HPLC Columns for Carbohydrates

Product Specification

Within the different classes of sugars, chemical and physical properties vary only slightly. HPLC separations of carbohydrates depend on differences in conformation, configuration, and column type. Because of this complexity, no single HPLC column or method is capable of separating every carbohydrate. We offer eight SUPELCOSIL™ and SUPELCOGEL™ columns for separating mono-, di-, tri-, and oligosaccharides. To choose the best column for your carbohydrate analysis, consult Table 1 (below), the Retention Time Index (next page), and the Applications section of our catalog. For more information, request Bulletin 887 (*HPLC Carbohydrate Column Selection Guide*).

SUPELCOGEL K columns are useful for separating raffinose, sucrose, glucose, fructose, and betaine, a trimethylammonium zwitterionic compound found in beet and cane sugars and widely distributed in other plants.

The lead-form resin in **SUPELCOGEL Pb columns** provides the highest resolution and best selectivity for monosaccharides, including excellent separation of xylose, galactose, and mannose.

SUPELCOGEL Ca columns provide excellent separations of monosaccharides and sugar alcohols. Di-, tri-, and oligosaccharides are separated by class. This column often is used to separate sugars in high fructose corn syrup (HFCS).

SUPELCOGEL C-610H and H columns are ideal for separating carbohydrates, alcohols, and organic acids present in the same sample: fermentation products, fruit juices, etc.

SUPELCOGEL Column Characteristics

Particles:	sulfonated polystyrene/divinyl benzene, spherical, 9µm
Counter Ion:	varies (see Table 1)
pH Range:	1 - 13
Organic Compatibility:	<10% in mobile phase
Maximum Temperature:	varies (see Table 1)
Maximum Flow Rate:	1.5mL/min (7.8mm ID columns) 0.4mL/min (4.6mm ID columns)
Maximum Pressure:	1000psi (70 bar)

SUPELCOSIL LC-NH_2 Column Characteristics

Particles:	spherical silica, 5µm
Bonded Phase:	aminopropylsilyl
pH Range:	2 - 7.5
Organic Compatibility:	no limits (avoid aldehydes and ketones)
Maximum Flow Rate:	2mL/min (4.6mm ID columns)
Maximum Pressure:	6000psi (420 bar)

SUPELCOGEL C-611 columns contain a unique ion exchange resin containing two divalent cations, rather than one. This provides different selectivities for separating monosaccharides and sugar alcohols. Di-,tri-, and oligosaccharides are separated by class. Galactose and mannose are well separated.

SUPELCOGEL Ag columns provide rapid oligosaccharide separations.Glycerol and ethanol are well resolved.

Silica-based **SUPELCOSIL LC-NH_2 columns** separate monosaccharides, disaccharides, and some trisaccharides. Sugar retention decreases as the proportion of water : acetonitrile in the mobile phase is increased. Sugars generally will be eluted in order of increasing molecular weight.

Table 1. Carbohydrate Column Applications and Mobile Phases

Column	Application	Form	Typical Mobile Phase	Max. Temp. (°C)
SUPELCOGEL K	beet sugar, cane sugar, molasses, corn syrup	potassium	10mM K_2HPO_4	90
SUPELCOGEL Pb	monosaccharides, xylose/galactose/mannose	lead	deionized water	90
SUPELCOGEL Ca	high fructose corn syrup, monosaccharides, sugar alcohols, oligosaccharides	calcium	deionized water	90
SUPELCOGEL C-610H	organic acids	hydrogen	0.1% H_2SO_4 or H_3PO_4	60
SUPELCOGEL H	organic acids	hydrogen	0.1% H_2SO_4 or H_3PO_4	90
SUPELCOGEL C-611	mono-, di-, and trisaccharides, galactose/mannose	mixed cations (Ca^{++}, Mg^{++})	10^{-4} N NaOH	85
SUPELCOGEL Ag	oligosaccharides, glycerol/ethanol, beer, corn syrup, hydrolyzed starch	silver	deionized water	90
SUPELCOSIL LC-NH_2	mono-, di-, and trisaccharides	aminopropyl silica	75% CH_3CN in water	70

SUPELCOGEL and SUPELCOSIL Carbohydrate Columns and Guard Columns

Column	Length (cm)	ID (mm)	Cat. No.	Supelguard™ Guard Column	Cat. No.
SUPELCOGEL K	30	7.8	**59342**	K*	**59344**
SUPELCOGEL Pb	30	7.8	**59343**	Pb*	**59345**
SUPELCOGEL Ca	30	7.8	**59305-U**	Ca*	**59306-U**
SUPELCOGEL C-610H	30	7.8	**59320-U**	H*	**59319**
SUPELCOGEL H	30	7.8	**59304-U**	H*	**59319**
SUPELCOGEL H	25	4.6	**59346**	H*	**59319**
SUPELCOGEL C-611	30	7.8	**59310-U**	Ca*	**59306-U**
SUPELCOGEL Ag	30	7.8	**59315**	Ag*	**59316**
SUPELCOSIL LC-NH_2	25	4.6	**58338**	LC-NH_2**	**59558** (kit - column + holder) **59568** (pk. of 2 columns)

*5cm x 4.6mm ID column. **2cm x 4.6mm ID column.

Table 2. Retention Time Index for Carbohydrate Columns
(For optimal separations, allow at least 1 minute between compounds.)

	SUPELCOGEL Columns								SUPELCOSIL
	Ca	**C-610H**	**H**	**H**	**Pb**	**C-611**	**K**	**Ag**	**LC-NH_2**
Cat. No.:	**59305-U**	**59320-U**	**59304-U**	**59346**	**59343**	**59310-U**	**59342**	**59315**	**58338**
Dimensions (mm):	300 x 7.8	300 x 7.8	300 x 7.8	250 x 4.6	300 x 7.8	300 x 7.8	300 x 7.8	300 x 7.8	250 x 4.6
Temperature:	80°C	30°C	30°C	30°C	85°C	60°C	85°C	85°C	ambient
Mobile Phase:	DH_2O	0.1% H_3PO_4	0.1% H_3PO_4	0.1% H_3PO_4	DH_2O	10^{-4} N NaOH	15mM K_2HPO_4	DH_2O	ACN:DH_2O (3:1)
Flow Rate (mL/min):	0.5	0.5	0.5	0.17	0.5	0.5	0.5	0.5	1.0
Detection: refractive index									
Compound	**Retention Times (min)**								
Arabinose	15.3	13.9	14.3	13.8	19.2	19.6	16.8	17.1	7.5
Arabitol	19.8	14.1	14.9	14.3	32.3	22.8	13.5	16.0	7.2
Betaine	**ND**	**ND**	**ND**	**ND**	**NR**	**ND**	13.0	**ND**	**ND**
Dulcitol	22.3	13.4	14.2	13.7	43.4	25.7	12.9	15.9	9.0
Erythritol	17.7	15.0	15.6	14.8	24.5	20.2	14.0	16.1	5.9
Ethanol	19.4	25.6	**ND**	**ND**	**ND**	21.0	**ND**	18.4	**NR**
Fructose	14.9	13.1	13.3	12.9	20.8	20.7	15.2	16.0	8.3
Galactose	13.4	12.9	13.0	12.6	17.6	17.6	15.1	15.8	10.3
Glucose	12.0	12.1	11.9	11.7	14.9	15.8	14.0	14.6	9.8
Glycerol	18.7	16.8	17.6	16.6	23.8	20.9	15.2	17.1	**NR**
Inositol	14.9	12.6	12.7	12.4	24.5	20.1	15.7	17.4	**ND**
Isomaltose	9.6	10.3	**ND**	**ND**	**ND**	13.8	**ND**	11.6	19.4
Isomaltotriose	8.5	9.5	**ND**	**ND**	**ND**	12.6	**ND**	9.8	**NR**
Lactitol	**ND**	**ND**	11.1	11.0	26.5	**ND**	10.6	**ND**	**ND**
Lactose	10.2	10.8	10.2	10.2	13.5	14.3	10.9	11.8	19.5
Maltitol	13.6	11.0	10.7	10.7	23.8	17.7	10.2	15.0	15.5
Maltoheptaose	7.5	8.8	7.6	7.9	9.2	11.6	7.2	7.3	**NR**
Maltohexaose	7.7	8.9	7.7	8.1	9.7	12.0	7.4	7.6	**NR**
Maltopentaose	7.9	9.1	7.9	8.2	10.5	12.6	7.8	8.1	**NR**
Maltose	9.8	10.5	9.9	9.9	13.0	14.2	10.7	11.5	17.4
Maltotetraose	8.3	9.3	8.2	8.5	11.2	13.2	8.4	8.8	**NR**
Maltotriose	8.8	9.7	8.8	9.0	12.0	13.6	9.2	9.8	31.0
Mannitol	19.2	13.2	13.7	13.2	32.5	22.1	12.6	15.2	9.2
Mannose	13.7	12.8	12.9	12.5	19.8	18.9	15.6	15.9	9.1
Melezitose	8.7	9.7	8.8	9.0	10.8	12.4	8.6	9.3	24.5
Psicose	22.5	13.4	14.5	13.9	36.5	32.9	15.5	17.2	6.6
Raffinose	8.7	9.7	8.7	8.9	11.2	12.6	8.7	9.6	29.7
Ribitol	16.7	13.7	14.2	13.6	25.1	19.5	13.1	15.3	**ND**
Ribose	24.3	14.2	15.8	15.0	40.7	34.6	17.7	19.1	6.0
Sorbitol	23.4	13.4	14.4	13.9	46.9	28.3	13.3	16.3	9.0
Stachyose	8.1	9.3	8.1	8.4	10.4	11.9	7.9	8.5	67.3
Sucrose	9.8	10.6	9.9	9.9	12.2	13.6	10.1	11.2	14.0
Xylitol	23.3	14.4	15.7	15.0	42.1	28.0	14.2	17.1	7.3
Xylose	13.2	12.8	12.8	12.6	16.1	17.2	15.3	15.6	6.8

NR - not recommended ND - no data available

For resins used in processing sugars and foods refer to the low pressure LC media section of our catalog.

Contact our Technical Service Department
(phone 800-359-3041 or 814-359-3041,
FAX 800-359-3044 or 814-359-5468)
for expert answers to your questions.

For more information, or current prices, contact your nearest Supelco subsidiary listed below. To obtain further contact information, visit our website (www.sigma-aldrich.com), see the Supelco catalog, or contact Supelco, Bellefonte, PA 16823-0048 USA.

ARGENTINA · Sigma-Aldrich de Argentina, S.A. · Buenos Aires 1119 **AUSTRALIA** · Sigma-Aldrich Pty. Ltd. · Castle Hill NSW 2154 **AUSTRIA** · Sigma-Aldrich Handels GmbH · A-1110 Wien
BELGIUM · Sigma-Aldrich N.V./S.A. · B-2880 Bornem **BRAZIL** · Sigma-Aldrich Quimica Brasil Ltda. · 01239-010 São Paulo, SP **CANADA** · Sigma-Aldrich Canada, Ltd. · 2149 Winston Park Dr., Oakville, ON L6H 6J8
CZECH REPUBLIC · Sigma-Aldrich s.r.o.· 186 00 Praha 8 **DENMARK** · Sigma-Aldrich Denmark A/S · DK-2665 Vallensbaek Strand **FINLAND** · Sigma-Aldrich Finland/YA-Kemia Oy · FIN-00700 Helsinki
FRANCE · Sigma-Aldrich Chimie · 38297 Saint-Quentin-Fallavier Cedex **GERMANY** · Sigma-Aldrich Chemie GmbH · D-82041 Deisenhofen **GREECE** · Sigma-Aldrich (o.m.) Ltd. · Ilioupoli 16346, Athens
HUNGARY · Sigma-Aldrich Kft. · H-1067 Budapest **INDIA** · Sigma-Aldrich Co. · Bangalore 560 048 **IRELAND** · Sigma-Aldrich Ireland Ltd. · Dublin 24 **ISRAEL** · Sigma Israel Chemicals Ltd. · Rehovot 76100
ITALY · Sigma-Aldrich s.r.l. · 20151 Milano **JAPAN** · Sigma-Aldrich Japan K.K. · Chuo-ku, Tokyo 103 **KOREA** · Sigma-Aldrich Korea · Seoul **MALAYSIA** · Sigma-Aldrich (M) Sdn. Bhd. · 58200 Kuala Lumpur
MEXICO · Sigma-Aldrich Química S.A. de C.V. · 50200 Toluca **NETHERLANDS** · Sigma-Aldrich Chemie BV · 3330 AA Zwijndrecht **NORWAY** · Sigma-Aldrich Norway · Torshov · N-0401 Oslo
POLAND · Sigma-Aldrich Sp. z o.o. · 61-663 Poznañ **PORTUGAL**· Sigma-Aldrich Quimica, S.A. · Sintra 2710 **RUSSIA** · Sigma-Aldrich Russia · Moscow 103062 **SINGAPORE** · Sigma-Aldrich Pte. Ltd.
SOUTH AFRICA · Sigma-Aldrich (pty) Ltd. · Jet Park 1459 **SPAIN** · Sigma-Aldrich Quimica, S.A. · 28100 Alcobendas, Madrid **SWEDEN** · Sigma-Aldrich Sweden AB · 135 70 Stockholm
SWITZERLAND · Supelco · CH-9471 Buchs **UNITED KINGDOM** · Sigma-Aldrich Company Ltd. · Poole, Dorset BH12 4QH
UNITED STATES · Supelco · Supelco Park · Bellefonte, PA 16823-0048 · Phone 800-247-6628 or 814-359-3441 · Fax 800-447-3044 or 814-359-3044· email:supelco@sial.com