

Columns for Ligand Exchange Chromatography

* A list of elution volume of saccharides for Shodex columns is available.
Please refer to our website (www.shodex.de) or technical notebook (No.2 and 3).

Features

- | | |
|---|---|
| <p>SC1011
SC1821
SP0810
KS-801 to 802</p> | <ul style="list-style-type: none"> • Separates saccharides by the combination of ligand exchange and size exclusion modes • Three types of counter ions are available: Ca²⁺, Pb²⁺, and Na⁺ • Only water is required for the analysis of neutral sugars • SC1011 and SC1821 correspond to USP L19 and L22 • SP0810 corresponds to USP L22 and L34 • KS-801 and KS-802 correspond to USP L22 and L58 |
| <p>KS-803 to 807</p> | <ul style="list-style-type: none"> • 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 • Corresponds to USP L22 and L58 |
| <p>DC-613
SZ5532
SC1211</p> | <ul style="list-style-type: none"> • Separates by the 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 separation of sugar alcohols • DC-613 corresponds to USP L22 and L58 • SZ5532 corresponds to USP L22 • SC1211 corresponds to USP L19 and L22 |
| <p>SC1011-7F</p> | <ul style="list-style-type: none"> • For the analysis of mannitol under the method of JP, USP and EP • Ca-type ligand exchange chromatography column • Only water is required for the analysis of neutral sugars • Corresponds to USP L19 and L22 |

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 x 300	H ₂ O
F6378103	SUGAR SC1821	≥ 13,000	Sulfo (Ca ²⁺)	10,000	6	8.0 x 300	H ₂ O
F6700090	SUGAR SC-G 6B (SUGAR SC-LG)	(guard column)	Sulfo (Ca ²⁺)	–	10	6.0 x 50	H ₂ O
F6378105	SUGAR SP0810	≥ 11,000	Sulfo (Pb ²⁺)	1,000	7	8.0 x 300	H ₂ O
F6700081	SUGAR SP-G 6B (SUGAR SP-G)	(guard column)	Sulfo (Pb ²⁺)	–	10	6.0 x 50	H ₂ O
F6378010	SUGAR KS-801	≥ 17,000	Sulfo (Na ⁺)	1,000	6	8.0 x 300	H ₂ O
F6378020	SUGAR KS-802	≥ 17,000	Sulfo (Na ⁺)	10,000	6	8.0 x 300	H ₂ O
F6378025	SUGAR KS-803	≥ 17,000	Sulfo (Na ⁺)	50,000	6	8.0 x 300	H ₂ O
F6378035	SUGAR KS-804	≥ 17,000	Sulfo (Na ⁺)	400,000	7	8.0 x 300	H ₂ O
F6378050	SUGAR KS-805	≥ 9,000	Sulfo (Na ⁺)	5,000,000	17	8.0 x 300	H ₂ O
F6378060	SUGAR KS-806	≥ 9,000	Sulfo (Na ⁺)	*(50,000,000)	17	8.0 x 300	H ₂ O
F6700020	SUGAR KS-G 6B (SUGAR KS-G)	(guard column)	Sulfo (Na ⁺)	–	10	6.0 x 50	H ₂ O
F6378070	SUGAR KS-807	≥ 4,000	Sulfo (Na ⁺)	*(200,000,000)	30	8.0 x 300	H ₂ O
F6700021	SUGAR KS-807G	(guard column)	Sulfo (Na ⁺)	–	30	8.0 x 50	H ₂ O

*() 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 x 150	H ₂ O/CH ₃ CN=30/70
F6700170	RSpak DC-G 4A (RSpak DC-G)	(guard column)	Sulfo (Na ⁺)	10	–	4.6 x 10	H ₂ O/CH ₃ CN=30/70
F7001300	SUGAR SZ5532	≥ 5,500	Sulfo (Zn ²⁺)	6	–	6.0 x 150	H ₂ O/CH ₃ CN=30/70
F6700110	SUGAR SZ-G	(guard column)	Sulfo (Zn ²⁺)	6	–	4.6 x 10	H ₂ O/CH ₃ CN=30/70
F7001400	SUGAR SC1211	≥ 5,500	Sulfo (Ca ²⁺)	6	50	6.0 x 250	H ₂ O/CH ₃ CN=75/25
F6700120	SUGAR SC1211G 4A (SUGAR SC-G)	(guard column)	Sulfo (Ca ²⁺)	10	–	4.6 x 10	H ₂ O/CH ₃ CN=75/25

Base Material : Styrene divinylbenzene copolymer

For the analysis of mannitol in conformity with JP and USP

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 ₂ O
F6379230	USPpak MN-431	Sulfo (Ca ²⁺)	8	4.0 × 250	H ₂ O

See p.75 for USP (Ver.38) 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)
F6514021	RSpak DC-5013	-	10	50.0 × 300	DC-613
F6700172	RSpak DC-G 20C (RSpak DC-LLG)	(guard column)	10	20.0 × 100	(guard column)

Elution volume of saccharides analysis with various 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	*
Palatinin	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

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

Column : SUGAR SP0810, SC1011, KS-801
 Eluent : H₂O
 Flow rate : 1.0mL/min
 Detector : RI
 Column temp. : 80°C

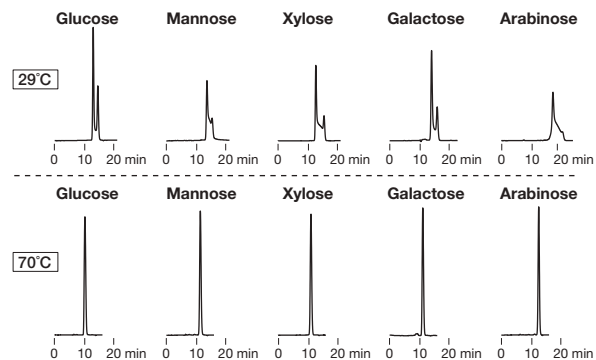
Column : SUGAR SC1211
 Eluent : H₂O/CH₃CN=65/35
 Flow rate : 1.0mL/min
 Detector : RI
 Column temp. : 70°C

Column : SUGAR SZ5532
 Eluent : H₂O/CH₃CN=25/75
 Flow rate : 1.0mL/min
 Detector : RI
 Column temp. : 60°C

Column : Asahipak NH2P-50 4E
 Eluent : H₂O/CH₃CN=25/75
 Flow rate : 1.0mL/min
 Detector : RI
 Column temp. : 30°C

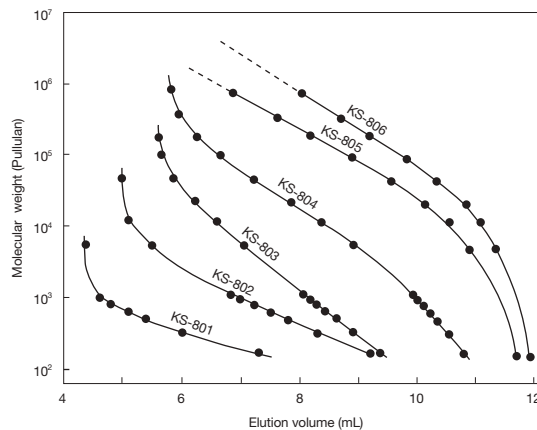
Anomer separation of saccharides

Temperature can affect chromatograms when separating saccharide anomers. When using a SUGAR column to analyze saccharides, the analysis at high temperatures would suppress the influence of anomer separation, resulting in better chromatograms.



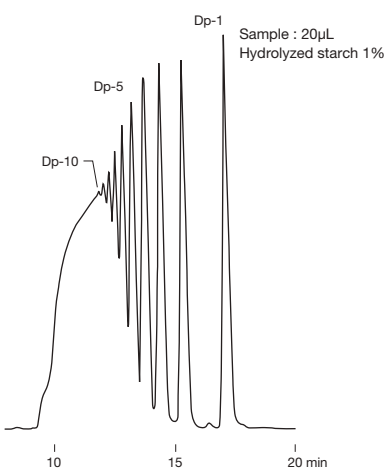
Column : Shodex SUGAR SC1011
 Eluent : H₂O
 Flow rate : 0.7mL/min
 Detector : RI
 Column temp. : 29°C, 70°C

Calibration curves for KS-800 series using pullulan



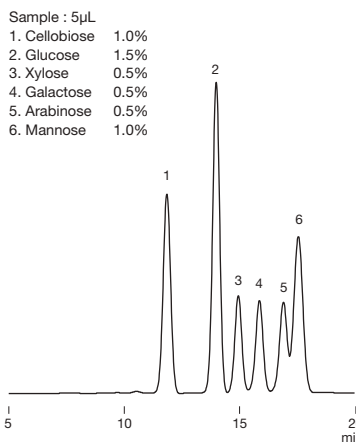
Column : Shodex SUGAR KS-800 series
 Eluent : H₂O
 Detector : RI
 Column temp. : 80°C

Hydrolyzed starch



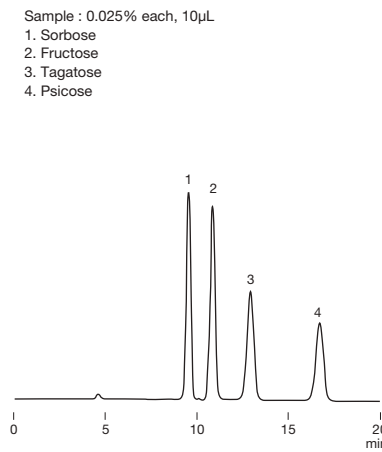
Sample : 20µL
 Hydrolyzed starch 1%
 Column : Shodex SUGAR KS-802 x 2
 Eluent : H₂O
 Flow rate : 1.0mL/min
 Detector : RI
 Column temp. : 80°C

Saccharides in wood (model)



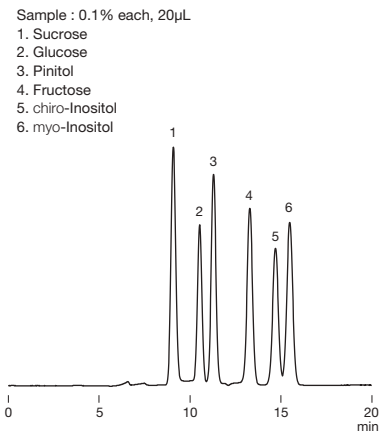
Sample : 5µL
 1. Cellobiose 1.0%
 2. Glucose 1.5%
 3. Xylose 0.5%
 4. Galactose 0.5%
 5. Arabinose 0.5%
 6. Mannose 1.0%
 Column : Shodex SUGAR SP0810
 Eluent : H₂O
 Flow rate : 0.6mL/min
 Detector : RI
 Column temp. : 85°C

Ketohexoses



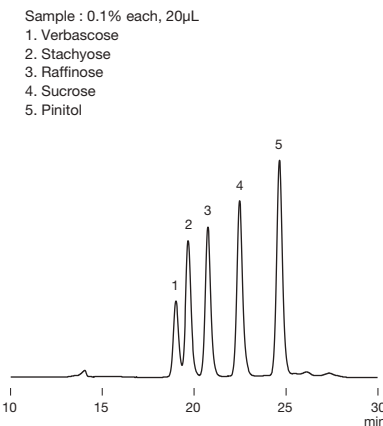
Sample : 0.025% each, 10µL
 1. Sorbose
 2. Fructose
 3. Tagatose
 4. Psicose
 Column : Shodex SUGAR SP0810
 Eluent : H₂O
 Flow rate : 1.0mL/min
 Detector : RI
 Column temp. : 80°C

Pinitol



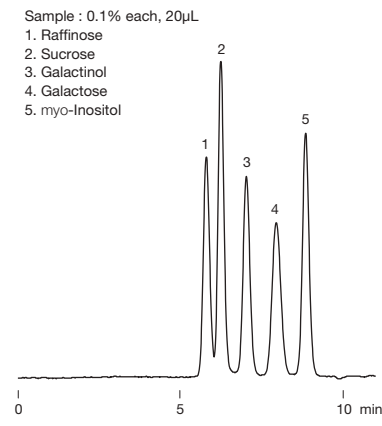
Sample : 0.1% each, 20µL
 1. Sucrose
 2. Glucose
 3. Pinitol
 4. Fructose
 5. chiro-Inositol
 6. myo-Inositol
 Column : Shodex SUGAR SP0810
 Eluent : H₂O
 Flow rate : 0.8mL/min
 Detector : RI
 Column temp. : 85°C

Oligosaccharides in soybean

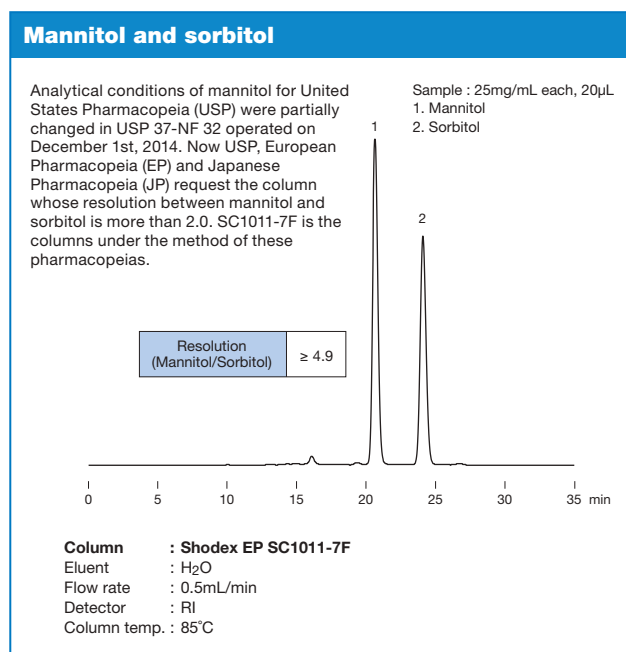
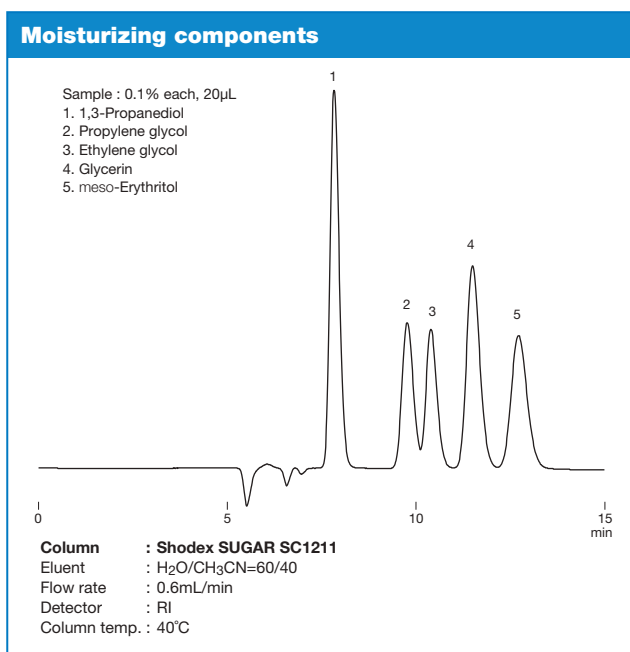
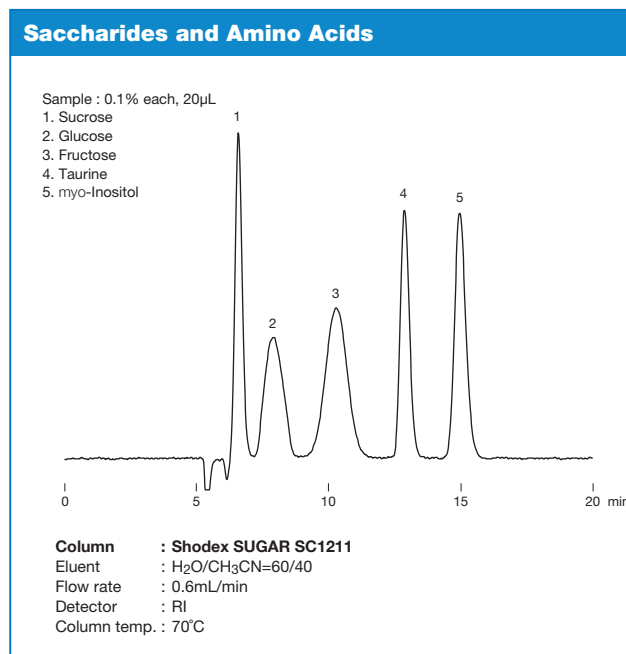
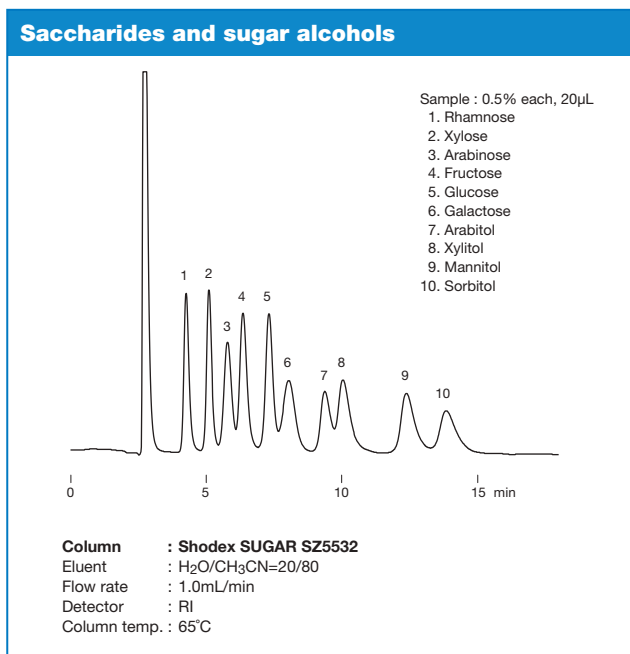
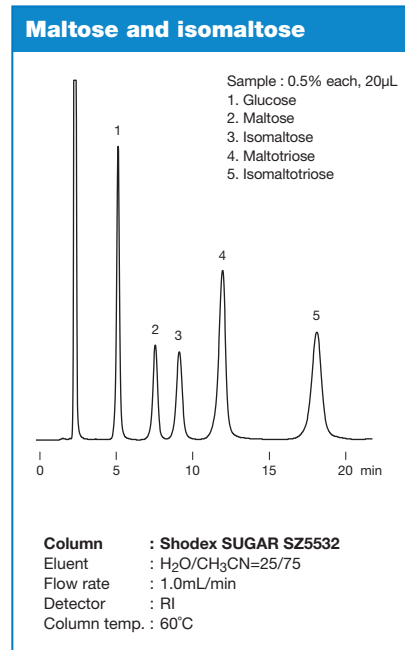
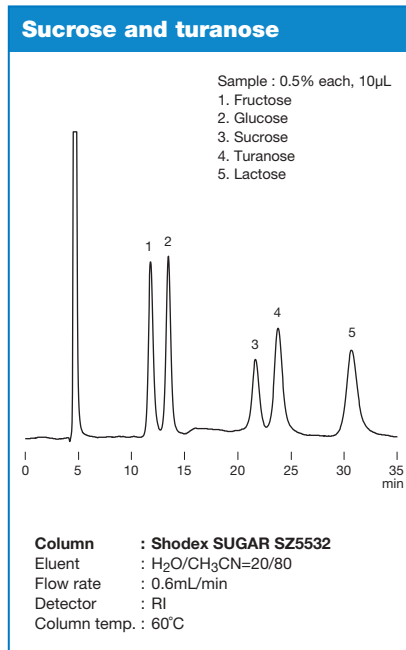
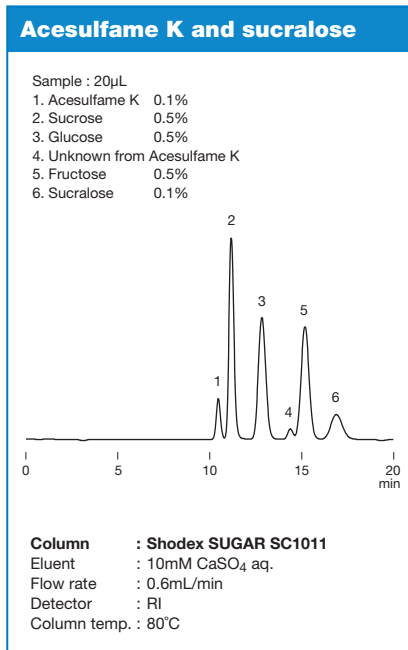


Sample : 0.1% each, 20µL
 1. Verbascose
 2. Stachyose
 3. Raffinose
 4. Sucrose
 5. Pinitol
 Column : Shodex SUGAR KS-802 + KS-801
 Eluent : H₂O
 Flow rate : 0.6mL/min
 Detector : RI
 Column temp. : 85°C

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 : H₂O
 Flow rate : 1.0mL/min
 Detector : RI
 Column temp. : 80°C



Columns for Ion Exclusion Chromatography

Features

- SH1011** • Columns for simultaneous analysis of saccharides and organic acids
- SH1821** • Separates neutral sugars in size exclusion mode and organic acids in ion exclusion mode
 • Suitable for the analysis of uronic and aldonic acids
 • Corresponds to USP L17 and L22
-
- KC-811** • Columns for the analysis of organic acids
 • Ion exclusion mode (+ reversed phase mode)
 • Highly selective detection 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
 • Corresponds to USP L17 and L22

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 x 300	H ₂ O
F6378101	SUGAR SH1821	≥ 17,000	Sulfo	10,000	6	8.0 x 300	H ₂ O
F6700080	SUGAR SH-G	(guard column)	Sulfo	–	10	6.0 x 50	H ₂ O

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 x 300	0.1% H ₃ PO ₄ aq.
F6378033	RSpak KC-811 6E	≥ 13,000	Sulfo	6	6.0 x 250	0.1% H ₃ PO ₄ aq.
F6700030	RSpak KC-G 6B (RSpak KC-G)	(guard column)	Sulfo	10	6.0 x 50	0.1% H ₃ PO ₄ aq.
F6700010	RSpak KC-G 8B (RSpak KC-LG)	(guard column)	Sulfo	13	8.0 x 50	0.1% H ₃ PO ₄ aq.

* As a guard column, 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

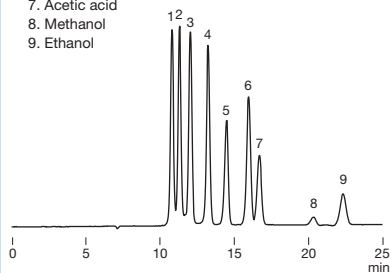
Preparative columns * Preparative columns are made to order.

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 x 300	KC-811
F6700010	RSpak KC-G 8B (RSpak KC-LG)	(guard column)	13	8.0 x 50	(guard column)

Maltoligosaccharides, 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

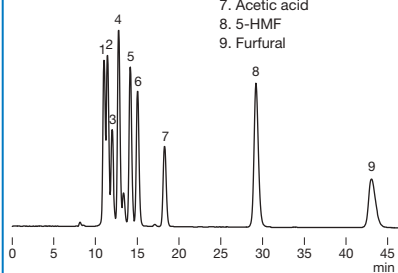


Column : Shodex SUGAR SH1821
Eluent : 0.5mM H₂SO₄ aq.
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 75°C

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

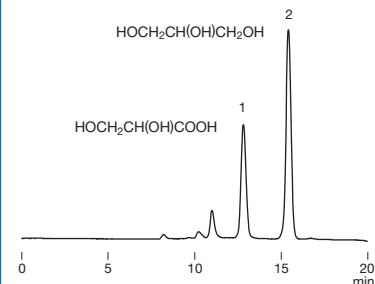


Column : Shodex SUGAR SH1821
Eluent : 2mM H₂SO₄ aq.
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 60°C

Glycerin and glyceric acid

Sample : 0.1% each, 10µL

1. Glyceric acid
2. Glycerin

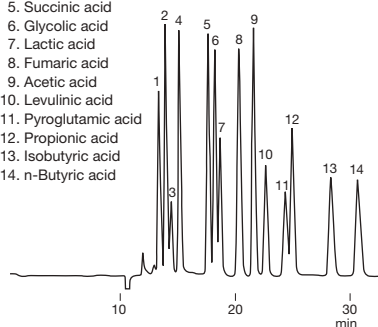


Column : Shodex SUGAR SH1011
Eluent : 2mM H₂SO₄ aq.
Flow rate : 0.6mL/min
Detector : RI
Column temp. : 60°C

General 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

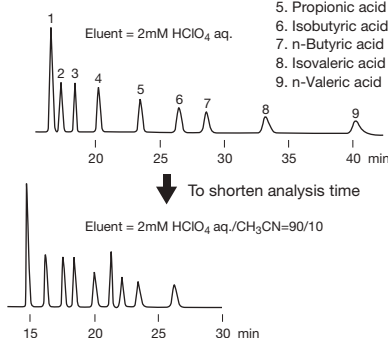


Column : Shodex RSPak KC-811 x 2
Eluent : 6mM HClO₄ aq.
Flow rate : 1.0mL/min
Detector : VIS (430nm)
 post column method
Column temp. : 50°C

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

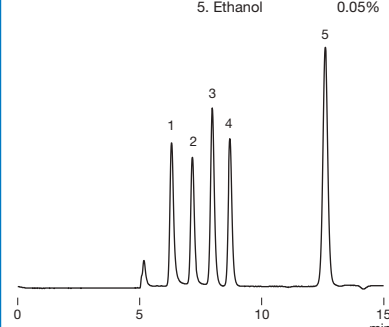


Column : Shodex RSPak KC-LG + KC-811 x 2
Flow rate : 1.0mL/min
Detector : VIS (430nm)
 post column method
Column temp. : 47°C

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%

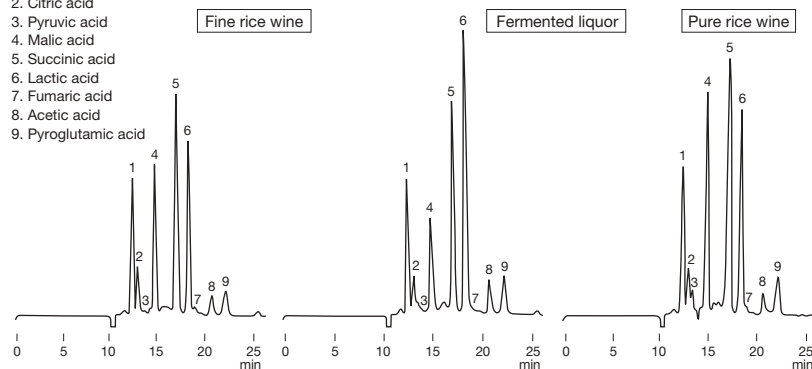


Column : Shodex RSPak KC-811
Eluent : 3mM HClO₄ aq.
Flow rate : 1.0mL/min
Detector : RI
Column temp. : 40°C

Organic acids in sake

Sample : 100µL

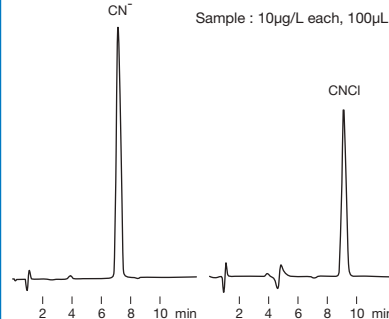
1. Phosphoric acid etc.
2. Citric acid
3. Pyruvic acid
4. Malic acid
5. Succinic acid
6. Lactic acid
7. Fumaric acid
8. Acetic acid
9. Pyroglutamic acid



Column : Shodex RSPak KC-LG + KC-811 x 2
Eluent : 4.8mM HClO₄ 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 H₂SO₄ 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