

- Cation exchange resins
MCI GEL™ CK series
- Anion exchange resins
MCI GEL™ CA series

Mitsubishi Chemical Ion Exchange Resins

MCI GEL™ specializes in polymer based packing materials. Specifically, polystyrene polymer based ion exchange resins are derived from over 50 years of manufacturing experience of Diaion™ product line. MCI GEL™ ion exchange resins for HPLC have been developed with the same attention to performance and quality. For several decades, Mitsubishi Chemical has been providing MCI GEL™ ion exchange columns are offered in a variety of chemistries, particle sizes and counter ions to support a broad range of applications.

Features

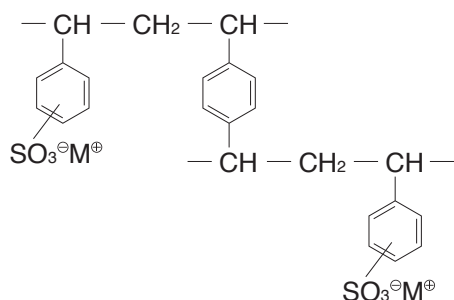
- Variety of products** gel type, porous type, DVB%, particle size, particle size distribution
analytical use, preparative use
- Persistence of high quality, excellent separation performance**
- Accumulation of abundant knowledge and experience of applications**

Ion exchange resins are generally used for analysis of amino acids, sugars, organic acids and amines, etc. MCI GEL™ custom pre-packed columns are specifically designed for each application using the most appropriate packing material among our product line and using the most suitable column dimensions.

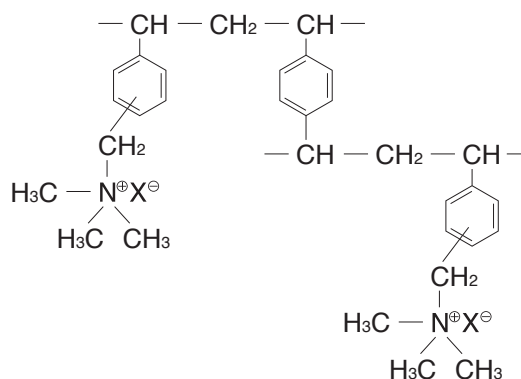
Typical application for each column is shown in this catalog. These data will suggest an appropriate column.

● Chemical structure of ion exchange resin

〈Strongly acidic cation exchange resin〉



〈Strongly basic anion exchange resin〉



● MCI GEL™ columns for HPLC

	Description						Typical usage					
	Product name	Column dimensions I.D×L [mm]	Packing material			USP	Amino acid	Mono saccharide	Oligo-saccharide	Carboxylic acid	Amine	Physiological fluid
			Cross linkage [%]	Counter ion	Particle size [μm]							
MCI GEL™ Cation exchange columns	MCI GEL™ CK10U	6×120	10	Na ⁺	5		○				○	
	MCI GEL™ CK08S	8×500	8	Na ⁺	11	L58		○				
	MCI GEL™ CK08E	8.0×300 7.8×300	8	Na ⁺	9	L58		○				
	MCI GEL™ CK08EC	8.0×300 7.8×300	8	Ca ²⁺	9	L19		○				
	MCI GEL™ CK08EH	8.0×300 7.8×300	8	H ⁺	9	L17		○		○	○	
	MCI GEL™ CK04S	10×200	4	Na ⁺	11	L58			○			
	MCI GEL™ CK04SS	10×200	4	Ag ⁺	11				○			
	MCI GEL™ CK02A	20×250	2	Na ⁺	20	L58			○			
	MCI GEL™ CK02AS	20×250	2	Ag ⁺	20				○			
MCI GEL™ Anion exchange columns	MCI GEL™ CA08F	4.6×250	8	SO ₄ ²⁻	7				○		○	

● Packing materials

Packing materials are available. Please look at P.62 and P.63.

● Description of a gel type ion exchange column

MCI GEL™ CK08EC

for HPLC use

Cation=K
Anion=A

DVB%

Counter ion

(no letter=Na⁺, C=Ca²⁺
S=Ag⁺, H=H⁺)

Particle size (mode)

(A=20μm, S=11μm
E=9μm, F=7μm,
U=5μm)

● Note ; Pre-column and guard column

1. Please consider using a guard column concerning purity of injection sample. Guard columns, are listed in the end of this catalog, should be selected in accordance with a main column.
2. As for analysis of amino acids by MCI GEL™ CK10U, MCI GEL™ AFR2-PC is recommended as a pre-column. The AFR2-PC column is very effective to stabilize base line because it can trap ammonium ion in eluent. A peak caused of the ammonium ion may disturb base line stability.

CK08 series

Cation exchange columns applications; sugars, carboxylic acids, (poly)alcohols, etc.



CK08EC 8×300, 7.8×300

CK08EH 8×300, 7.8×300

● Column list

MCI GEL™ column	Counter ion	Application areas	USP
MCI GEL™ CK08S MCI GEL™ CK08E	Na ⁺	General sugar separation columns	L58
MCI GEL™ CK08EC	Ca ²⁺	The most general sugar separation column Highly recommended for fructose and glucose This column conforms to US Pharmacopeia.	L19
MCI GEL™ CK08EH	H ⁺	Organic acids with H ₃ PO ₄ eluent; sugars with distilled water eluent	L17

Application data of CK08EC

Fig. 2-1 Sugars

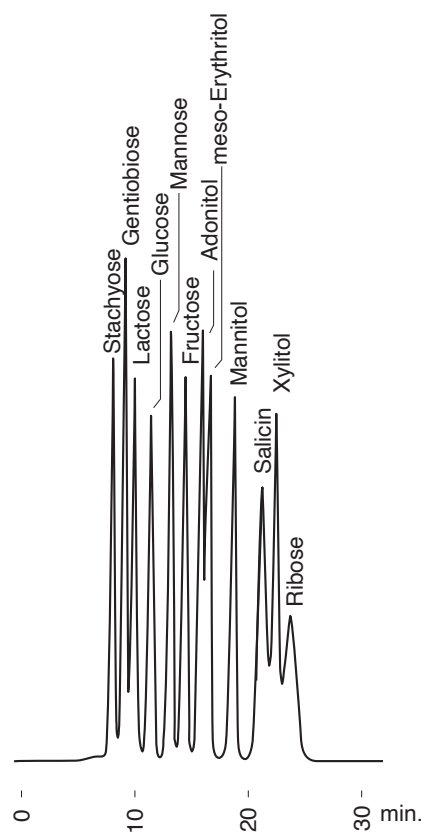
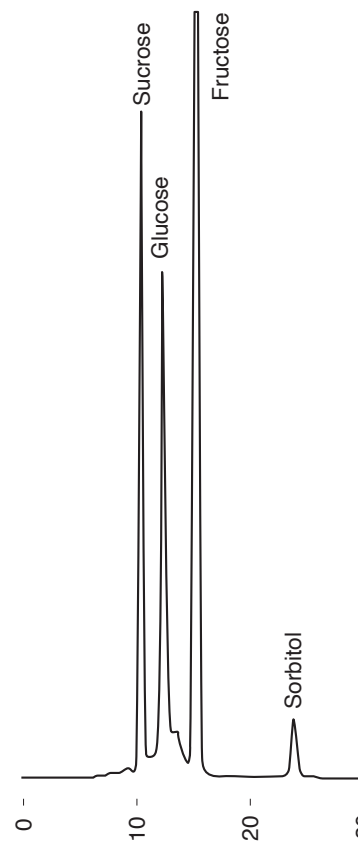
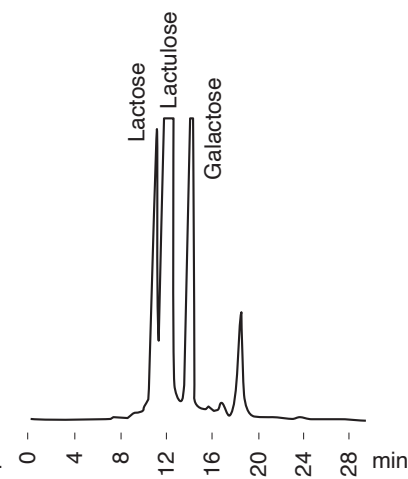


Fig. 2-2 Apple juice



Conditions
 Column : MCI GEL™ CK08EC
 8mm I.D.×300mm
 Eluent : H₂O
 Flow rate : 0.6mL/min
 Column temp. : 75°C
 Detection : RI

Fig. 2-3 Lactulose syrup



Application data of CK08EC

Fig. 2-4 Sports drink A

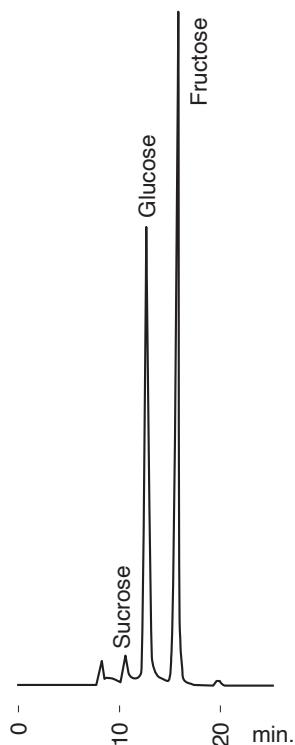


Fig. 2-5 Sports drink B

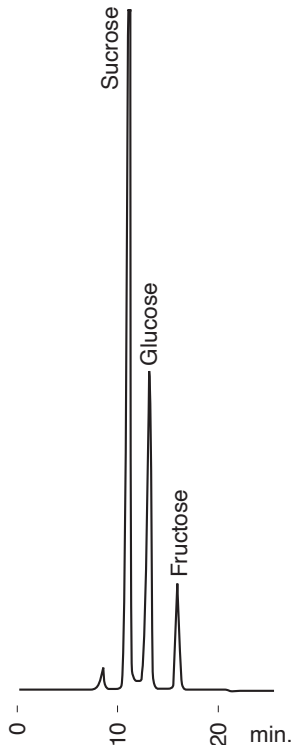


Fig. 2-6 Honey

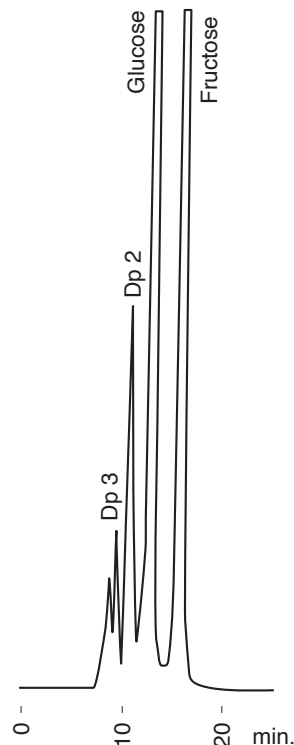


Fig. 2-7 Jam

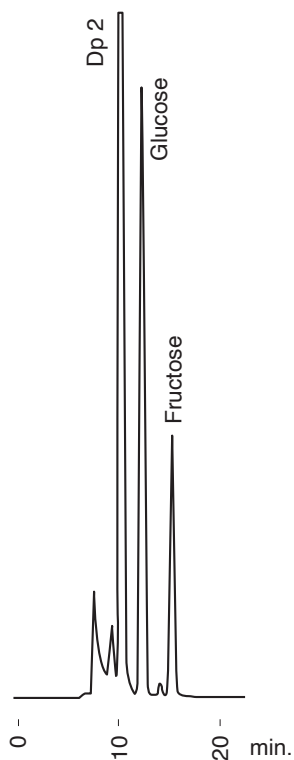
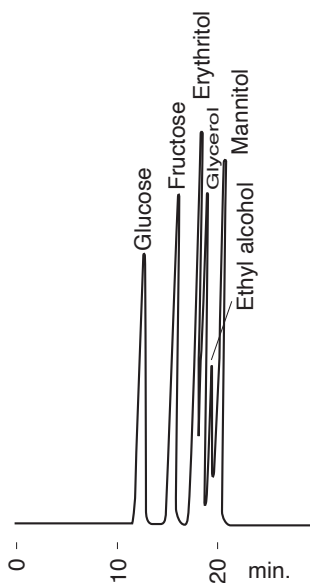


Fig. 2-8 Sugars/Alcohols

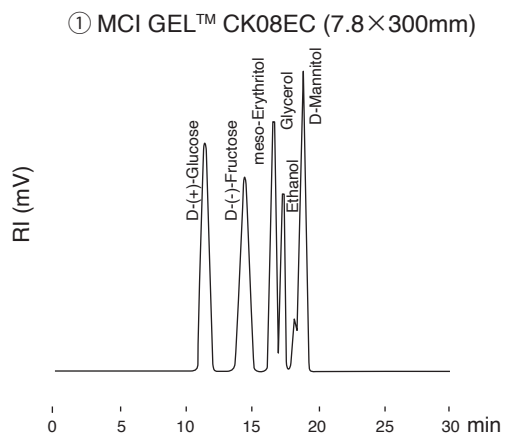


Conditions
 Column : MCI GEL™ CK08EC
 8mm I.D.×300mm
 Eluent : H₂O
 Flow rate : 0.6mL/min
 Column temp. : 75°C
 Detection : RI

Application data of CK08EC

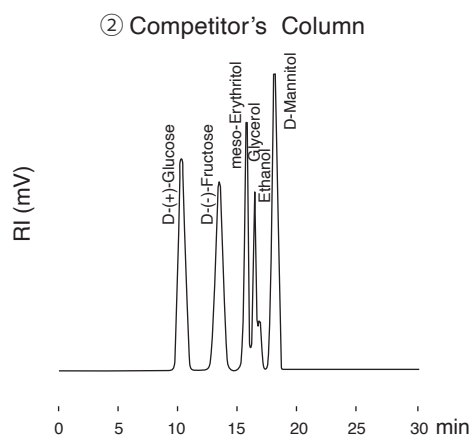
Fig. 2-9 Sugars / Alcoles (Comparison with competitor's column)

Conditions
 Column : 7.8x 300 mmI.D. (MCI GEL™ CK08EC / Competitor's Column)
 Eluent : Milli Q water
 Flow rate : 0.6mL/min
 Temperature : 75 °C
 Sample Conc : 40mmol/ml each
 Injection : 20µL
 Detection : RI



Results:	Rt	TPN	As	Rs
D-(+)-Glucose	11.39	2085	1.07	-
D-(-)-Fructose	14.39	2597	0.97	2.89
meso-Erythritol	16.59	16899	0.84	2.66
Glycerol	17.31	19051	0.95	1.40
Ethanol	18.18	37357	0.80	2.12
D-Mannitol	18.83	12885	1.00	1.33

Pressure: 28Bar (Including system pressure)

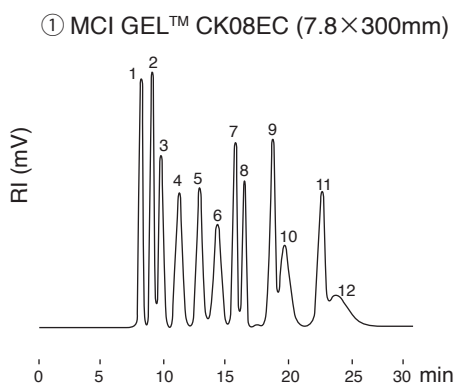


Results:	Rt	TPN	As	Rs
D-(+)-Glucose	10.25	1509	1.12	-
D-(-)-Fructose	13.37	2210	0.98	2.93
meso-Erythritol	15.63	15833	0.90	2.78
Glycerol	16.32	21608	0.95	1.50
Ethanol	16.73	35525	1.69	1.14
D-Mannitol	17.99	10387	0.96	2.43

Pressure: 38Bar (Including system pressure)

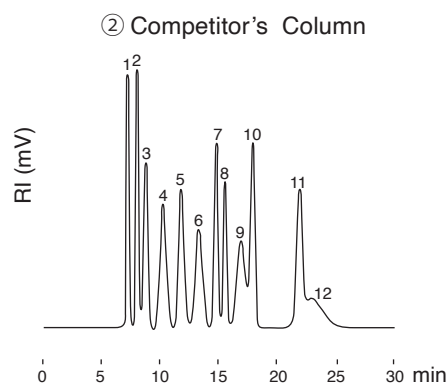
Fig. 2-10 Sugars (Comparison with competitor's column)

Conditions
 Column : 7.8x 300 mmI.D. (MCI GEL™ CK08EC / Competitor's Column)
 Eluent : Milli Q water
 Flow rate : 0.6mL/min
 Temperature : 75 °C
 Sample Conc : 40mmol/ml each
 Injection : 20µL
 Detection : RI



Results:	Rt	TPN	As	Rs
1 Stachyose hydrate	8.25	5111	1.04	-
2 β-Gentiobiose	9.13	5504	0.97	1.86
3 α-Lactose monohydrate	9.83	3024	1.19	1.22
4 D-(+)-Glucose	11.27	2002	1.09	1.77
5 D-(+)-Mannose	12.90	3350	1.01	1.76
6 D-(-)-Fructose	14.32	2713	1.01	1.47
7 Ribitol (Adonitol)	15.78	15410	0.84	1.85
8 meso-Erythritol	16.50	17734	0.99	1.43
9 D-Mannitol	18.73	13044	0.87	3.90
10 D-(-)-Salicin	19.69	4104	1.35	1.08
11 Xylitol	22.66	13965	0.88	3.09
12 D-(-)-Ribose	23.75	2278	2.09	0.86

Pressure: 28Bar (Including system pressure)



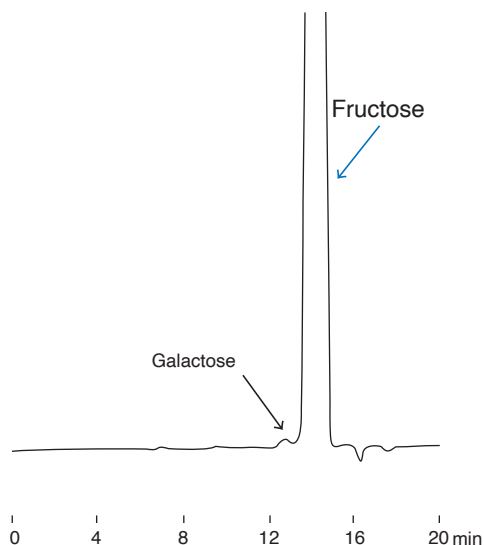
Results:	Rt	TPN	As	Rs
1 Stachyose hydrate	7.21	4243	1.07	-
2 β-Gentiobiose	8.02	4397	1.01	1.78
3 α-Lactose monohydrate	8.76	2249	1.14	1.28
4 D-(+)-Glucose	10.23	1441	1.06	1.73
5 D-(+)-Mannose	11.78	2830	1.03	1.63
6 D-(-)-Fructose	13.27	2188	1.00	1.51
7 Ribitol (Adonitol)	14.76	13744	0.92	1.86
8 meso-Erythritol	15.51	16005	1.01	1.50
9 D-(-)-Salicin	16.86	3594	0.88	1.79
10 D-Mannitol	17.88	12043	1.07	1.23
11 Xylitol	21.90	13235	0.94	5.72
12 D-(-)-Ribose	22.87	2381	3.00	0.86

Pressure: 39Bar (Including system pressure)

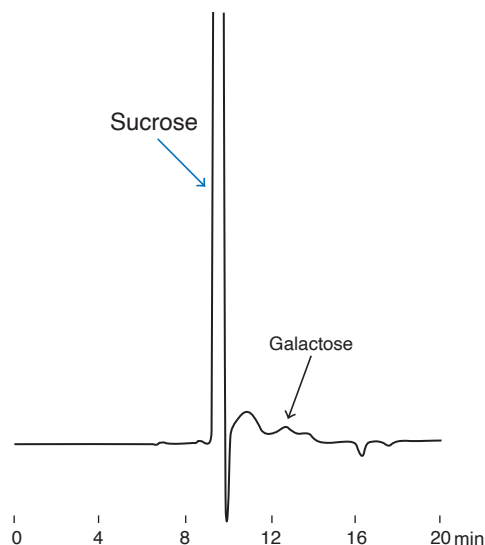
Application data of CK08EC

Fig. 2-11 Analysis of galactose impurity

① Galactose / Fructose = 0.1 / 99.9



② Galactose / Sucrose = 0.1 / 99.9

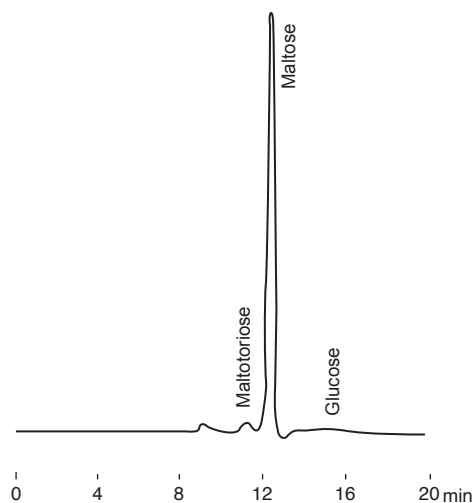


Conditions
 Column : MCI GEL™ CK08EC 7.8mm I.D.×300mm
 Eluent : Milli Q water
 Flow rate : 0.6mL/min
 Temp : 85°C
 Detection : RI

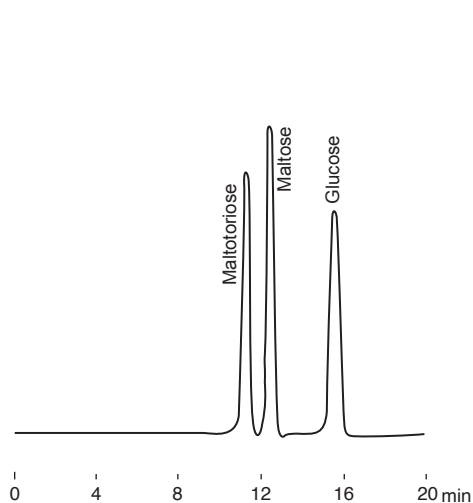
Application data of CK08E

Fig. 2-12 Maltose syrup powder

① Maltose syrup powder



② Mixture



Conditions
 Column : MCI GEL™ CK08E 7.8mm I.D.×300mm
 Eluent : Milli Q water
 Flow rate : 0.4mL/min
 Temp : 50°C
 Sample : Maltotriose
 Maltose
 Glucose
 Injection : 5µL
 Detection : RI

Application data of CK08EH

Fig. 2-13 Carboxylic acids

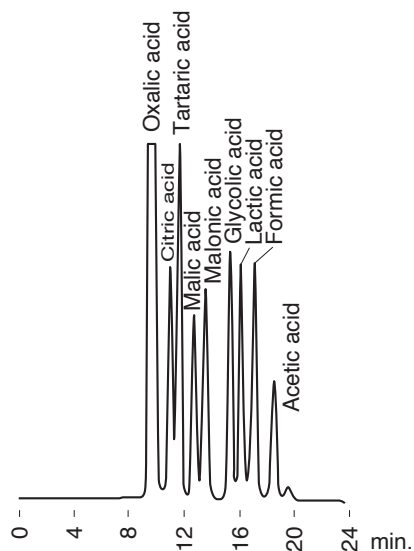
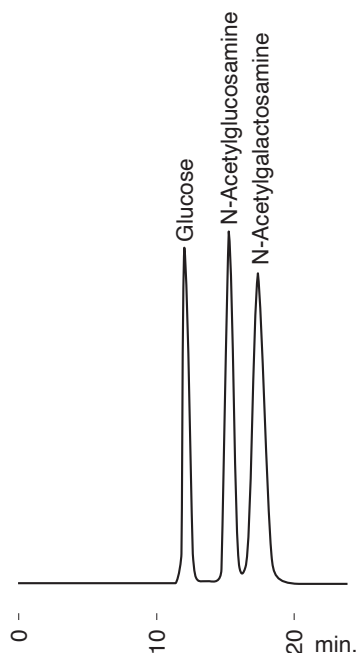
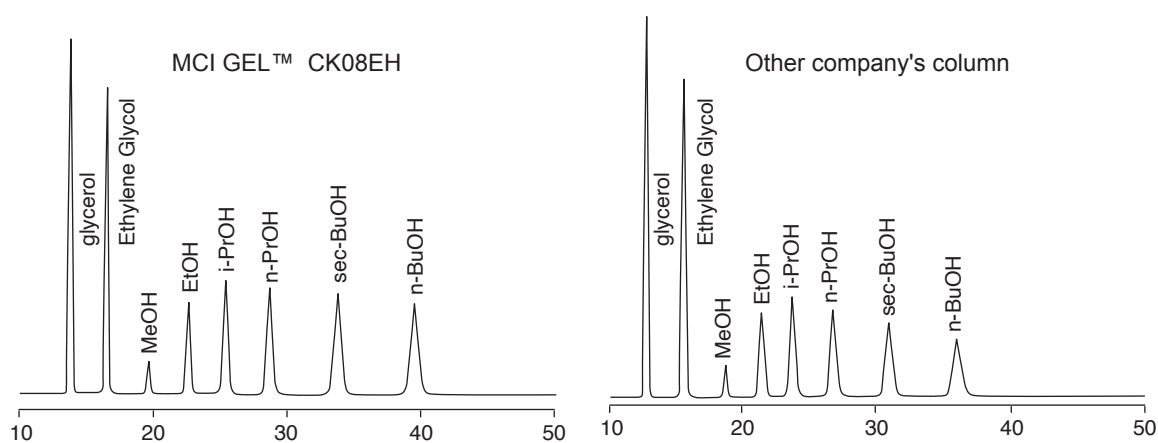


Fig. 2-14 Amino sugars



Conditions
 Column : MCI GEL™ CK08EH, 8mm I.D.×300mm
 Eluent : 1% H₃PO₄ (Fig.2-13,2-14)
 Flow rate : 0.6mL/min
 Column temp.: 45°C (Fig. 2-13) , ambient (Fig. 2-14)
 Detection : 210nm (Fig. 2-13) , RI (Fig. 2-14)

Fig. 2-15 Alcohols



Conditions
 Column : MCI GEL™ CK08EH, 7.8mm I.D.×300mm
 Eluent : 1% H₃PO₄
 Temp : 60 °C
 Press : 2.5 bar
 Detection : RI
 Injection : 10.0 μL

Application data of CK08EH

Fig. 2-16 Chloroacetic acids

Conditions
 Column : MCI GEL™ CK08EH
 : 8mm I.D.×300mm
 Eluent : 1% H₃PO₄
 Flow rate : 0.6mL/min
 Column temp. : 45°C
 Detection : 210nm

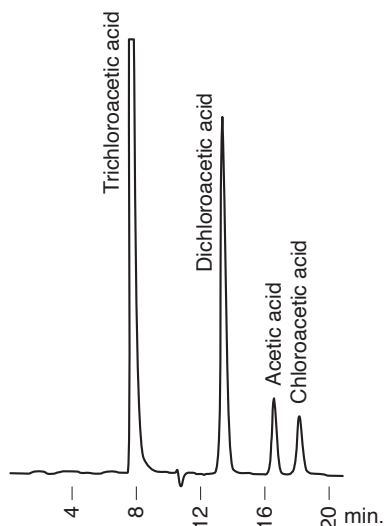


Fig. 2-17 Poly alcohols

Conditions
 Column : MCI GEL™ CK08EH
 : 8mm I.D.×300mm
 Eluent : 1% H₃PO₄
 Flow rate : 0.6mL/min
 Column temp. : 25°C
 Detection : RI

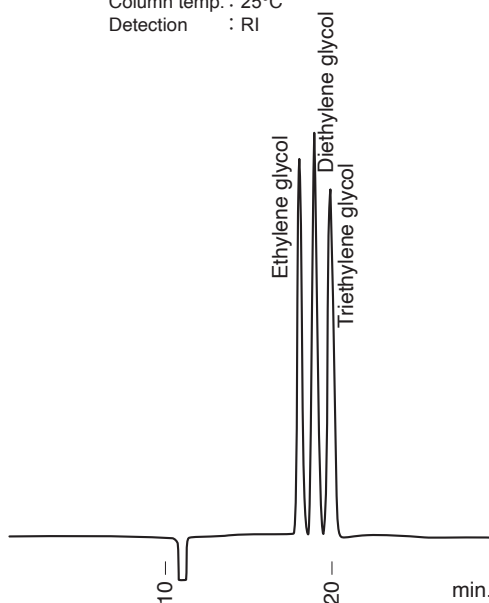
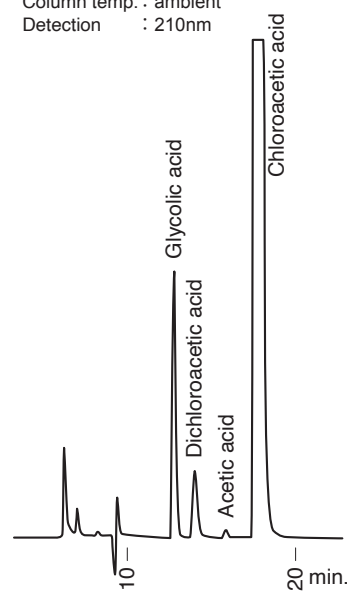


Fig. 2-18 Carboxylic acids

Conditions
 Column : MCI GEL™ CK08EH
 : 8mm I.D.×300mm
 Eluent : 2% H₃PO₄
 Flow rate : 0.6mL/min
 Column temp. : ambient
 Detection : 210nm



● Peak retention time for Sugars and Sugar alcohols on various columns [min]

CK08EC Ca ²⁺		CK08E Na ⁺	
Stachyose	9	Stachyose	8
Melezitose		Melezitose	
Raffinose		Raffinose	
Gentiobiose	10	Gentiobiose	9
Cellobiose		Cellobiose	
Trehalose		Trehalose	
Isomaltose		Sucrose	
Sucrose		Isomaltose	
Maltose		Melibiose	
Melibiose		Maltose	
Lactose		Maltulose	
Maltulose	11	Lactose	10
Lactulose	12	Lactulose	11
Glucose	13		
Xylose	14	Glucose	12
Galactose		Mannitol	
Mannose		Rhamnose	
Rhamnose	15	Adonitol	
Fructose	16	Sorbitol	13
Fucose		Digitoxose	
Inositol		Mannose	
Arabinose		Xylose	
Digitoxose		Galactose	
Adonitol	17	Fructose	14
Erythritol	18	Inositol	
Mannitol	20	Xylitol	
Salicin	22	Fucose	
Dulcitol	23	Dulcitol	
Xylitol	24	Arabinose	
Sorbitol	24	Erythritol	15
Ribose	25	Ribose	17
		Salicin	27

Column temp : CK08EC...75°C, CK08E...45°C
 Column size : 8mm I.D.×300mm
 Eluent : H₂O
 Flow rate : 0.6mL/min
 Sample : 1% aq. solution
 Injection vol. : 20μL

* ; These sugars, containing Fructose component, may partially be decomposed by CK08EH.

CK04S, CK04SS CK02A, CK02AS

Cation exchange columns
applications; oligosaccharides

The separation mechanism is based on gel filtration chromatography and elution is achieved via simple distilled water. A larger molecule elutes ahead.



CK02A 20×250



CK04S 10×200



CK04SS 10×200

● Separation ability of each column

MCI GEL™ column	Counter ion	Separation ability (degree of polymerization)	USP
MCI GEL™ CK04S	Na ⁺	8~9	L58
MCI GEL™ CK04SS	Ag ⁺	12~13	
MCI GEL™ CK02A	Na ⁺	15~16	L58
MCI GEL™ CK02AS	Ag ⁺	19~20	

Calibration curves of malto-oligosaccharides

Fig. 2-19

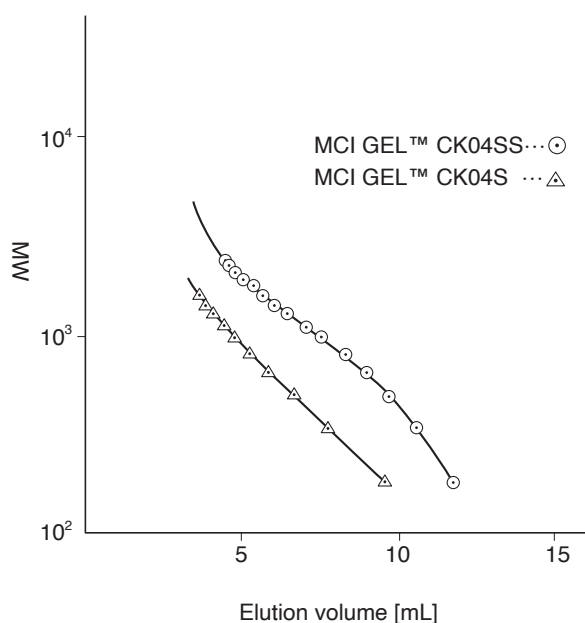
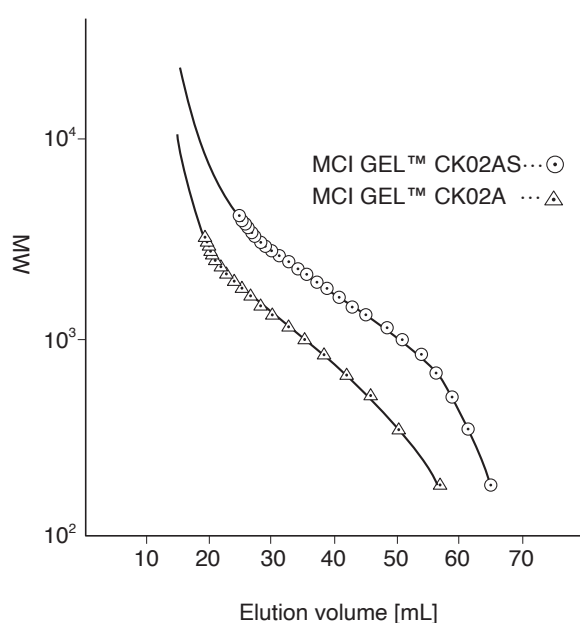


Fig. 2-20



Comparison data of malto-oligosaccharides

Fig. 2-21 MCI GEL™ CK04S
10mm I.D.×200mm

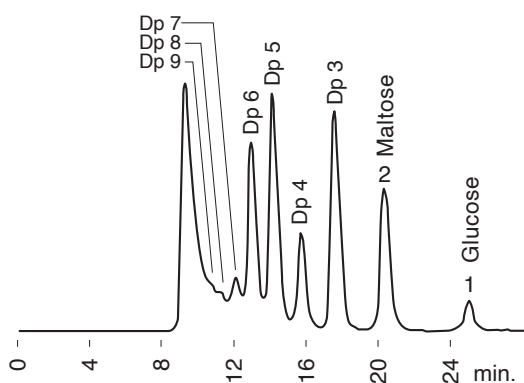


Fig. 2-22 MCI GEL™ CK04SS
10mm I.D.×200mm

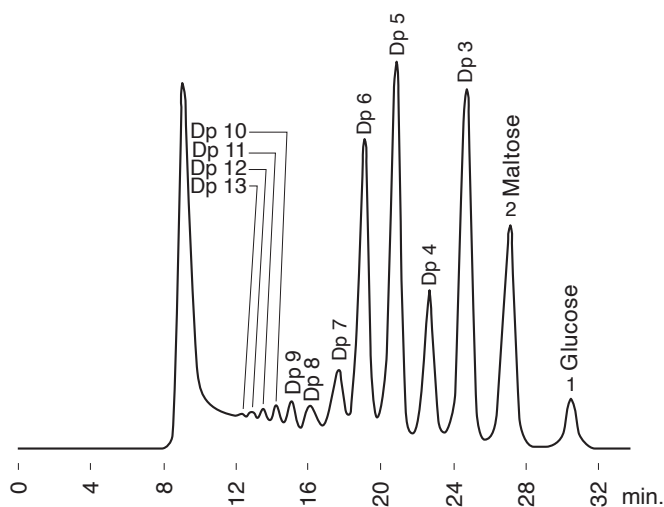


Fig. 2-23 MCI GEL™ CK02A
20mm I.D.×250mm

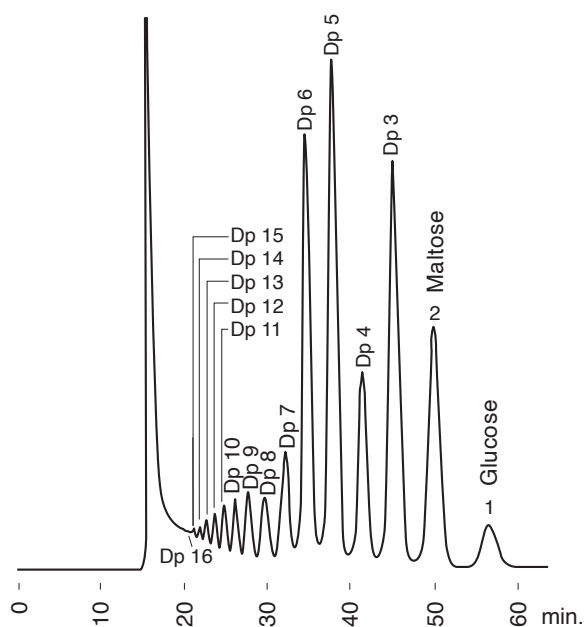
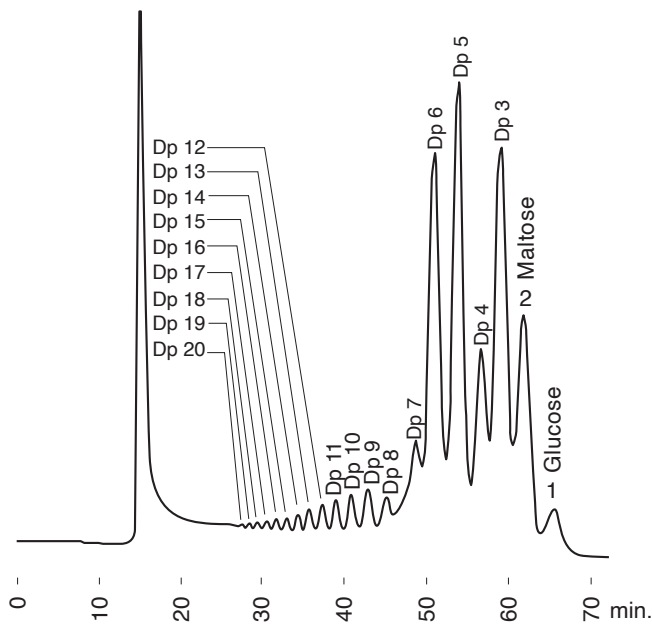


Fig. 2-24 MCI GEL™ CK02AS
20mm I.D.×250mm



Conditions
 Eluent : H₂O
 Flow rate : 0.4mL/min (Fig. 2-22, 2-23, 2-26, 2-27)
 1.0mL/min (Fig. 2-24, 2-25, 2-28)
 Column temp. : 85°C
 Detection : RI

Comparison data of authentic malto-oligosaccharides samples

Fig. 2-25 MCI GEL™ CK04S
10mm I.D.×200mm

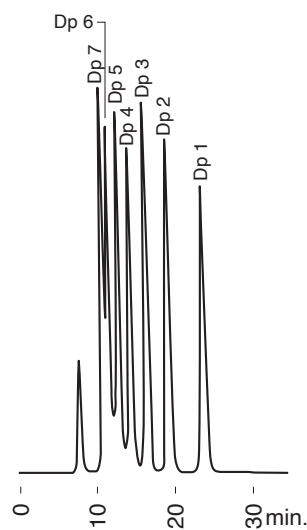


Fig. 2-26 MCI GEL™ CK04SS
10mm I.D.×200mm

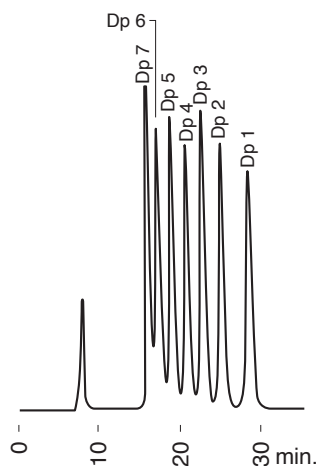
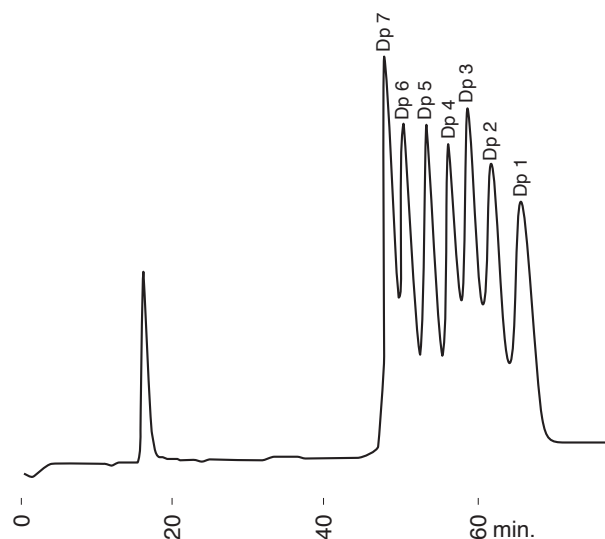


Fig. 2-27 MCI GEL™ CK02AS
20mm I.D.×250mm



Application data of CK04S

Fig. 2-28 Honey

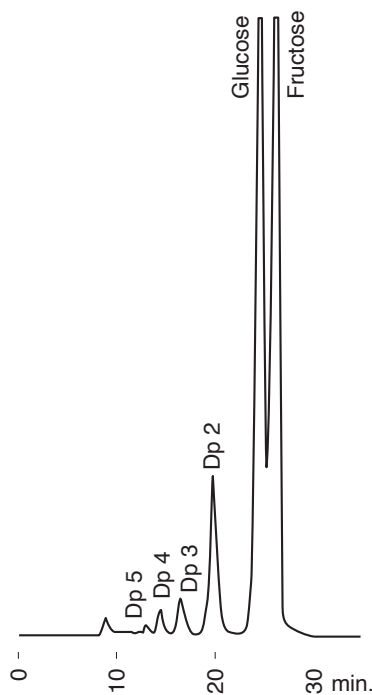


Fig. 2-29 Jam

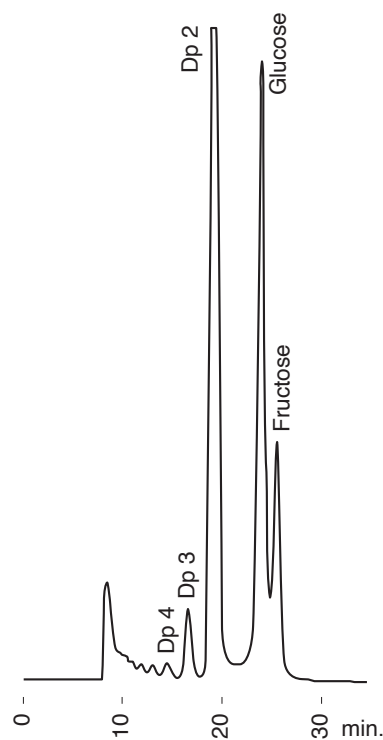
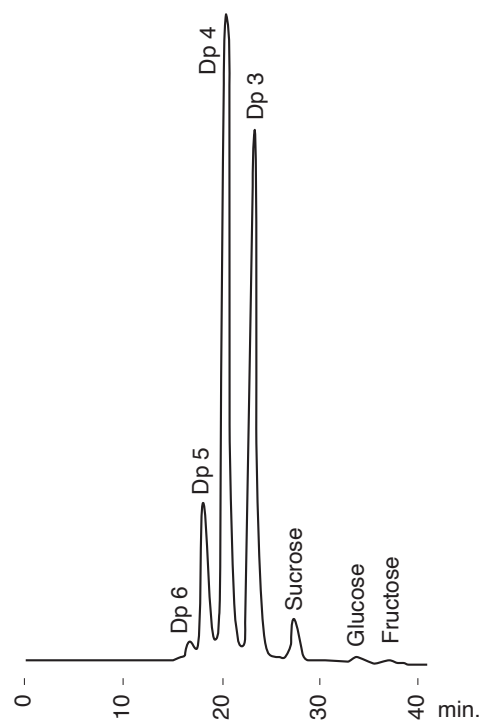


Fig. 2-30 Fructo-oligosaccharides



Conditions
 Column : MCI GEL™ CK04S
 10mm I.D.×200mm
 Eluent : H₂O
 Flow rate : 0.4mL/min (Fig. 2-29, 2-30) 0.3mL/min (Fig. 2-31)
 Column temp. : 85°C (Fig. 2-29, 2-30) 45°C (Fig. 2-31)
 Detection : RI

MCI GEL™ CA08F packed column has been designed for the analysis of nucleotides, sugars, and organic acids by anion exchange chromatography mode.

This column will provide excellent separation and short analysis time.

Application data of CA08F

Fig. 2-37 Sugars

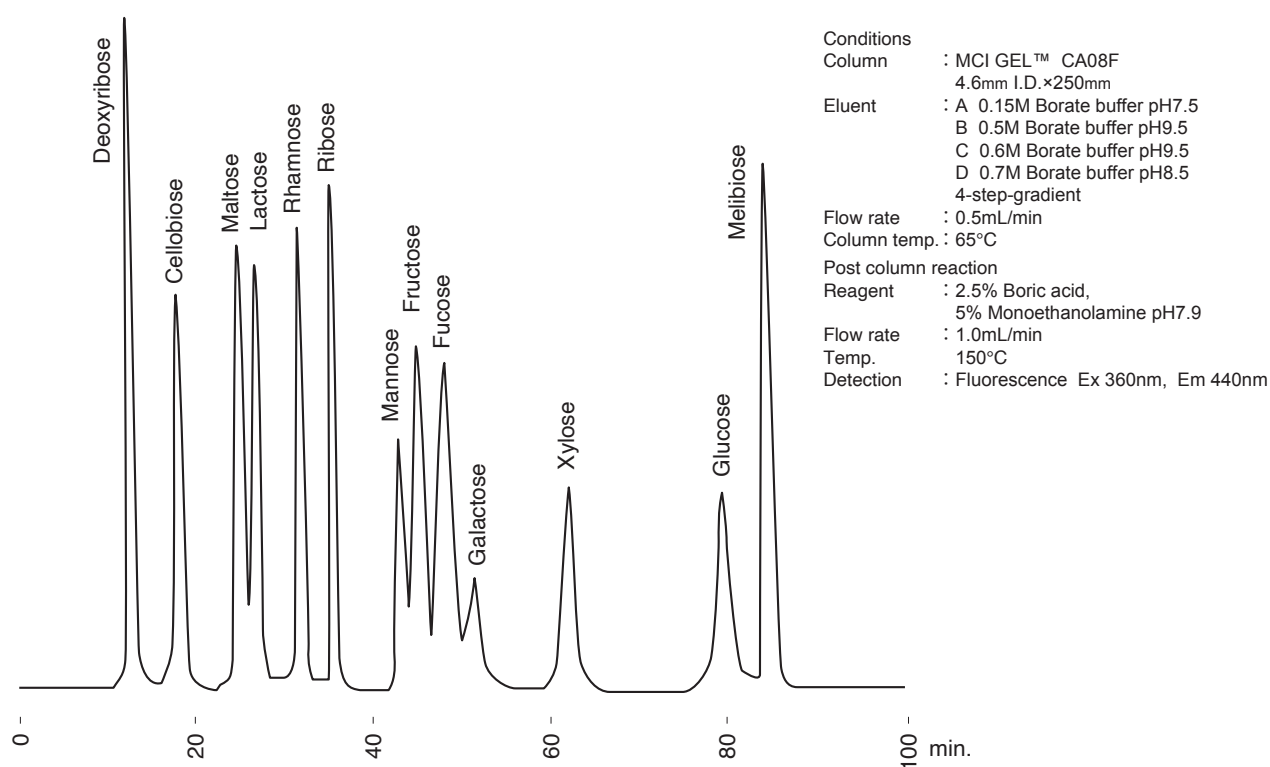
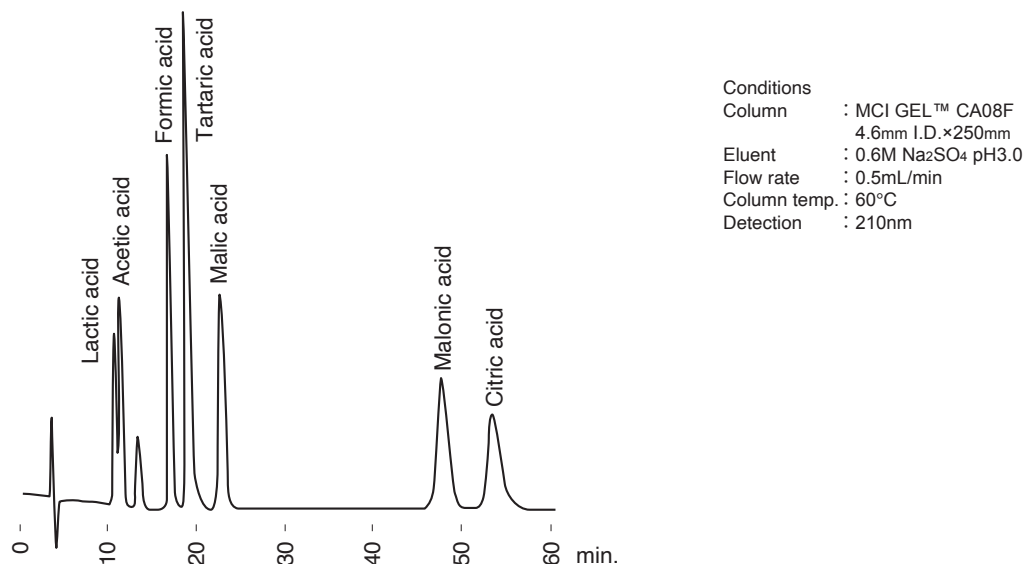


Fig. 2-38 Carboxylic acids



Application data of CA08F

Fig. 2-39 Carboxylic acids

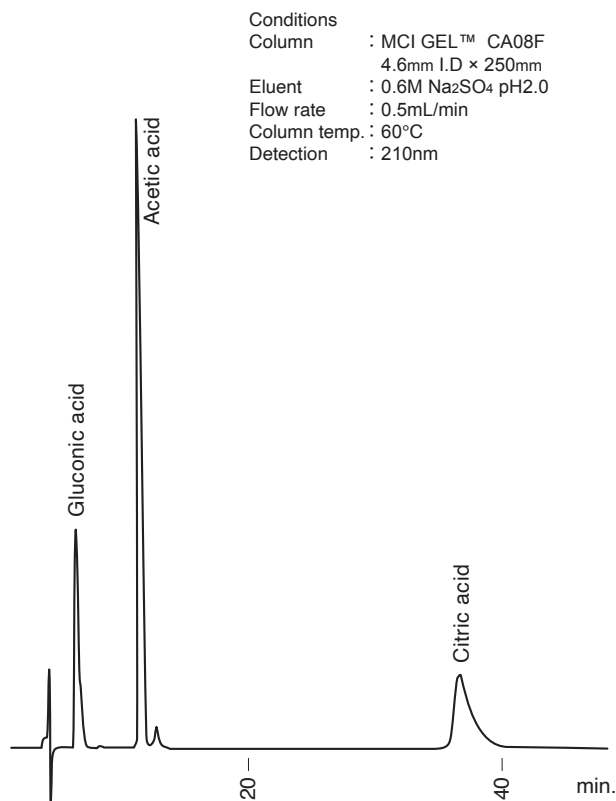


Fig. 2-40 Organic acid

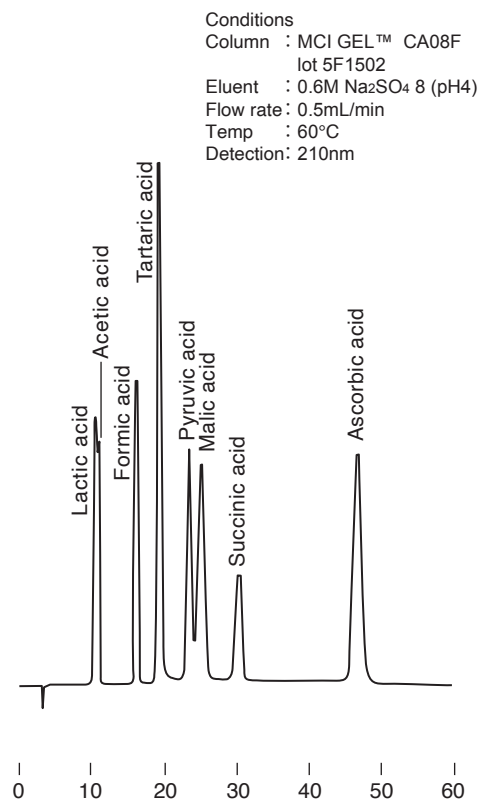


Fig. 2-41 Carboxylic acids

