ALCOHOLS

ACIDS

SUGARS

WINE

ANALYSIS OF SUGARS
SUGAR-ALCOHOLS
AND ORGANIC ACIDS

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ABOUT OUR PRODUCTS

Dr. Maisch GmbH is proud to announce its new line of HPLC columns for the separation of sugars, sugar-alcohols and organic acids.

On the market today are many columns designed for Carbohydrate analysis with different chemistries and selectivities. This flyer is designed to help you choose the right column for your separation of carbohydrates.

For separations of sugars, sugar-alcohols and organic acids there are 4 different main methods available.

IMPORTANT

Differences between these 4 column types:

They must be used with different eluents.
The elution order is different.

There are 2 helpfull rules of thumb:
With Reprosil Carbohydrate, Repromer RCX and Reprosil-Pur C18-AQ phases small sugars elute first, then the bigger polysaccharides. The opposite is true for the polymeric Reprogel/ Repromer (H, Ca, K, Na, Pb) phases, where the large polysaccharides elute first.

The separations of monosaccharides improve from Repromer Na to Ca to Pb. For oligosaccharides the opposite is true, the separations improve from Repromer Pb to Ca to Na.

01

Separation with Silica-amino phases
(USP-L8) e.g „Reprosil Carbohydrate“ at temperatures between 20 and 40 C°. Typical eluents are: Acetonitrile / water (about 70/30) Best pH stability is between 3 and 7.

02

Separations with polymeric IEX-phases
Repromer (previous ReproGel), which is a fully sulfonated styrene-divinylbenzene (PSDVB) strong cation exchanger with 8 % crosslinkage. In different ionic forms they are suitable for chromatography of sugars, sugar-alcohols and organic acids.

- Repromer H (USP-L17): Sugars, sugar-alcohols, organic acids
- Repromer Ca (USP-L19): Disaccharides, Monosaccharides, Sugaralcohols
- Repromer Pb (USP-34): Monosaccharides, milk-samples with lactose and lactulose
- Repromer Na (USP-L58): Mono- and Oligosaccharides
- Repromer K

Typical eluents are: water at high temperatures (60–90°C) for all phases, or 5-10 mM H_2SO_4 with the Repromer H phase at lower temperatures. Detection: RI or UV (192–200 nm). Pressure: should be kept below 100 bar.

03

Separations with polymeric anion exchange PSDVB phases at high pH
(USP-L47) in isocratic or gradient mode with PAD, conductivity or RI. Use Repromer 10-RCX: for small sugars and sugar-alcohols up tp DP8 or use Repromer 30 RCX: for bigger sugars up to DP-15. Typical eluents are: 10-100 mM NaOH or sodium acetate for gradients. Pressure stability: Keep pressure below 100 bar.

04

Separation with silica C18-phases
(USP-L1) e.g. Reprosil-Pur C18-AQ, typical eluent is pure water for sugars, or 0.2M H_3PO_4 for org. acids at 20-40 C°. Pressure stability: up to 400 bar.

Reprosil Carbohydrate, 5 µm

250 x 4.6 mm	PN: r15.ch.s2546
250 x 4 mm	PN: r15.ch.s2504
10 x 4.6 mm, 5 guards	PN: r15.ch.v0146
10 x 4 mm, 5 guards	PN: r15.ch.v0104

Repromer H, 9 µm

300 x 8 mm	PN: su9.h0.s3008
250 x 8 mm	PN: su9.h0.s2508
150 x 8 mm	PN: su9.h0.s1508
100 x 8 mm	PN: su9.h0.s1008
20 x 8 mm, short column	PN: su9.h0.s0208
300 x 4.6 mm	PN: su9.h0.s3046
250 x 4.6 mm	PN: su9.h0.s2546
10 x 4.6 mm, 5 guards	PN: su9.h0.v0146

Repromer Ca, 9 µm

300 x 8 mm	PN: su9.ca.s3008
250 x 8 mm	PN: su9.ca.s2508
150 x 8 mm	PN: su9.ca.s1508
100 x 8 mm	PN: su9.ca.s1008
20 x 8 mm, short column	PN: su9.ca.s0208
300 x 4.6 mm	PN: su9.ca.s3046
300 x 4 mm	PN: su9.ca.s3004
250 x 4.6 mm	PN: su9.ca.s2546
250 x 4 mm	PN: su9.ca.s2504
10 x 4 mm, 5 guards	PN: su9.ca.v0104

Repromer Na, 9 µm

300 x 8 mm	PN: su9.na.s3008
250 x 8 mm	PN: su9.na.s2508
150 x 8 mm	PN: su9.na.s1508
100 x 8 mm	PN: su9.na.s1008
20 x 8 mm, short column	PN: su9.na.s0208

Repromer K, 9 µm

300 x 8 mm	PN: su9.ka.s3008
250 x 8 mm	PN: su9.ka.s2508
150 x 8 mm	PN: su9.ka.s1508
100 x 8 mm	PN: su9.ka.s1008
20 x 8 mm, short column	PN: su9.ka.s0208

Repromer Pb, 9 µm

300 x 8 mm	PN: su9.pb.s3008
250 x 8 mm	PN: su9.pb.s2508
150 x 8 mm	PN: su9.pb.s1508
100 x 8 mm	PN: su9.pb.s1008
20 x 8 mm, short column	PN: su9.pb.s0208

Repromer 10 RCX, 7 µm

250 x 4 mm	PN: rm10.rcx.s2504
10 x 4 mm, 5 guards	PN: rm10.rcx.v0104
Guard holder, stand alone	PN: 82.10

Repromer 30 RCX, 7 µm

250 x 4 mm	PN: rm30.rcx.s2504
10 x 4 mm. 5 guards	PN: rm30.rcx.v0104
Guard holder, stand alone	PN: 82.10

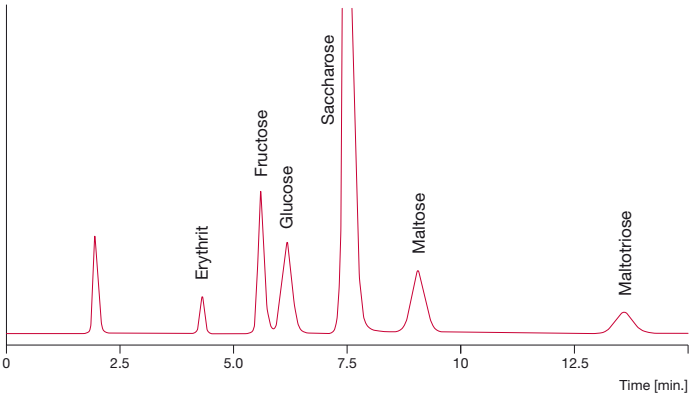
Reprosil-Pur C18-AQ, 5 µm

250 x 4.6 mm	PN: r15.aq.s2546
200 x 4.6 mm	PN: r15.aq.s2046
10x4.6 mm, 5 guards	PN: r15.aq.v0146
Guard holder direct	PN: 81.10

Other dimensions are available on request

REPROSIL CARBOHYDRATE

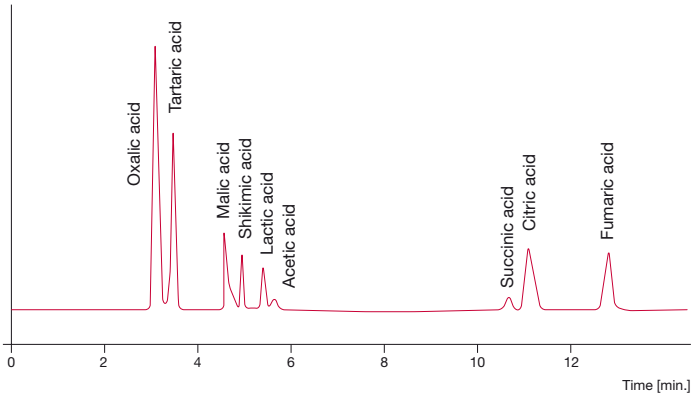
Column: 5 µm (250x4.6 mm)
Flow: 1.4 ml/min.
Eluent: ACN/Water (68/32)
Injection: 10 µl
Temp.: 35° C
Det.: RI



REPROSIL-PUR C18-AQ

Organic acids

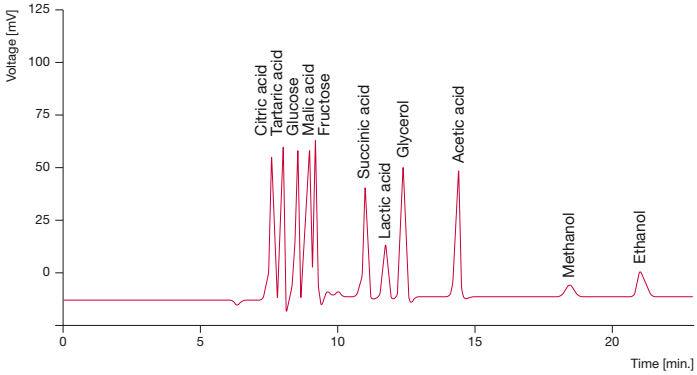
Column: 5 µm (200x4.6 mm)
Eluent: 200mmol/l H_3PO_4
Temp.: 20° C
Det.: 230nm



REPROMER H

Wine components

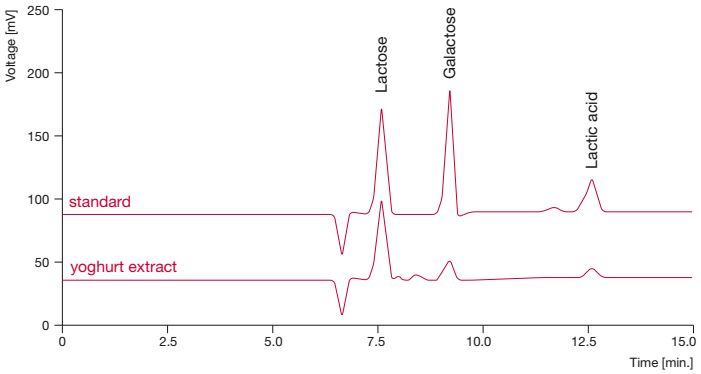
Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: 1 mM sulfuric acid
Pressure: 50 bar
Temp.: 50° C
Det.: RI



REPROMER H

Lactose and lactic acid

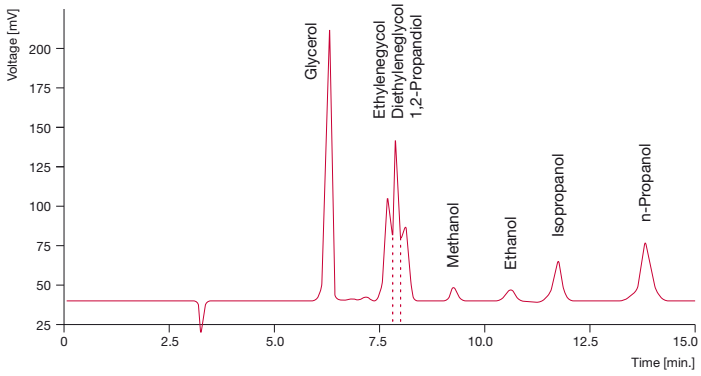
Column: 9 µm (250x8 mm)
Flow: 1 ml/min.
Eluent: 9 mM sulfuric acid
Pressure: 100 bar
Temp.: 25° C
Det.: RI



REPROMER H

Alcohols and glycols

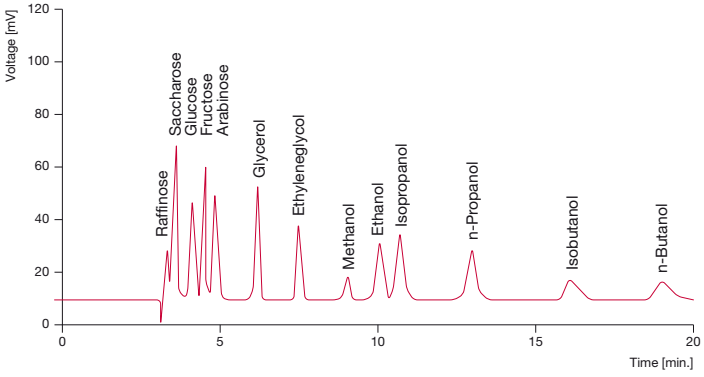
Column: 9 µm (250x8 mm)
Flow: 1 ml/min.
Eluent: 9 mM sulfuric acid
Pressure: 60 bar
Temp.: 45° C
Det.: RI



REPROMER H

Alcohols and sugars

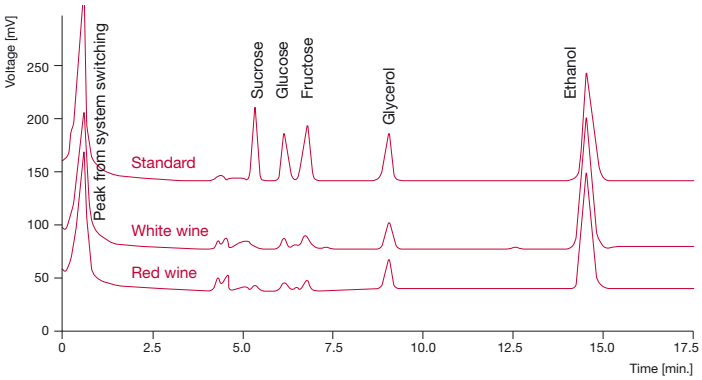
Column: 9 µm (250x8 mm)
Flow: 1 ml/min.
Eluent: 9 mM sulfuric acid
Pressure: 90 bar
Temp.: 25° C
Det.: RI



REPROMER H

Sugars and alcohol in wine-on-line separation

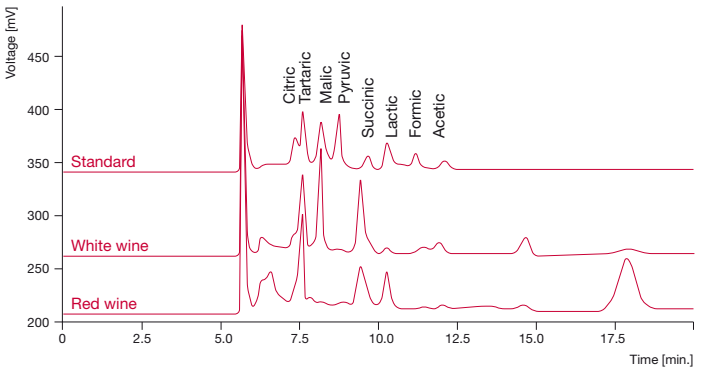
Column: 9 µm (250x8 mm)
Flow: 0.7 ml/min.
Eluent: Water
Pressure: 60 bar
Temp.: 25° C
Det.: RI



REPROMER H

Organic acids in wine-on-line pre-separation on anion exchanger

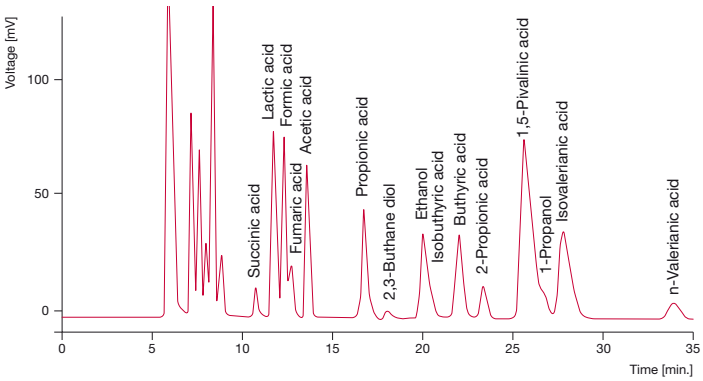
Column: 9um (250x8 mm)
Flow: 0.7 ml/min.
Eluent: 20 mM Methan-sulfonic acid
Pressure: 55 bar
Temp.: 50° C
Det.: 210 nm



REPROMER H

Content of a cow stomach
(only centrifuged and injected)

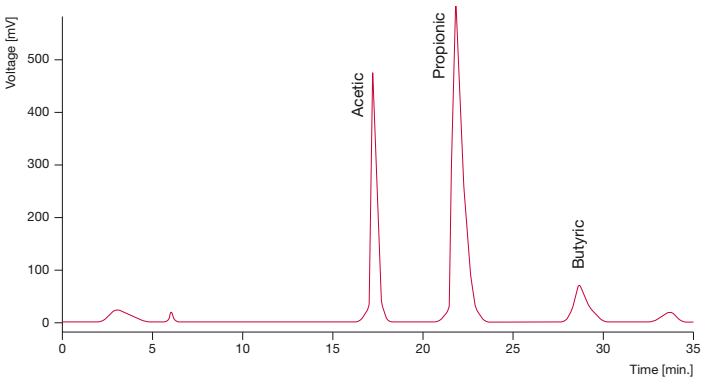
Column: 9um (250x8mm)
Flow: 0.8 ml/min.
Eluent: 6 mM sulfuric acid
Temp.: ambient



REPROMER H

Acetic, propionic and butyric acid

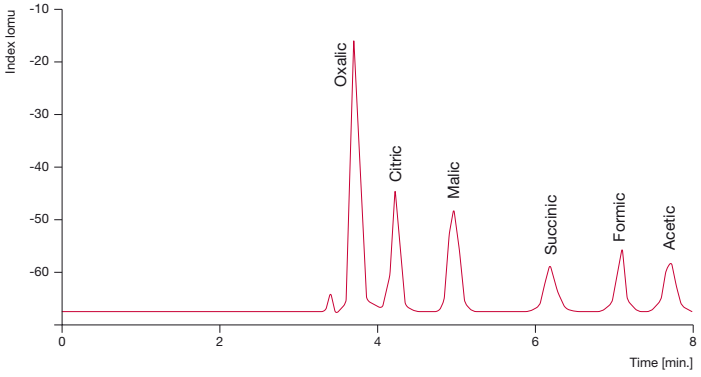
Column: 9um (250x8mm)
Flow: 0.5 ml/min.
Eluent: 1mM sulfuric acid
Temp.: ambient
Det.: 210 nm



REPROMER H

Organic acids

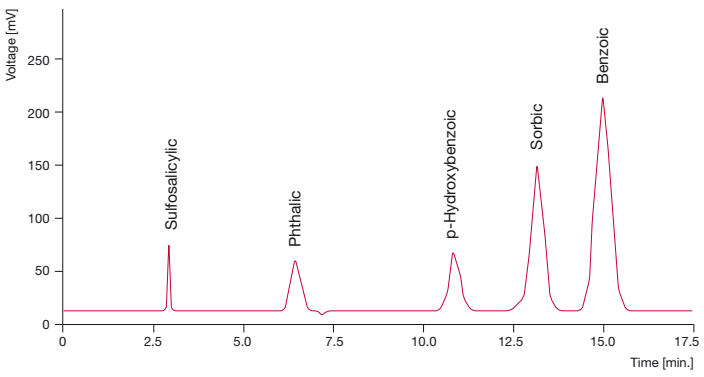
Column: 9 µm (250x8 mm)
Flow: 1 ml/min.
Eluent: 9 mM sulfuric acid
Pressure: 90 bar
Temp.: ambient
Det.: 210 mm



REPROMER H

Aromatic acids

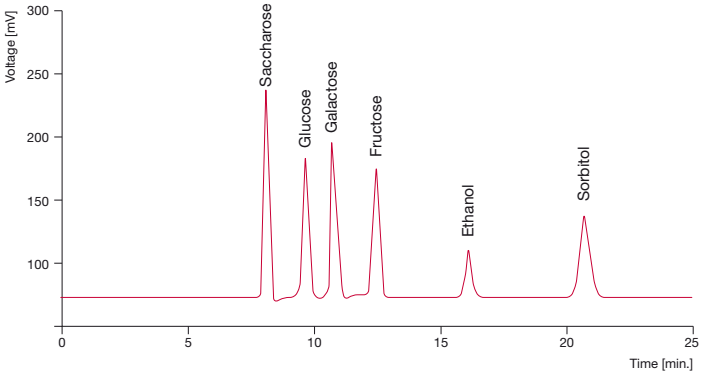
Column: 9 µm (250x8 mm)
Flow: 1 ml/min.
Eluent: 9 mM sulfuric acid
Pressure: 90 bar
Temp.: 80° C
Det.: 254 nm



REPROMER Ca

Sugars and alcohols

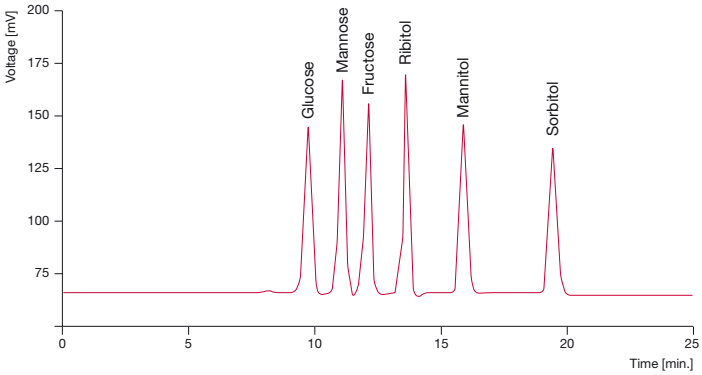
Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: Water
Pressure: 35 bar
Temp.: 80° C
Det.: RI



REPROMER Ca

Sugar alcohols

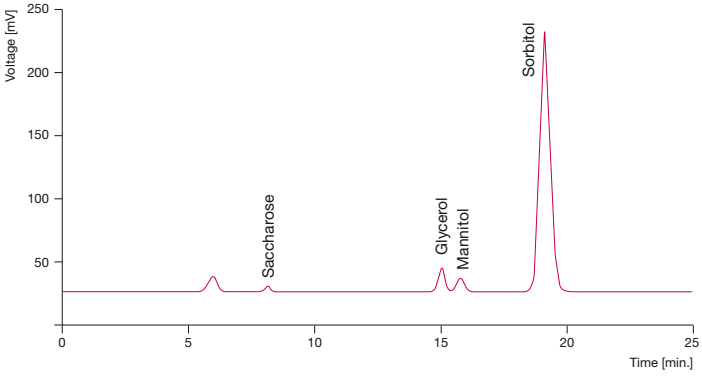
Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: Water
Pressure: 35 bar
Temp.: 80° C
Det.: RI



REPROMER Ca

Sugar free chewing gum

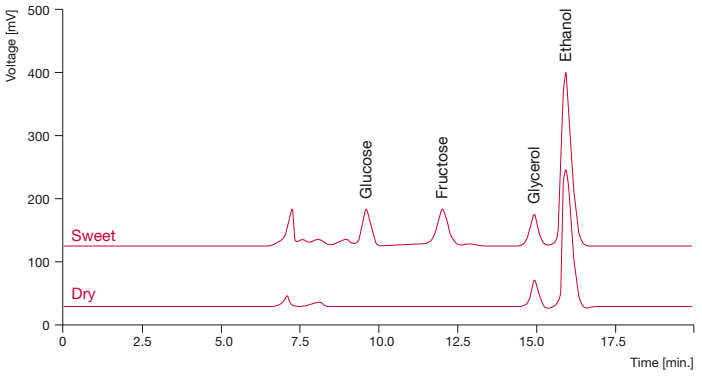
Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: Water
Pressure: 35 bar
Temp.: 80° C
Det.: RI



REPROMER Ca

Red wine

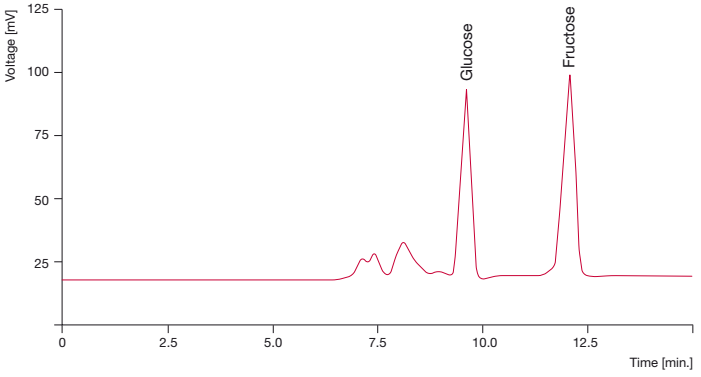
Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: Water
Pressure: 35 bar
Temp.: 80° C
Det.: RI



REPROMER Ca

Bee honey

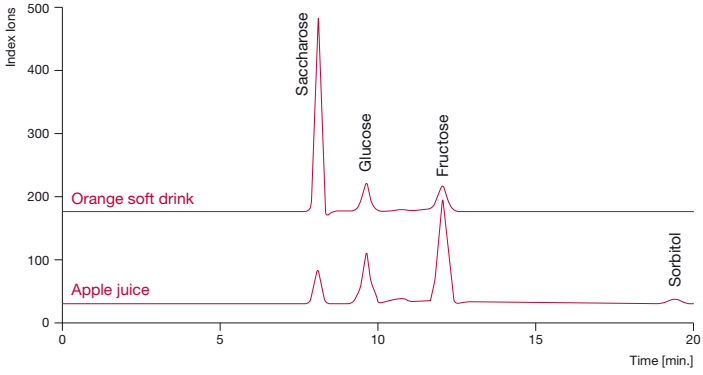
Column: 9 µm (250x8 mm)
Flow: 0.3 ml/min.
Eluent: Water
Pressure: 20 bar
Temp.: 80° C
Det.: RI



REPROMER Ca

Soft drinks

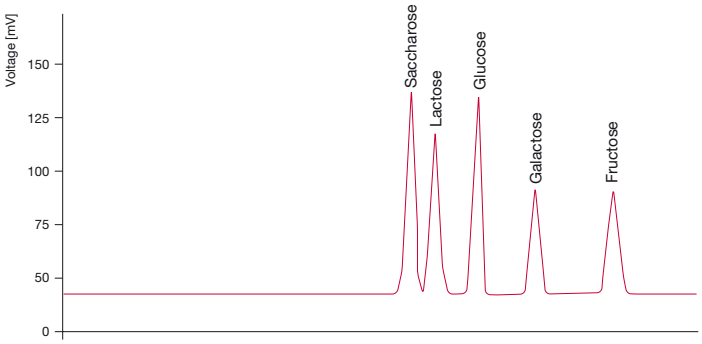
Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: Water
Pressure: 35 bar
Temp.: 80° C
Det.: RI



REPROMER Pb

Saccharose & lactose

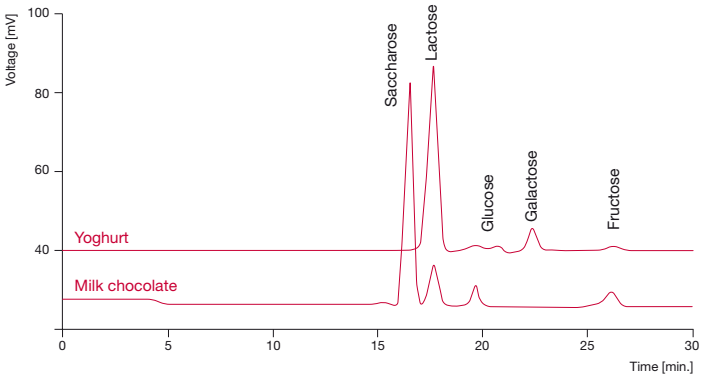
Column: 9 µm (250x8 mm)
Flow: 0.3 ml/min.
Eluent: Water
Pressure: 20 bar
Temp.: 80° C
Det.: RI



REPROMER Pb

Sugars in yoghurt & milk chocolate

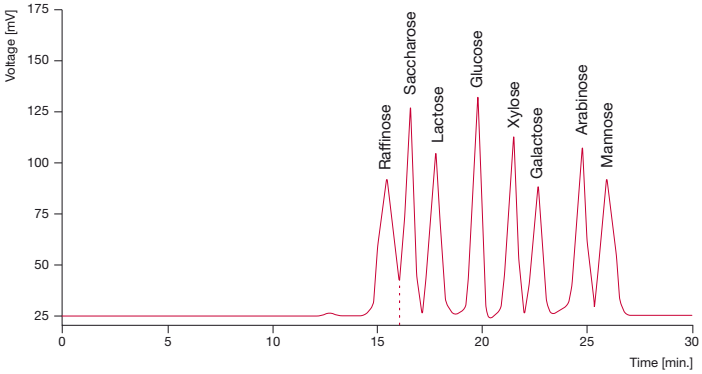
Column: 9 µm (250x8 mm)
Flow: 0.3 ml/min.
Eluent: Water
Pressure: 20 bar
Temp.: 80° C
Det.: RI



REPROMER Pb

Arabinose & mannose

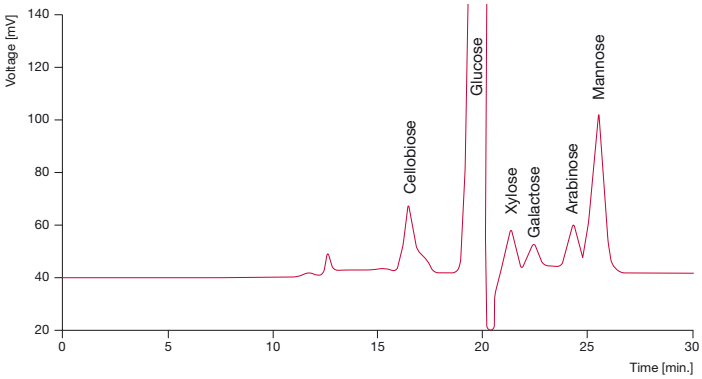
Column: 9 µm (250x8 mm)
Flow: 0.3 ml/min.
Eluent: Water
Pressure: 20 bar
Temp.: 80° C
Det.: RI



REPROMER Pb

Wood pulp hydrolysate mixture

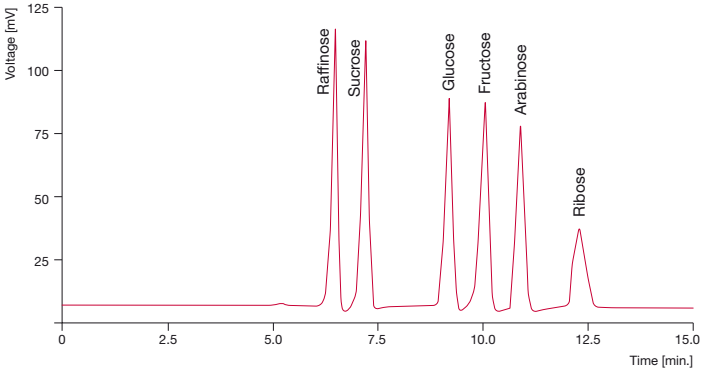
Column: 9 µm (250x8 mm)
Flow: 0.3 ml/min.
Eluent: Water
Pressure: 20 bar
Temp.: 80° C
Det.: RI



REPROMER Na

Sugar mixture

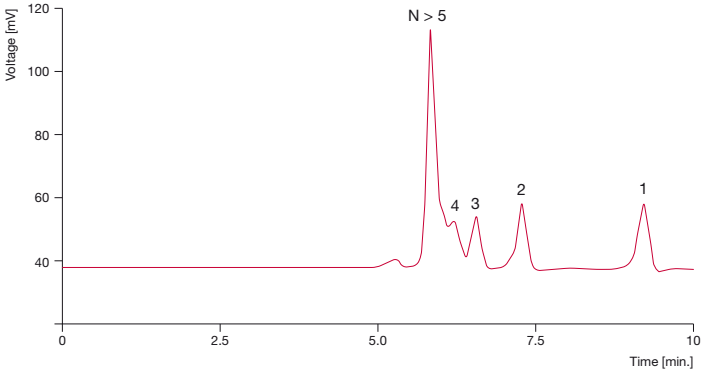
Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: Water
Pressure: 45 bar
Temp.: 80° C
Det.: RI



REPROMER Na

Starch hydrolysate

Column: 9 µm (250x8 mm)
Flow: 0.5 ml/min.
Eluent: Water
Pressure: 45 bar
Temp.: 80° C
Det.: RI



RETENTION TIMES

Reprosil Carbohydrate

Column:	5 µm (250x4.6 mm)
Flow:	1.4 ml/min.
Eluent:	ACN/Water (70/30)
Injection:	10 µl
Temp.:	35° C
Det.:	RI

Substance	min.
Ethanol in dead volume	
Rhamnose	4,1
Ribose	4,2
Erythrit	4,3
Fucose	4,6
Arabinose	5,0
Sorbose	5,3
Fructose	5,6
Mannose	5,8
Glucose	6,2
Galactose	6,4
Sucrose	7,5
Cellobiose	8,8
Trehalose	8,9
Maltose	9,1
Lactose	9,7
Melibiose	10,9
Melezitose	11,5
Raffinose	13,2
Maltotriose	13,6
Stachyose	23.5

Repromer H

Column:	9 µm. 300 x 8 mm
Flow:	0.6 ml/min
Eluent:	9 mM Sulfuric acid
Temp.:	60 C°
Det.:	RI

Substance	min.
Oxalic acid	7.4
Sucrose	inverts
cis-Aconitic acid	8.2
Glucuronic acid	8.5
Oxaloacetic acid	8.7
Citric acid	9.1
Isocitric acid	9.3
alpha-Ketoglutaric a.	9.5
Glucose	9.6
Gluconic acid	9.6
Galacturonic acid	9.7
Maleic acid	9.8
Tartaric acid	9.9
Isocitric acid	10.1
Pyruvic acid	10.4
Glyoxillic acid	10.6
Fructose	10.7
Citramalic acid	11.0
Malic acid	11.1
Quinic acid	11.4
Ascorbic acid	11.6
Malonic acid	11.6
Glyceric acid	12.2
Aconitic acid	13.1
Glucuronic acid	13.1
Glycerol	14.0
Succinic acid	14.1
Lactic acid	15.0
Formic acid	15.8
Fumaric acid	16.4
Acetic acid	17.4
Glutaric acid	17.5
Methanol	19.7
Propionic acid	20.2
Ethanol	22.9
Isobutyric acid	23.4
n-Butyric acid	24.9
2-Propionic acid	26.1
1-Propanol	29.0
Iso-valerianic acid	31.1
N-Valerianic acid	34.5

Repromer Pb

Column:	9 µm. 300 x 8 mm
Flow:	0.5 mL/min.
Eluent:	Deionised water
Temp.:	80° C.
Det.:	RI

Substance	min.
Melezitose	11.6
Raffinose	12.0
Maltotriose	12.2
Cellobiose	12.6
Sucrose	12.8
Trehalose	12.9
Maltose	13.5
Melibiose	13.7
Lactose	13.7
Glucose	15.1
Xylose	16.3
Lactulose	16.5
Galactose	17.0
Sorbose	17.1
Fucose	18.5
Arabinose	18.7
Rhamnose	18.9
Mannose	19.8
Fructose	20.3

Repromer Ca

Column:	9 µm. 300 x 8 mm
Flow:	0.6ml/min.
Eluent:	Water
Temp.:	80 C°
Det.:	RI

Substance	min.
Stachyose	7.8
Maltotetraose	7.9
Gentlanose	8.1
1-Kestose	8.2
Melezitose	8.3
Raffinose	8.4
Maltotriose	8.9
Gentiobiose	8.9
Cellobiose	9.1
Isomaltose	9.1
Sucrose (Saccharose)	9.2
Trehalose	9.2
Maltose	9.3
Palatinose	9.3
Turanose	9.3
Galactopinitol	9.6
Melibiose	9.7
Lactose	9.7
Lactulose	10.5
Galactinol	10.7
Glucose	11.2
Pinitol	11.9
Xylose	12.1
Galactose	12.4
Sorbose	12.4
Lactitol	12.5
Sedoheptulose	12.5
Maltitol	12.7
Rhamnose	12.6
Mannose	12.7
Mannoheptulose	13.0
Sedoheptulosan	13.4
Fructose	13.7
Fucose	13.8
Arabinose	13.9
myo-Inositol	14.0
Glucoheptose	15.1
Adonitol (Ribitol)	15.2
meso-Erythritol	15.9
Glycerol	16.3
Tagatose	16.3
Acetone	16.5
Methanol	16.5
Ethanol	16.9
Acetonitrile	16.9
Ethylen Glycol	17.0
Propylene Glycol	17.4
Mannitol	17.6
Arabitol	18.0
Perseitol	20.0
Galacititol	20.3
Xylitol	20.9
Ribose	21.1
Sorbitol	21.2

Sample preparation

Can be carried out by homogenisation, solubilisation, filtration and / or centrifugation of the samples. If sample contains proteins, please make precipitation with sulfosalicylic acid.

Column protection

Use guard column to protect packing from contamination, if samples are not very clean. Polymeric columns (Repromer / ReproGel) are very sensitive to high backpressures, therefore keep column pressure always below 100 bar. Reprosil Carbohydrate and Reprosil–Pur C18-AQ columns are stable up to 400 bar.

Column cleaning and regeneration of Repromer / Reprogel phases

Cleaning: To clean column from organic contamination, please rinse column with 10 % MeOH / Water mixtures in reverse direction at a low flow for several hours.

Regeneration:

Repromer/ ReproGel

Ca: rinse with 100 mM $Ca(NO_3)_2$ at low flow and high temperature.

Na: rinse with 25 mM NaCl at low flow and high temperature.

K: rinse with 25 mM KNO_3 at low flow and high temperature.

Pb: rinse with 100 mM $Pb(NO_3)_2$ at low flow and high temperature.

Ship and Storage solvent: Pure water

Store polymeric columns in deionised water in a refrigerator.

CROSS-LIST & OPERATING RECOMMENDATIONS FOR REPROMER

	USP-L17	USP-L19	USP-L34	USP-L58
Dr. Maisch	**Repromer H (ReproGel H)**	**Repromer Ca (ReproGel Ca)**	**Repromer Pb (ReproGel H)**	**Repromer Na (R.Gel Na)**
Altech	Brownlee Polypore H	Brownlee Polypore Ca	-	-
Bio-Rad	Aminex HPX-87H	Aminex HPX-87C	Aminex HPX-87P	Aminex 87 N
Hamilton	HC-75 H	HC-75 Ca	HC-75 Pb	-
MN	Nucleogel Sugar H / 300 OA	Nucleogel Sugar Ca	Nucleogel Sugar Pb	Nucleogel Sugar Na
Merck	Polyspher OA KC	Polyspher CH CA	Polyspher CH PB	-
MetaChem	MetaCarb 87H	MetaCarb 87C	MetaCarb 87P	-
Phenomenex	Rezex RHM Monosac.	Rezex RCM Monosac.	Rezex RPM Monosac.	-
Polymer Labs	PL Hi-Plex H	PL Hi-Plex Ca	PL Hi-Plex Pb	-
Shodex	Sugar SH 1011/1821 / Sugar H	Sugar SC1011/1821	Sugar SP0810	Shodex Sugar -KS-80
Supelco	Supelcogel H	Supelcogel Ca	Supelcogel Pb	-
Thermo/Hypersil	HyperREZ Carbohydrate H	HyperREZ Carbohydrate Ca	HyperREZ Carbohydrate Pb	-
Transgenomic	-	CarboSep CHO-620/820 /87-C	CarboSep CHO-682 Lead / 87-P	CoreGel 87N
Varian	Chrompack Org. Acids	Chrompack Carbohydrates Ca	Chrompack Carbohydrates Pb	-
Waters	Fast Fr. Juice /IC Pak ION Excl.	Sugar-Pak 1	-	-
Typical Eluents	5-10 mM Sulfuric acid	Destilled Water	Destilled Water	Destilled Water
Max. Flow	1 ml/min	1 ml/min	1 ml/min	1 ml/min
Max.Pressure	100 bar	100 bar	100 bar	100 bar
Applications	Org. Acids, Sugars, alcohols	Sugars, Alcohols	Sugars, Alcohols,	Sugars, Alcohols,
Temperature	up to 70 C°	60 - 90 C°	60 - 90 C°	60 - 90 C°
Dimensions	300 x 8 (7.8) mm	300 x 8 (7.8)mm, 250 x 4 mm	300 x 8 (7.8)mm	300 x 8 (7.8)mm
Regeneration	25 mM Sulfuric acid	100 mM $Ca(NO_3)_2$	100 mM $Pb(NO_3)_2$	20 mM Na_2HPO_4
Organic modifier	up to 10 % MeOH	up to 10 % MeOH	up to 10 % MeOH	up to 10 % MeOH
Avoid	Salts, Metal Ions	Non-Calcium-salts	Non-Lead-salts	Non-Sodium-salts
Storage solvent	5 - 10 mM Sulfuric acid	Water	Water	Water