
Detector : VIS (430nm)
post column method
Column temp. : 47°C

Glucronolactone and organic acids

Sample : 20µL

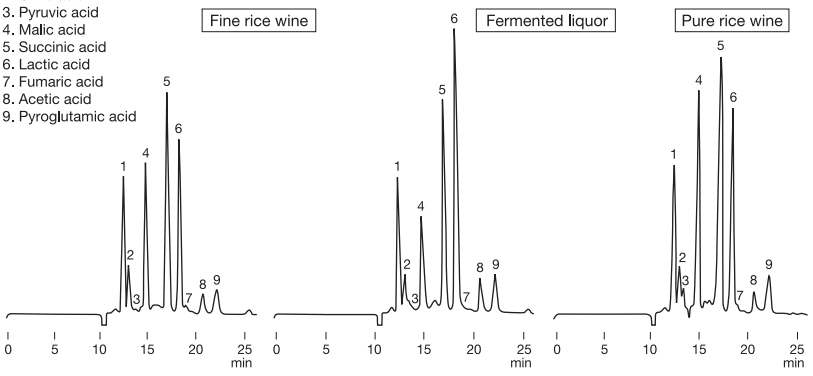
1. Citric acid	0.01%
2. Malic acid	0.01%
3. Glucronolactone	0.01%
4. Glycerin	0.01%
5. Ethanol	0.05%



Column : **Shodex RSpak KC-811**
Eluent : 3mM $HClO_4$ aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Organic acids in sake

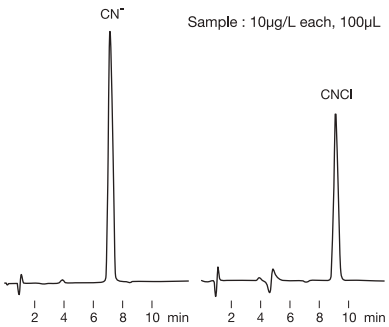
Sample : 100µL
1. Phosphoric acid etc.
2. Citric acid
3. Pyruvic acid
4. Malic acid
5. Succinic acid
6. Lactic acid
7. Fumaric acid
8. Acetic acid
9. Pyroglutamic acid



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

Analysis of Cyanide ion and cyanogen chloride with post column method

Sample : 10µg/L each, 100µL



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