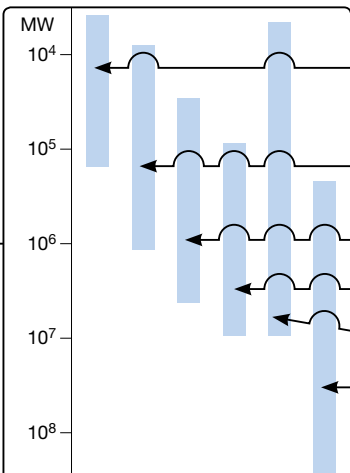
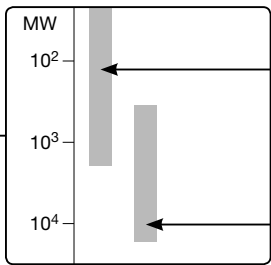


Column Selection (Saccharides)

	Separation mode	Column	Page
Mono-, di-saccharides, and sugar alcohols Saccharides and sugar alcohols	Ligand exchange + SEC	SP0810 (Pb ²⁺)	26
		SC1011 (Ca ²⁺)	26
		KS-801 (Na ⁺)	26
	Ligand exchange + HILIC	SZ5532 (Zn ²⁺)	26
		DC-613 (Na ⁺)	26
	HILIC	VG-50 series	18
		NH2P series	22
Sugar alcohols	Ligand exchange + HILIC	SC1211 (Ca ²⁺)	26
Oligosaccharides and sugar alcohols	Ligand exchange + SEC	KS-801 (Na ⁺) + KS-802 (Na ⁺)	26
Amino sugars	HILIC	VG-50 series	18
		NH2P series	22
	Ion exchange	SC1011 (Ca ²⁺)	26
Acidic sugars	Ion exclusion	SH1011 (H ⁺)	30
		KC-811	30
	Ion exchange	VT-50 2D	18
		NH2P series	22
Saccharides and organic acids	Ion exclusion + SEC	SH1011 (H ⁺), SH1821 (H ⁺)	30
Oligosaccharides	SEC	KS-801 (Na ⁺)	26
		SB-802 HQ	40
		GS-220 HQ	44
		KS-802 (Na ⁺)	26
		SB-802.5 HQ, LB-802.5	40, 41
	HILIC	GS-320 HQ	44
		VN-50 series	18
		NH2P series	22
		KS-803 (Na ⁺)	26
		SB-803 HQ, LB-803	40, 41
Polysaccharides	SEC	KS-804 (Na ⁺)	26
		SB-804 HQ, LB-804	40, 41
		SB-805 HQ, LB-805	40, 41
		SB-806 HQ, LB-806	40, 41
		SB-806M HQ, LB-806M	40, 41
		SB-807 HQ	40



Ligand Exchange Chromatography Columns

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

<https://www.shodex.de/sugar-columns-ligand-exchange>

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

EP 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	Plate Number (TP/column)	Functional Group (Counter Ion)	Particle Size (µm)	Column Size (mm) I.D. x Length	Shipping Solvent
F6379300	SUGAR EP SC1011-7F	≥ 11,000	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	≥ 4,000	Sulfo (Ca ²⁺)	8	4.0 x 250	H ₂ O

See page 72 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
<i>meso</i> -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
<i>myo</i> -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

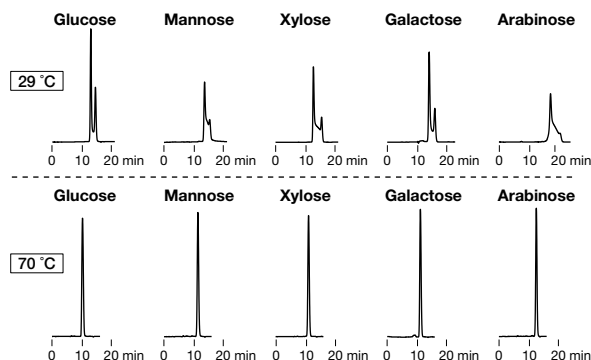
Column : SUGAR SZ5532
Eluent : H₂O/CH₃CN = 25/75
Flow rate : 1.0 mL/min
Detector : RI
Column temp. : 60 °C

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

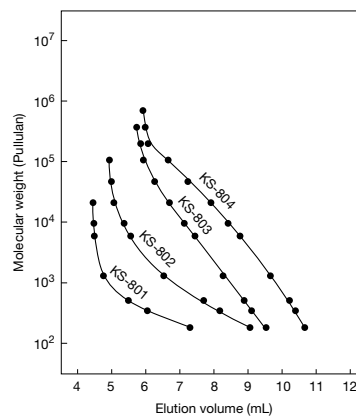
Saccharides may present their anomers at lower temperatures. By setting the SUGAR series columns at higher temperatures will prevent the anomer separation and this results in providing better chromatograms of each saccharide.

Sample : 0.5 % each, 10 μ L



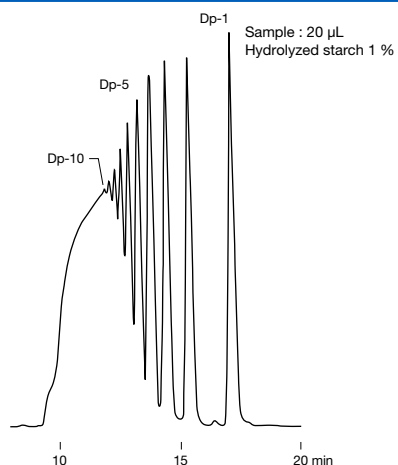
Column : Shodex SUGAR SC1011
Eluent : H₂O
Flow rate : 0.7 mL/min
Detector : RI
Column temp. : 29 °C, 70 °C

Calibration curves for KS-800 series using pullulan



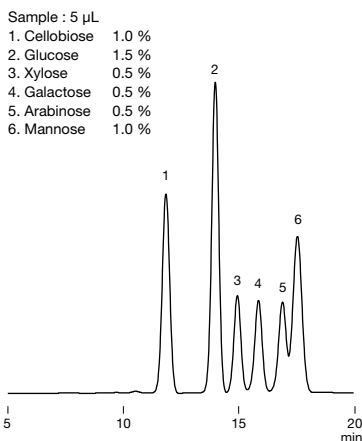
Column : Shodex SUGAR KS-800 series
Eluent : H₂O
Detector : RI
Column temp. : 80 °C

Hydrolyzed starch



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

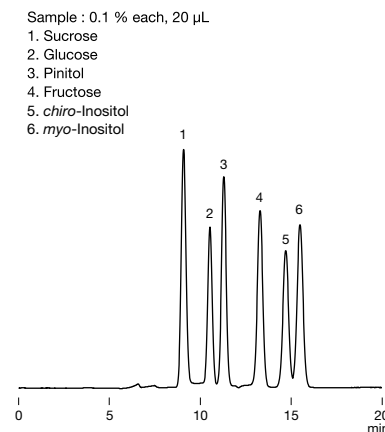
Biomass sugars



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

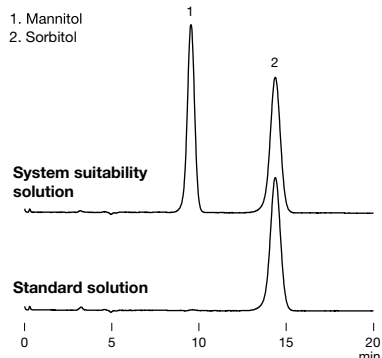


Sample : 0.1 % each, 20 μ L
 1. Sucrose
 2. Glucose
 3. Pinitol
 4. Fructose
 5. *chiro*-Inositol
 6. *myo*-Inositol

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

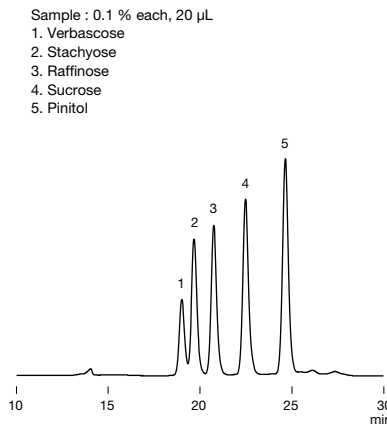
Analysis of sorbitol according to USP-NF method

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



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

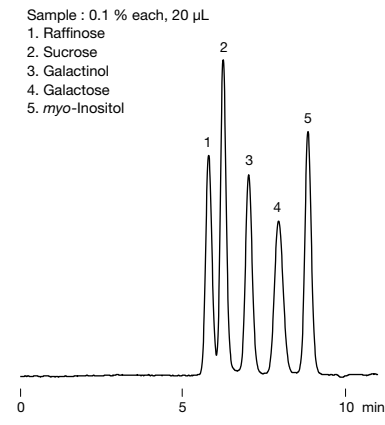
Oligosaccharides in soybean



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



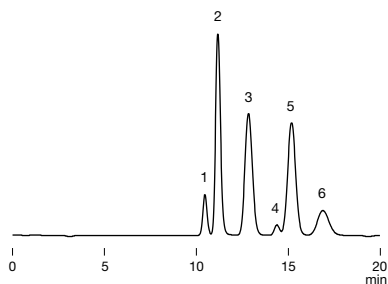
Sample : 0.1 % each, 20 μ L
 1. Verbascose
 2. Sucrose
 3. Galactinol
 4. Galactose
 5. *myo*-Inositol

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 %

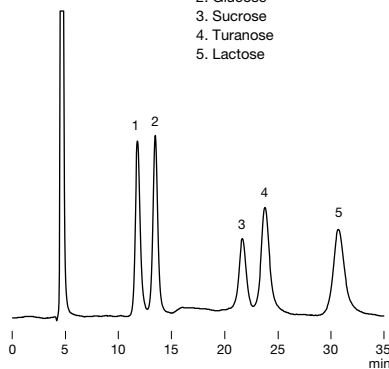


Column : Shodex SUGAR SC1011
 Eluent : 10 mM CaSO₄ aq.
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 80 °C

Sucrose and turanose

Sample : 0.5 % each, 10 μ L

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

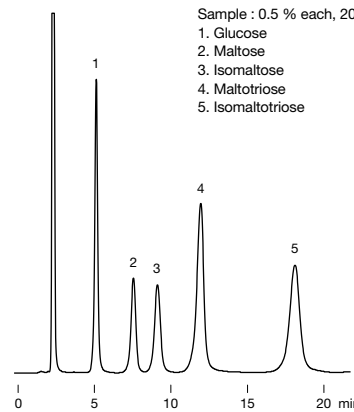


Column : Shodex SUGAR SZ5532
 Eluent : H₂O/CH₃CN = 20/80
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 60 °C

Maltose and isomaltose

Sample : 0.5 % each, 20 μ L

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

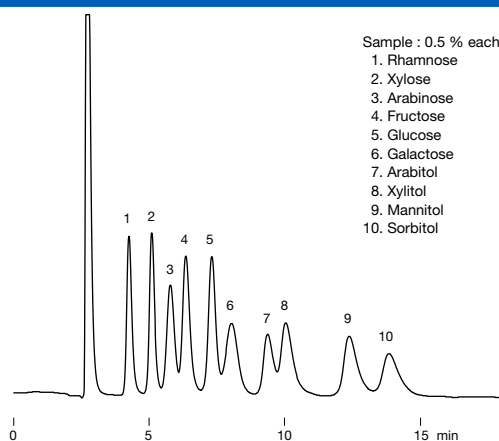


Column : Shodex SUGAR SZ5532
 Eluent : H₂O/CH₃CN = 25/75
 Flow rate : 1.0 mL/min
 Detector : RI
 Column temp. : 60 °C

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

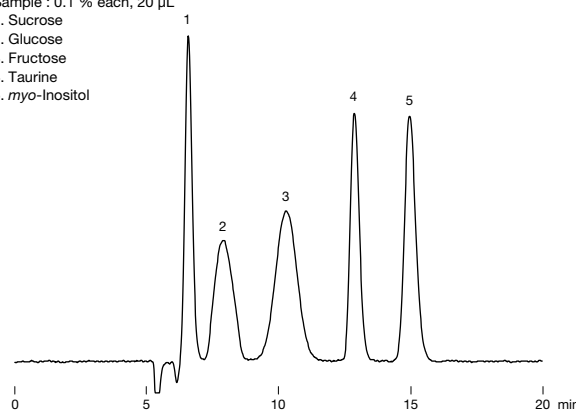


Column : Shodex SUGAR SZ5532
 Eluent : H₂O/CH₃CN = 20/80
 Flow rate : 1.0 mL/min
 Detector : RI
 Column temp. : 65 °C

Saccharides and taurine

Sample : 0.1 % each, 20 μ L

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

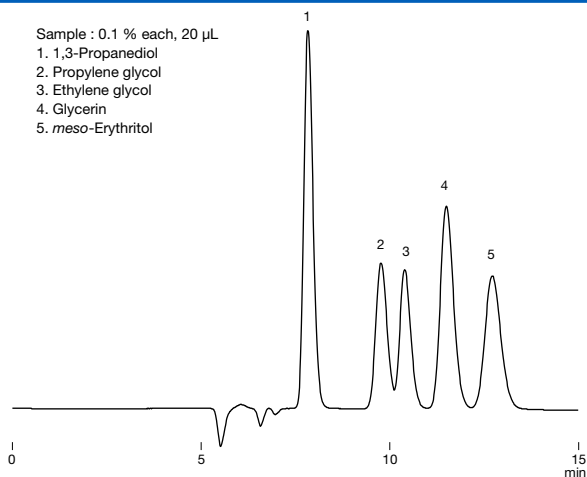


Column : Shodex SUGAR SC1211
 Eluent : H₂O/CH₃CN = 60/40
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 70 °C

Moisturizing components

Sample : 0.1 % each, 20 μ L

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

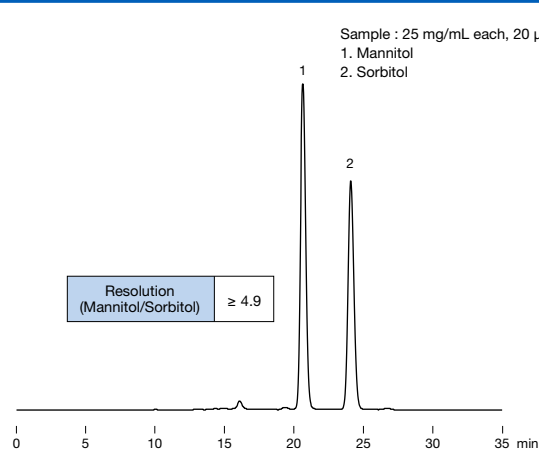


Column : Shodex SUGAR SC1211
 Eluent : H₂O/CH₃CN = 60/40
 Flow rate : 0.6 mL/min
 Detector : RI
 Column temp. : 40 °C

Analysis of mannitol according to Pharmacopeias (JP, USP and EP)

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