

Ligand Exchange Chromatography Columns

* Please check our website for elution-volume summary lists of various saccharides using Shodex columns.

Features

SC1011

SP0810

KS-801

KS-802

- Separates saccharides by 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 fulfills USP-NF L19 and L22 requirements
- SP0810 fulfills USP-NF L22 and L34 requirements
- KS-801 and KS-802 fulfill USP-NF L22 and L58 requirements

KS-803

KS-804

- Suitable for separation of polysaccharides by size exclusion mode
- Can be used in combination with other columns e.g., KS-801 and/or KS-802
- Only water is required for the analysis of neutral sugars
- Fulfill USP-NF 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-NF L22 and L58 requirements
- SZ5532 fulfills USP-NF L22 requirements
- SC1211 fulfills USP-NF L19 and L22 requirements

SC1011-7F

MN-431

- Pharmacopoeia method relevant columns
- Ca²⁺ modified ligand exchange chromatography column
- Only water is required for the analysis of neutral sugars
- Fulfill USP-NF L19 and L22 requirements

Ligand exchange and size exclusion

• Standard columns

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
F6700090	SUGAR SC-G 6B	(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	(guard column)	Sulfo (Pb ²⁺)	—	10	6.0 x 50	H ₂ O
F6378106	SUGAR SP0810 8C	≥ 3,000	Sulfo (Pb ²⁺)	1,000	7	8.0 x 100	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
F6700020	SUGAR KS-G 6B	(guard column)	Sulfo (Na ⁺)	—	10	6.0 x 50	H ₂ O

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	(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	(guard column)	Sulfo (Ca ²⁺)	10	—	4.6 x 10	H ₂ O/CH ₃ CN = 75/25

Base Material: Styrene divinylbenzene copolymer

Pharmacopoeia Method Relevant Columns

● Standard columns

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 x 300	H ₂ O
F6700090	SUGAR SC-G 6B (guard column)	Sulfo (Ca ²⁺)	10	6.0 x 50	H ₂ O
F6379230	USPpak MN-431	Sulfo (Ca ²⁺)	8	4.0 x 250	H ₂ O

See page 70 for USP-NF Column List.

Base Material: Styrene divinylbenzene copolymer

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
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	2 peaks	2 peaks	5.90	2 peaks	12.73	2 peaks
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 : H₂O
Flow rate : 1.0 mL/min
Detector : RI
Column temp. : 80 °C

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

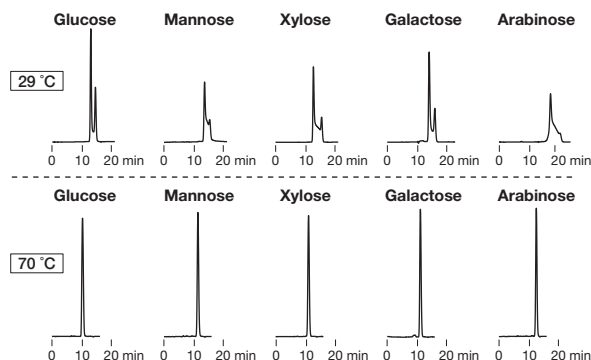
Column : SUGAR SZ5532
Eluent : H₂O/CH₃CN = 25/75
Flow rate : 1.0 mL/min
Detector : RI
Column temp. : 60 °C

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

Saccharides anomer separation

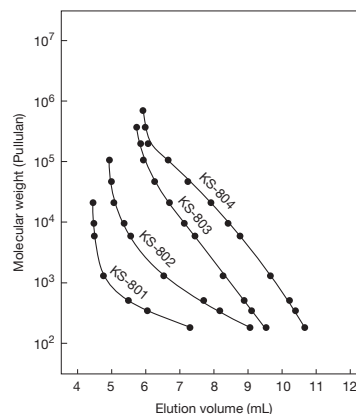
Saccharides may present their anomers at lower temperatures. By setting the SUGAR series columns at higher temperatures will prevent the anomer separation and this results in providing better chromatograms of each saccharide.

Sample : 0.5 % each, 10 μ L



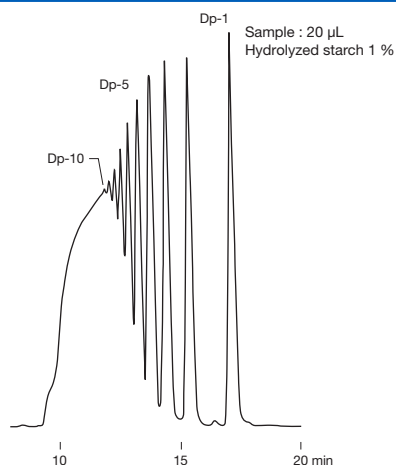
Column : Shodex SUGAR SC1011
 Eluent : H₂O
 Flow rate : 0.7 mL/min
 Detector : RI
 Column temp. : 29 °C, 70 °C

Calibration curves for KS-800 series using pullulan



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

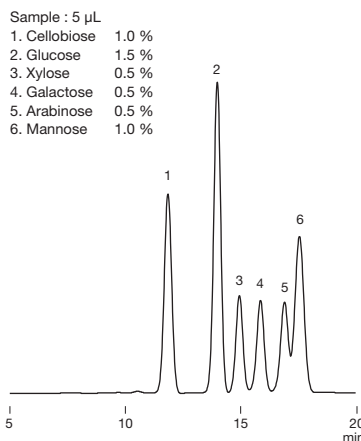
Hydrolyzed starch



Sample : 20 μ L
 Hydrolyzed starch 1 %

Column : Shodex SUGAR KS-802 x 2
 Eluent : H₂O
 Flow rate : 1.0 mL/min
 Detector : RI
 Column temp. : 80 °C

Biomass sugars

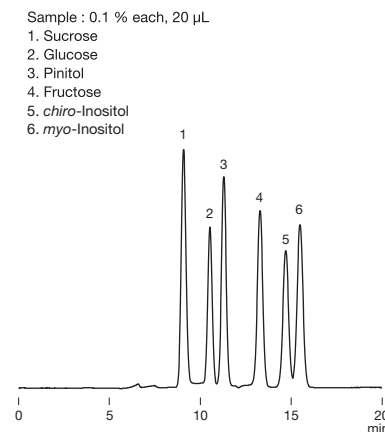


Sample : 5 μ L

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 : 0.6 mL/min
 Detector : RI
 Column temp. : 85 °C

Pinitol



Sample : 0.1 % each, 20 μ L

1. Sucrose
2. Glucose
3. Pinitol
4. Fructose
5. *chiro*-Inositol
6. *myo*-Inositol

Column : Shodex SUGAR SP0810
 Eluent : H₂O
 Flow rate : 0.8 mL/min
 Detector : RI
 Column temp. : 85 °C

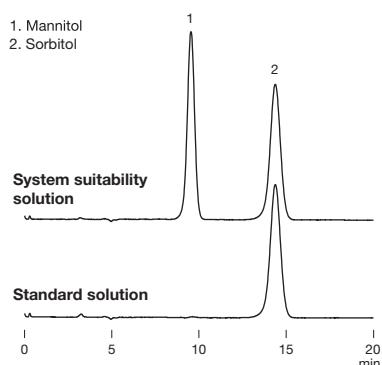
Analysis of sorbitol according to USP-NF method

Sample : 10 μ L
 (System suitability solution) Mannitol, Sorbitol 4.8 mg/g each
 (Standard solution) Sorbitol 4.8 mg/g

1. Mannitol
 2. Sorbitol

System suitability solution

Standard solution

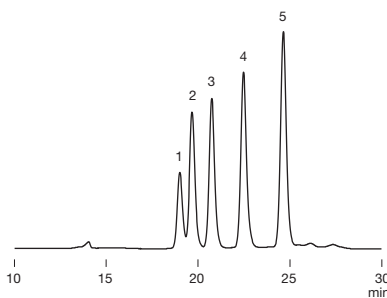


Column : Shodex SUGAR SP0810 8C
 Eluent : H₂O
 Flow rate : 0.7 mL/min
 Detector : RI (35 °C)
 Column temp. : 50 °C

Oligosaccharides in soybean

Sample : 0.1 % each, 20 μ L

1. Verbascose
2. Stachyose
3. Raffinose
4. Sucrose
5. Pinitol

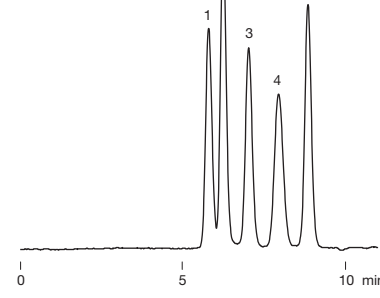


Column : Shodex SUGAR KS-802 + KS-801
 Eluent : H₂O
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 85 °C

Saccharides related to raffinose biosynthesis

Sample : 0.1 % each, 20 μ L

1. Raffinose
2. Sucrose
3. Galactinol
4. Galactose
5. *myo*-Inositol

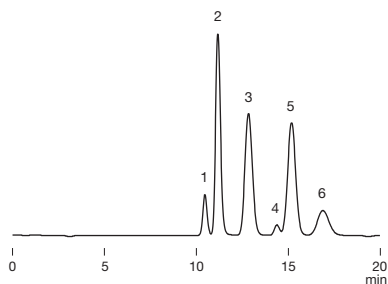


Column : Shodex SUGAR SC1011
 Eluent : H₂O
 Flow rate : 1.0 mL/min
 Detector : RI
 Column temp. : 80 °C

Acesulfame K and sucralose

Sample : 20 μ L

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 %

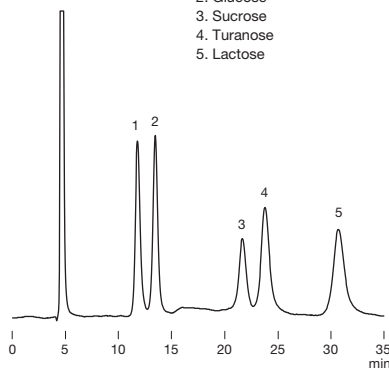


Column : Shodex SUGAR SC1011
 Eluent : 10 mM CaSO₄ aq.
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 80 °C

Sucrose and turanose

Sample : 0.5 % each, 10 μ L

1. Fructose
2. Glucose
3. Sucrose
4. Turanose
5. Lactose

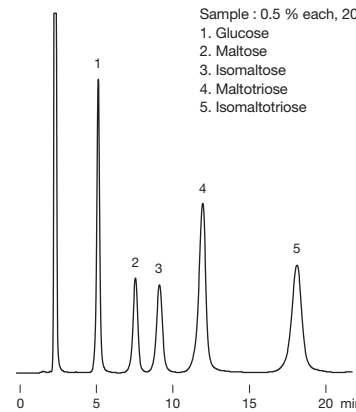


Column : Shodex SUGAR SZ5532
 Eluent : H₂O/CH₃CN = 20/80
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 60 °C

Maltose and isomaltose

Sample : 0.5 % each, 20 μ L

1. Glucose
2. Maltose
3. Isomaltose
4. Maltotriose
5. Isomaltotriose

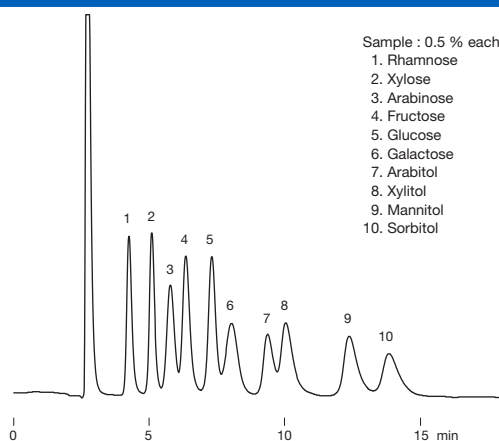


Column : Shodex SUGAR SZ5532
 Eluent : H₂O/CH₃CN = 25/75
 Flow rate : 1.0 mL/min
 Detector : RI
 Column temp. : 60 °C

Saccharides and sugar alcohols

Sample : 0.5 % each, 20 μ L

1. Rhamnose
2. Xylose
3. Arabinose
4. Fructose
5. Glucose
6. Galactose
7. Arabitol
8. Xylitol
9. Mannitol
10. Sorbitol

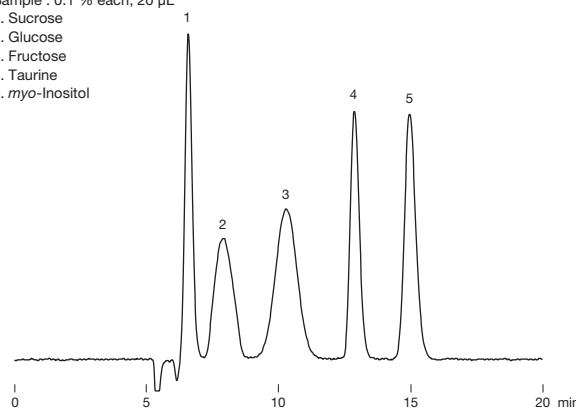


Column : Shodex SUGAR SZ5532
 Eluent : H₂O/CH₃CN = 20/80
 Flow rate : 1.0 mL/min
 Detector : RI
 Column temp. : 65 °C

Saccharides and taurine

Sample : 0.1 % each, 20 μ L

1. Sucrose
2. Glucose
3. Fructose
4. Taurine
5. *myo*-Inositol

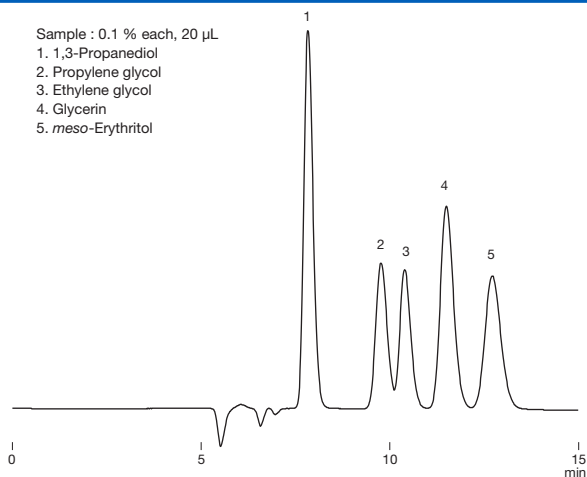


Column : Shodex SUGAR SC1211
 Eluent : H₂O/CH₃CN = 60/40
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 70 °C

Moisturizing components

Sample : 0.1 % each, 20 μ L

1. 1,3-Propanediol
2. Propylene glycol
3. Ethylene glycol
4. Glycerin
5. *meso*-Erythritol



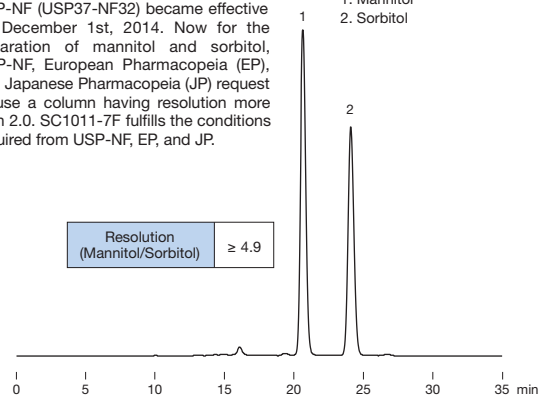
Column : Shodex SUGAR SC1211
 Eluent : H₂O/CH₃CN = 60/40
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 40 °C

Mannitol and sorbitol

Partial modifications on the analytical conditions of mannitol stated in the USP-NF (USP37-NF32) became effective on December 1st, 2014. Now for the separation of mannitol and sorbitol, USP-NF, 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-NF, EP, and JP.

Sample : 25 mg/mL each, 20 μ L

1. Mannitol
2. Sorbitol



Column : Shodex EP SC1011-7F
 Eluent : H₂O
 Flow rate : 0.5 mL/min
 Detector : RI
 Column temp. : 85 °C