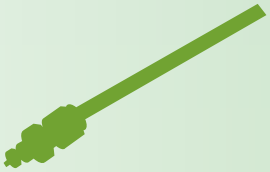
MITSUBISHI CHEMICAL GROUP

MCI GEL™ XtalSpeed™

TECHNICAL INFORMATION 2024-

MITSUBISHI CHEMICAL CORPORATION



MCI GEL™ XtalSpeed™

Excellent performance

spherical and sharp particle size distribution

Persistence and highest quality

offeres packing materials and packed columns,
under strict quality control

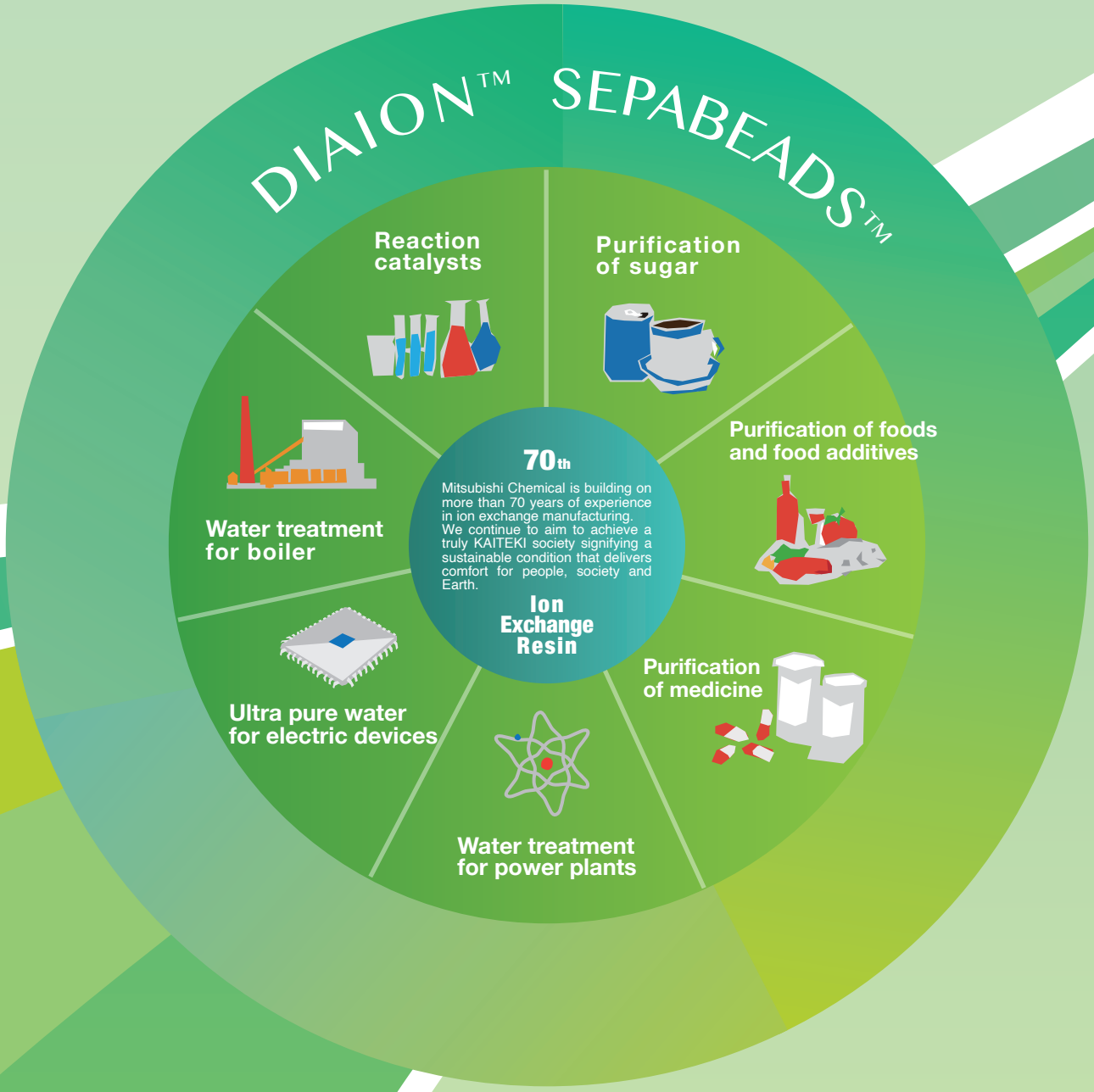
Wide range of product line

MCI GEL™ has been designed based on technology of
the world famous Diaion™ and Sepabeads™,
specialized in polymeric packing materials including
from analytical to preparative use,
for ion exchange, reversed-phase mode

Abundant accumulation of technology and experience

for more than 50 years, MCI GEL™ has been used for
HPLC applications

DIAION™ SEPABEADS™



CONTENTS

1 MCI GEL™ Column selection guide

Nature of sample	Separation mode	MCI GEL™ column	pH range	Applications	Pages
Sample → Water Soluble → M.W. >2,000	Size Exclusion	CQP10 CQP30	2 ～12	Proteins,Biopolymers Water soluble polymers	29～30
	Ion Exchange	XtalSpeed™	2 ～12	Proteins,Antibody	27～29
	Reversed-Phase	CMG20 CHPOD	2 ～12	Proteins,Peptides	31～51
		CHP20 CHP07	Full range	Proteins,Peptides	31～51
Sample → Water Soluble → M.W. <2,000	Size Exclusion	CK02A CK02AS	6 ～7	Oligosaccarides	14～16
		CK04S CK04SS	6 ～7	Oligosaccarides	14～16
		CQP06	2 ～12	Peptides	29～30
	Ion Exclusion	CK10U	1 ～14	Amino acids	17～ 18
		CA08F	1 ～13	Organic acids Saccharrides	19～20
	Ion Chromatography	SCA04	3 ～7	Anions	21～25
		SCK01 CHK45	1.5～12	Cations	21～23
	Reversed-Phase	CMG20	2 ～12	Organic Compounds peptide	31～51
		CHP20 CHP07	Full range	Organic Compounds peptide	31～51
	Mix mode	CHK40 CHK45	Full range	Amino acids, Nucletide	32,43～46
	Ion Exclusion	CK08EH	1 ～7	Organic adids	7,11～12
	Ligand Exchange	CK08E Series	1 ～7	Saccharrides	7～13
		CRS10W CRS15W	5 ～7	Optical isomers (α-amino acids・ α-hydroxy carboxylic acids)	52～57
Sample → Organic Solvent Soluble	Reversed-Phase	CHP20 CMG20 CHP07	Full range	Organic Compounds	31～51
	Normal Phase	CMG20 CHPOD	2 ～12	Organic Compounds	31～51
	Mix mode	CHK40 CHK45	Full range	Organic Compounds	32,43,46

●Product list by particle size and separation mode

Separation mode \ Particle size [μm]	Analytical		Preparative				
	5	10	30	50	150		
Ion exchange	CK XtalSpeed™	CK CA	CK CA	CK CA			CK CA
Ion chromatography	CHK45 SCA	SCK					
Size exclusion		CQP					
Normal phase	CHP20/C04 CHP07/C04 CMG20/C04	CHP20/C10 CHP07/C10 CMG20/C10 CMG20/P10	CHP20/P20 CHP50/P20	CHP20/P30 CHP50/P30 CMG20/P30	CHP20/P50	CHP20/P70	CHP20/P120 CHP07/P120
Mix mode	CHK40 CHK45						
Ligand exchange	CRS						

●USP LISTING OF MCI GEL™

USP Code	PACKING	MCI GEL™ Column	Page
L17	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 6 to 12 μm in diameter	CK08EH	7
L19	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the calcium form, 5 – 15 μm in diameter	CK08EC	7
L21	A rigid, spherical styrene-divinylbenzene copolymer, 3 to 30 μm in diameter	CHP20/C04 CHP20/C10	32
L25	Packing having the capacity to separate compounds with a molecular weight range from 100-5000 (as determined by polyethylene oxide), applied to neutral, anionic, and cationic water-soluble polymers. A polymethacrylate resin base, cross-linked with polyhydroxylated ether (surface contained some residual carboxyl functional groups) was found suitable	CQP06	29
L31	A hydroxide-selective, strong anion-exchange resin-quaternary amine bonded on latex particles attached to a core of 8.5-μm macroporous particles having a pore size of 2000 Å units and consisting of ethylvinylbenzene cross-linked with 55% divinylbenzene	SCA04	21
L32	A chiral ligand-exchange resin packing-L-proline copper complex covalently bonded to irregularly shaped silica particles, 5 to 10 μm in diameter	CRS10W CRS15W	52
L37	Packing having the capacity to separate proteins by molecular size over a range of 2,000 to 40,000 Da. It is a polymethacrylate gel	CQP30	29
L38	A methacrylate-based size-exclusion packing for water-soluble samples	CQP10 CQP30	29
L39	A hydrophilic polyhydroxymethacrylate gel of totally porous spherical resin	CMG20/C04 CMG20/C10	32
L58	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 6 to 30 μm diameter	CK08S CK08E CK04S CK02A	6
L71	A rigid, spherical polymetacrylate, 4 to 6 μm in diameter	CMG20/C04	32

2 MCI GEL™ Ion exchange columns and materials

○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

1. Variety of products gel type, porous type, DVB%, particle size, particle size distribution analytical use, preparative use

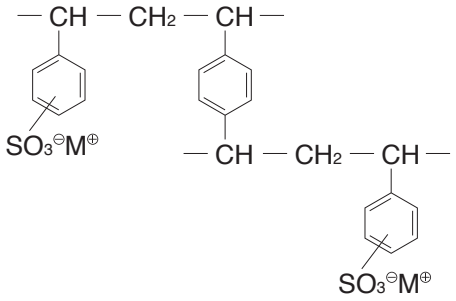
2. Persistence of high quality, excellent separation performance

3. Accumulation of abundant knowledge and experience of applications

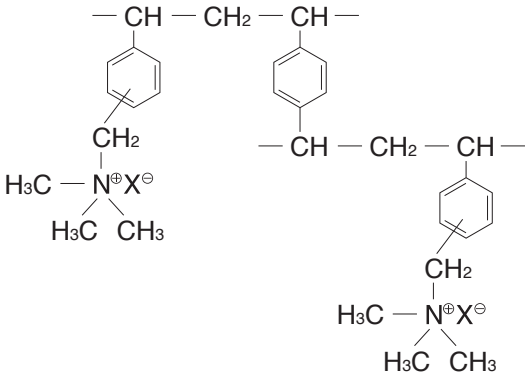
Ion exchange resins are generally used for analysis of amino acids, sugars, organic acids and amines, etc. MCI GEL™ custom pre-packed columns are specifically designed for each application using the most appropriate packing material among our product line and using the most suitable column dimensions.
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: Cross linkage [%]	Packing material: Counter ion	Packing material: Particle size [μm]	USP	Amino acid	Mono saccharide	Oligo-saccharide	Carboxylic acid	Amine	Physiological fluid
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=Ca^{2+}, 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.

2 MCI GEL™

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_3PO_4 eluent; sugars with distilled water eluent	L17

Application data of CK08EC

Fig. 2-1 Sugars

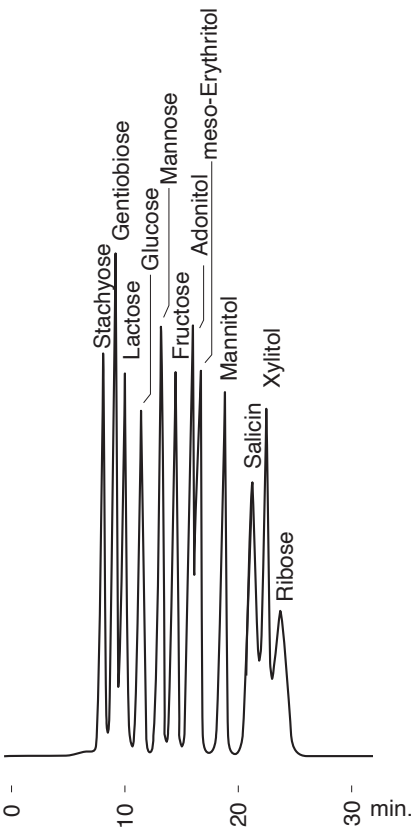


Fig. 2-2 Apple juice

Conditions
Column : MCI GEL™ CK08EC 8mm I.D.×300mm
Eluent : H_2O
Flow rate : 0.6mL/min
Column temp. : 75°C
Detection : RI

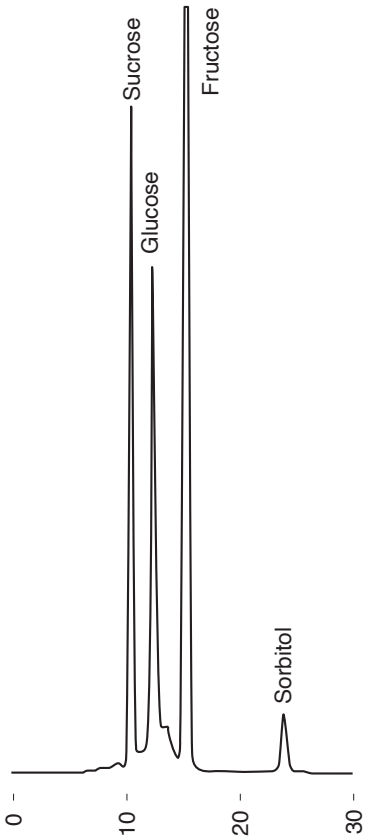
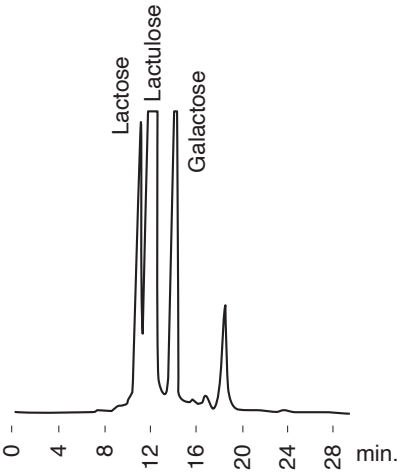


Fig. 2-3 Lactulose syrup



Application data of CK08EC

Fig. 2-4 Sports drink A

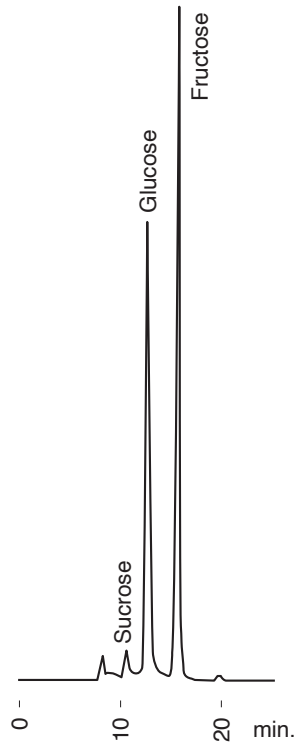


Fig. 2-5 Sports drink B

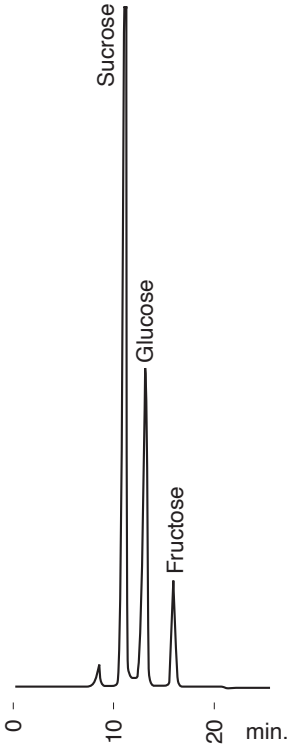


Fig. 2-6 Honey

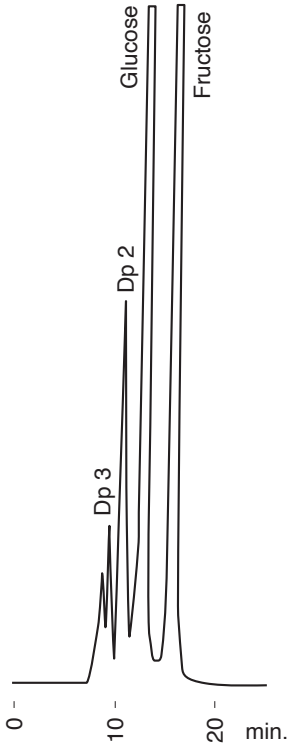


Fig. 2-7 Jam

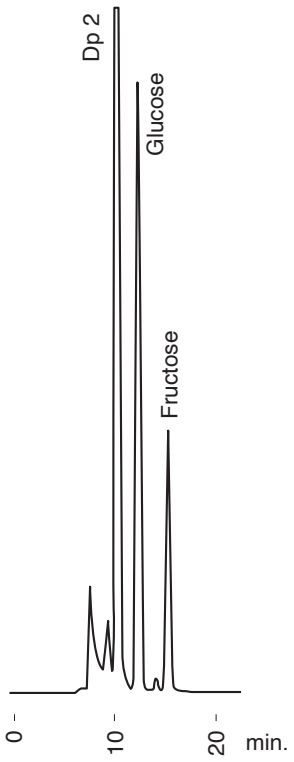
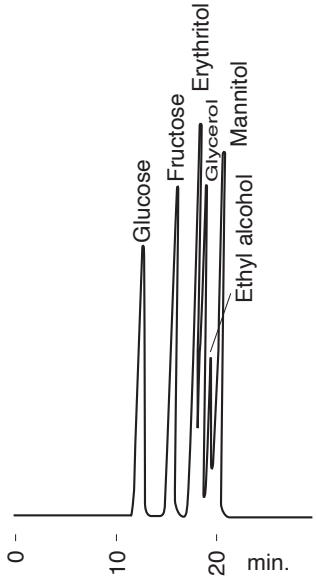


Fig. 2-8 Sugars/Alcohols



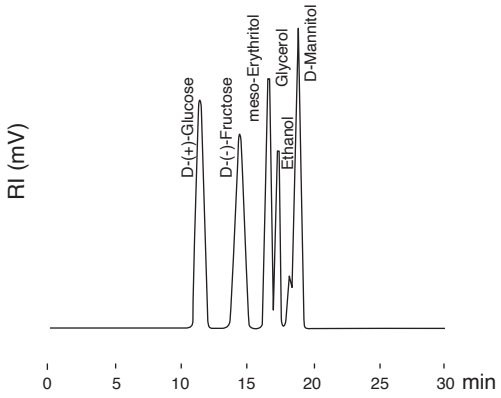
Conditions
Column : MCI GEL™ CK08EC 8mm I.D.×300mm
Eluent : H_2O
Flow rate : 0.6mL/min
Column temp. : 75°C
Detection : RI

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

① MCI GEL™ CK08EC (7.8×300mm)

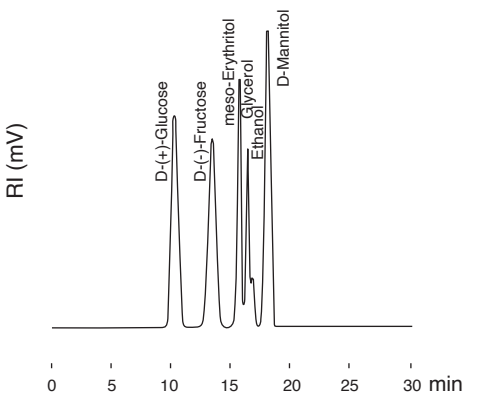


Results:

	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)

② Competitor's Column



Results:

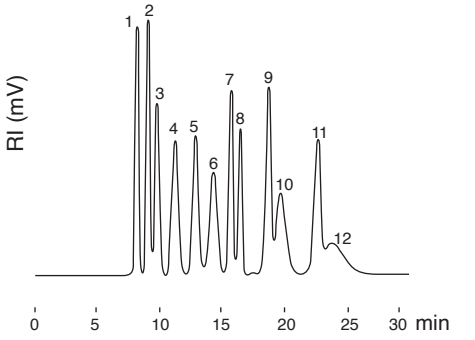
	Rt	TPN	As	Rs
D-(+)-Glucose	10.25	1509	1.12	-
D-(-)-Fructose	13.37	2210	0.98	2.93
meso-Erythritol	15.63	15833	0.90	2.78
Glycerol	16.32	21608	0.95	1.50
Ethanol	16.73	35525	1.69	1.14
D-Mannitol	17.99	10387	0.96	2.43

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

① MCI GEL™ CK08EC (7.8×300mm)

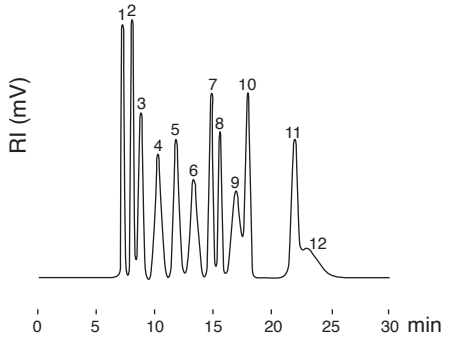


Results:

		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)

② Competitor's Column



Results:

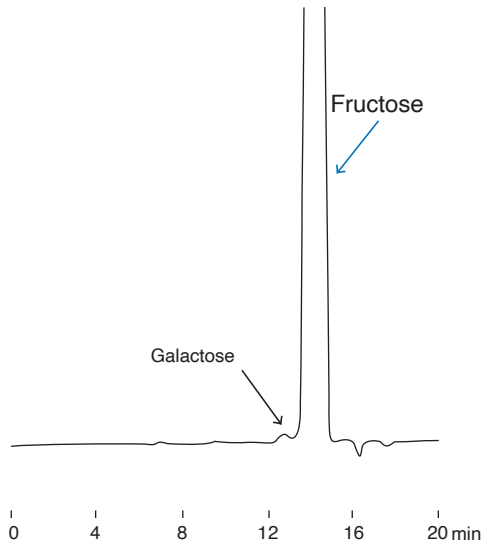
		Rt	TPN	As	Rs
1	Stachyose hydrate	7.21	4243	1.07	-
2	β-Gentiobiose	8.02	4397	1.01	1.78
3	α-Lactose monohydrate	8.76	2249	1.14	1.28
4	D-(+)-Glucose	10.23	1441	1.06	1.73
5	D-(+)-Mannose	11.78	2830	1.03	1.63
6	D-(-)-Fructose	13.27	2188	1.00	1.51
7	Ribitol (Adonitol)	14.76	13744	0.92	1.86
8	meso-Erythritol	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)

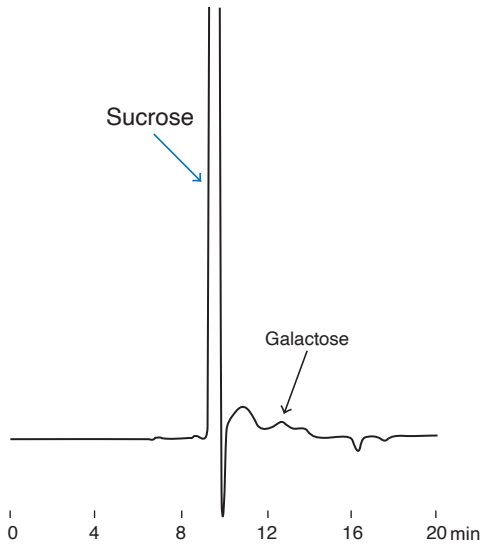
Application data of CK08EC

Fig. 2-11 Analysis of galactose impurity

① Galactose / Fructose = 0.1 / 99.9



② Galactose / Sucrose = 0.1 / 99.9

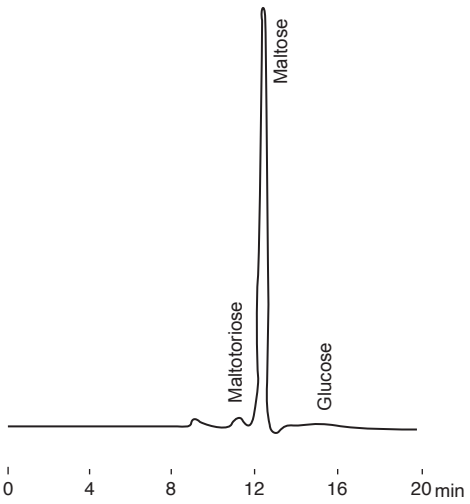


Conditions
Column : MCI GEL™ CK08EC 7.8mm I.D.×300mm
Eluent : Milli Q water
Flow rate : 0.6mL/min
Temp : 85°C
Detection : RI

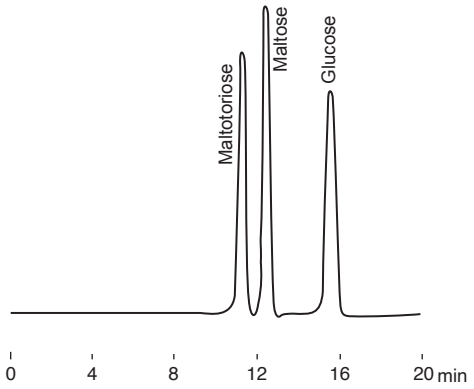
Application data of CK08E

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 : Maltotoriose
Maltose
Glucose
Injection : 5µl.
Detection : RI

Application data of CK08EH

Fig. 2-13 Carboxylic acids

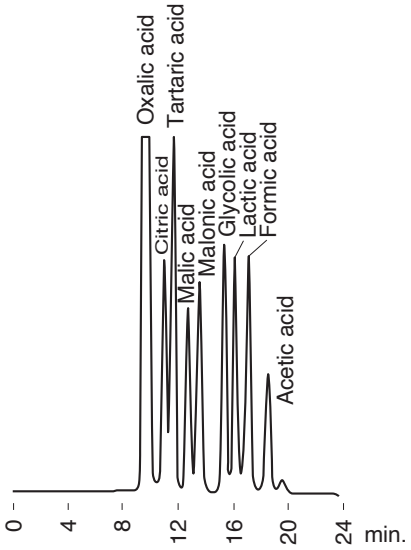
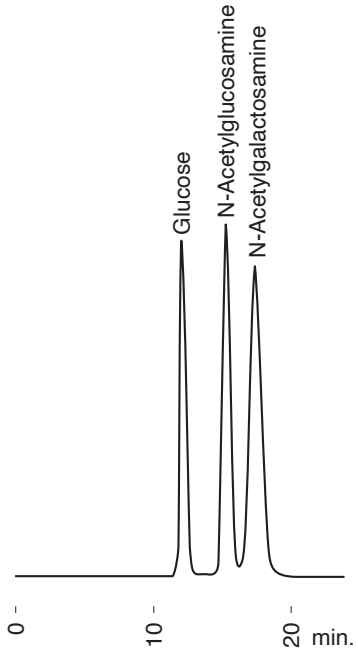
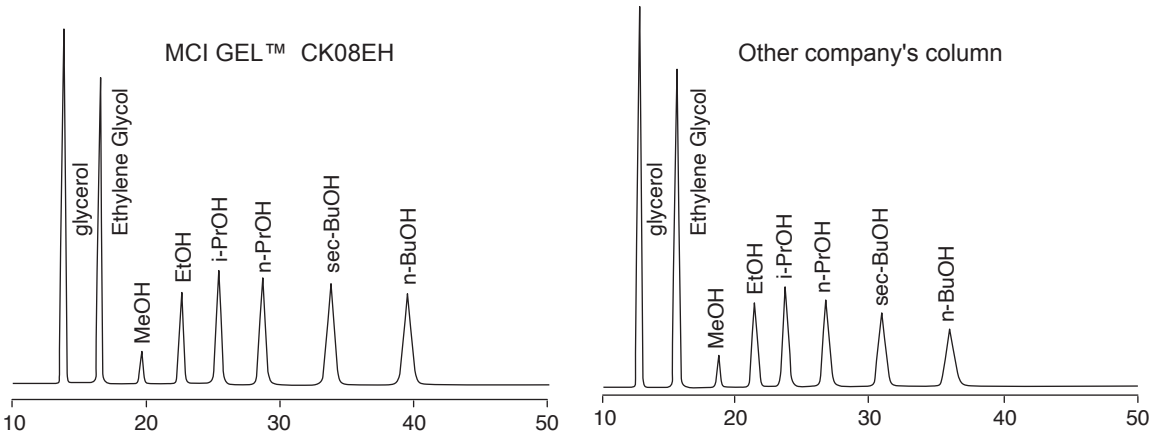


Fig. 2-14 Amino sugars



Conditions
Column : MCI GEL™ CK08EH, 8mm I.D.×300mm
Eluent : 1% H_3PO_4 (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% H_3PO_4
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% H_3PO_4
Flow rate : 0.6mL/min
Column temp. : 45°C
Detection : 210nm

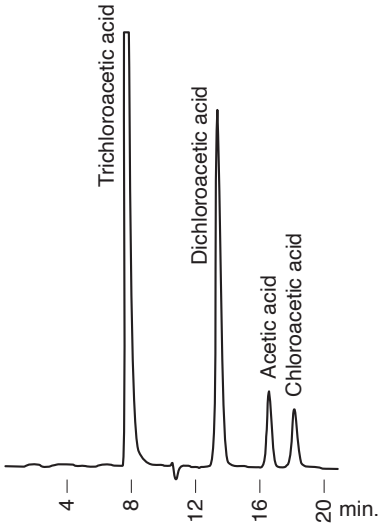


Fig. 2-17 Poly alcohols

Conditions
Column : MCI GEL™ CK08EH 8mm I.D.×300mm
Eluent : 1% H_3PO_4
Flow rate : 0.6mL/min
Column temp. : 25°C
Detection : RI

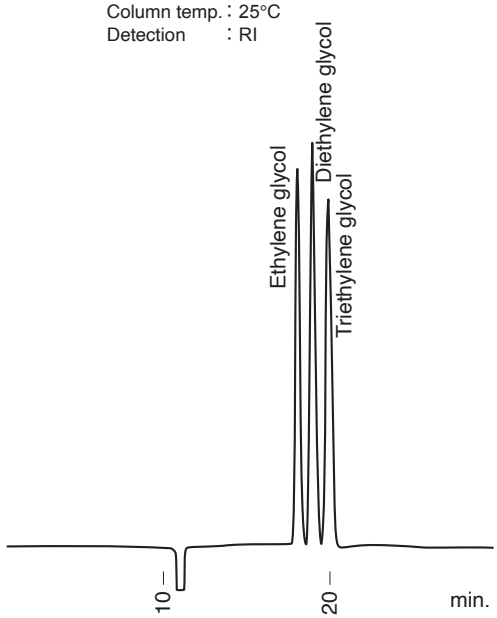
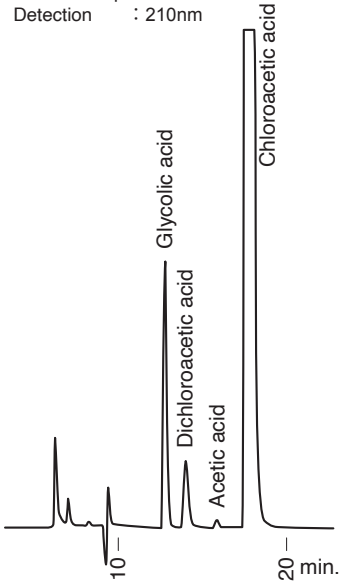


Fig. 2-18 Carboxylic acids

Conditions
Column : MCI GEL™ CK08EH 8mm I.D.×300mm
Eluent : 2% H_3PO_4
Flow rate : 0.6mL/min
Column temp. : ambient
Detection : 210nm



●Peak retention time for Sugars and Sugar alcohols on various columns〔min〕

Column temp ： CK08EC…75°C, CK08E…45°C
Column size ： 8mm I.D.×300mm
Elueunt ： H_2O
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

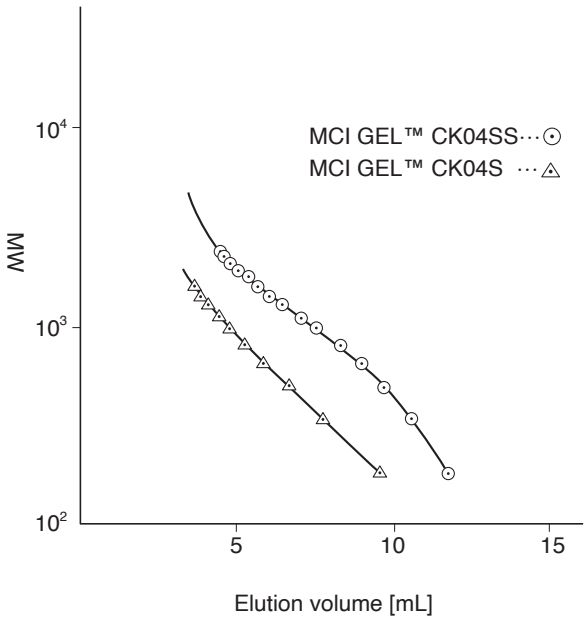
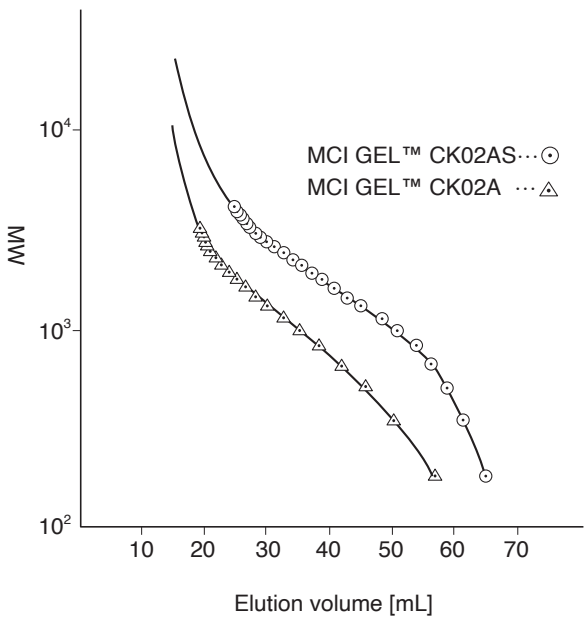


Fig. 2-20



Comparison data of malto-oligosaccharides

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

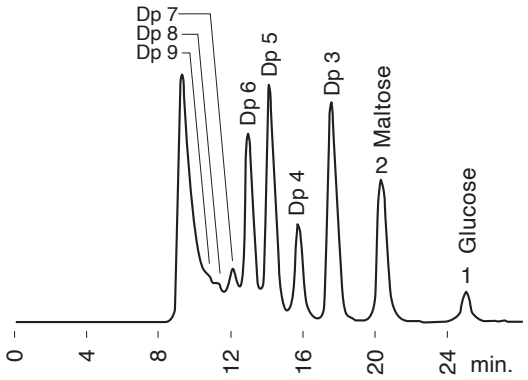


Fig. 2-22 MCI GEL™ CK04SS
10mm I.D.×200mm

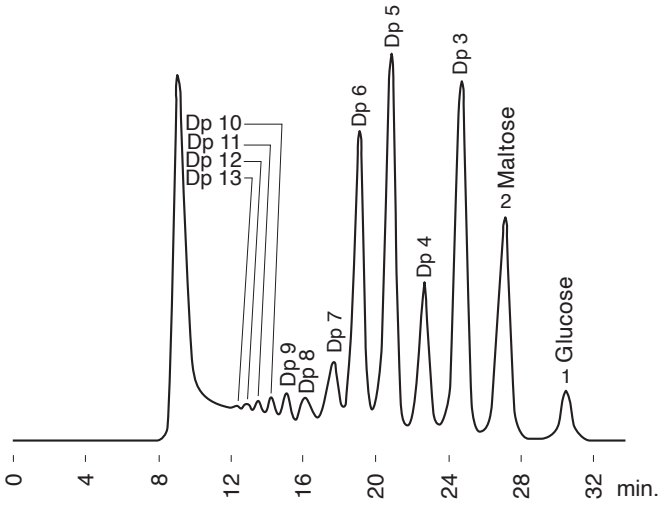


Fig. 2-23 MCI GEL™ CK02A
20mm I.D.×250mm

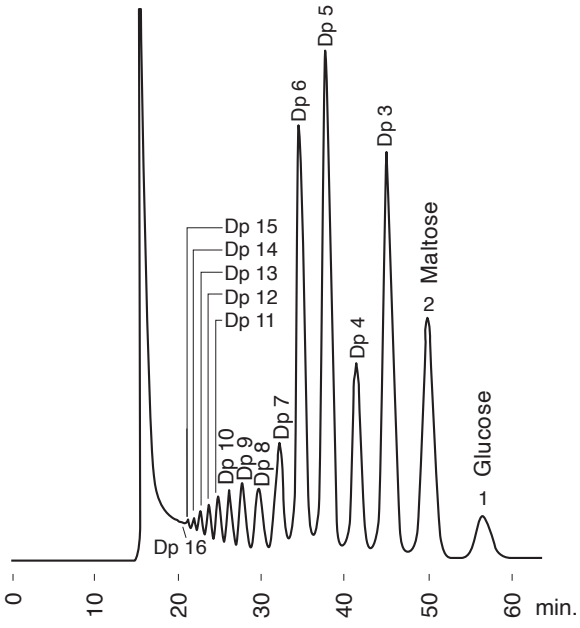
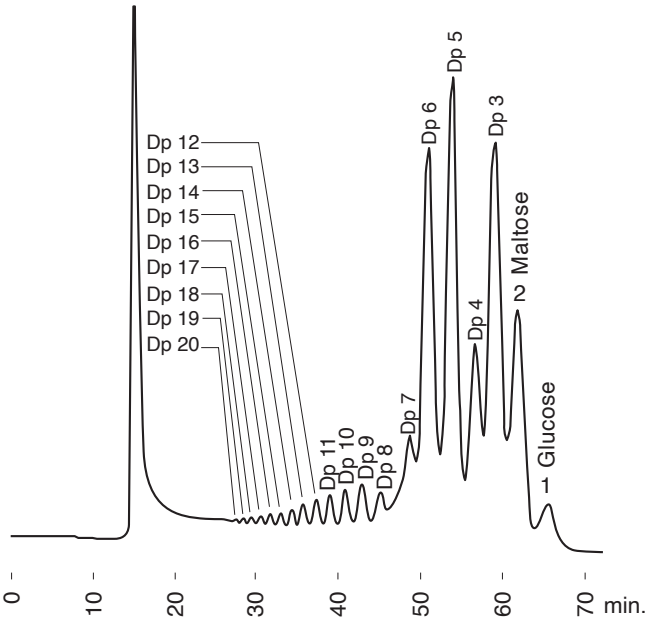


Fig. 2-24 MCI GEL™ CK02AS
20mm I.D.×250mm



Conditions
Eluent : H_2O
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

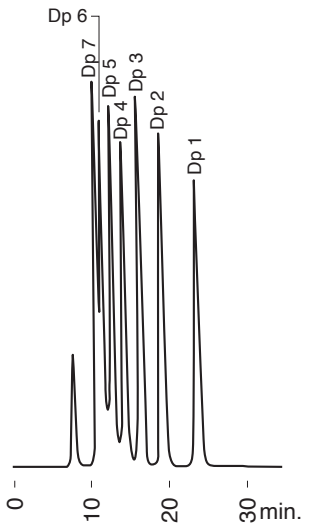


Fig. 2-26 MCI GEL™ CK04SS
10mm I.D.×200mm

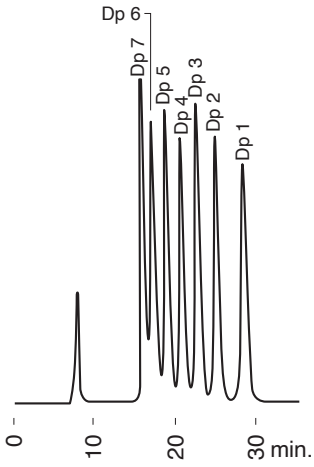
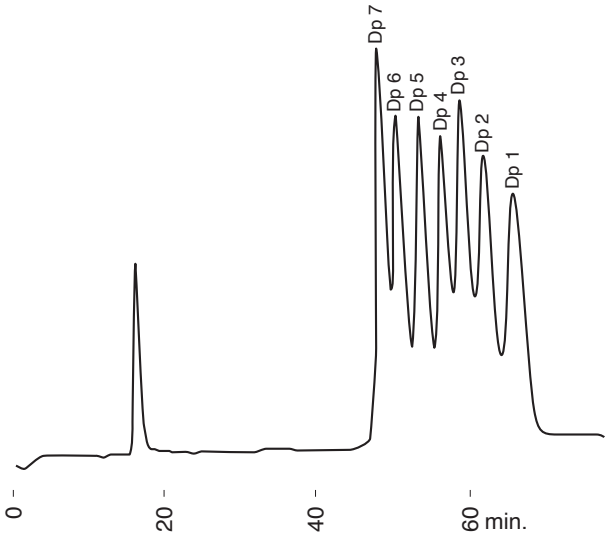


Fig. 2-27 MCI GEL™ CK02AS
20mm I.D.×250mm



Application data of CK04S

Fig. 2-28 Honey

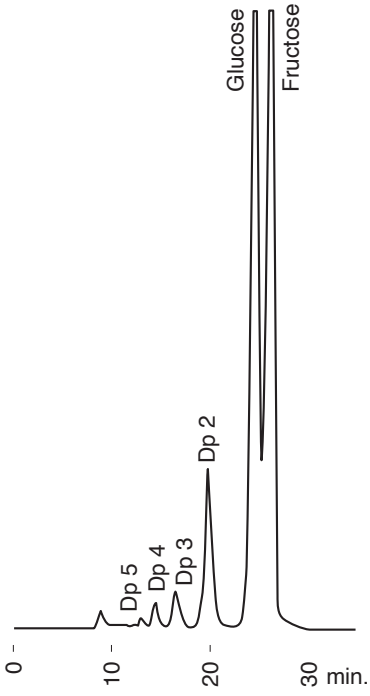


Fig. 2-29 Jam

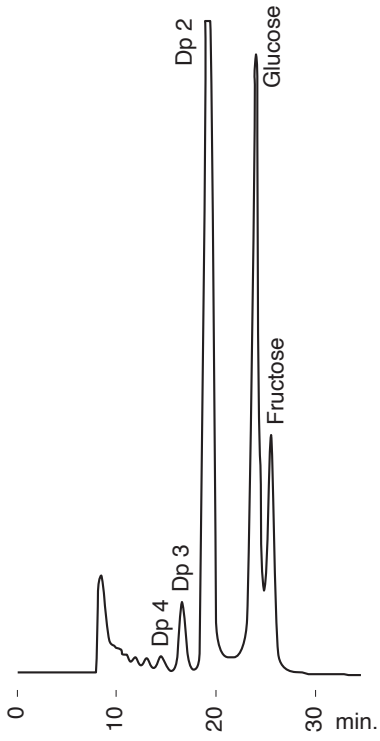
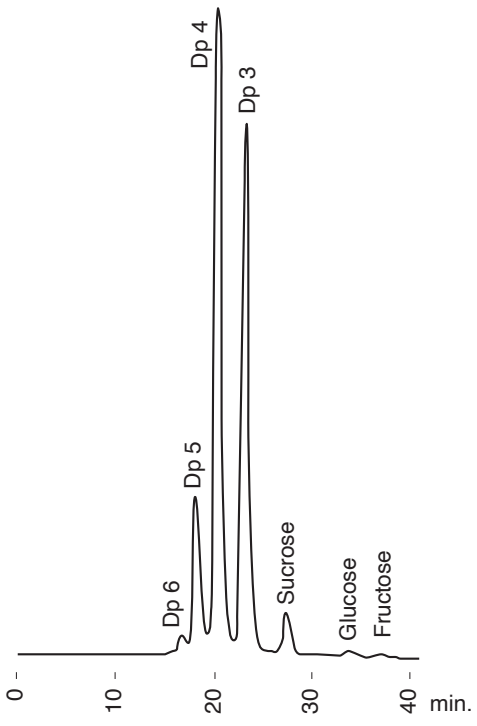


Fig. 2-30 Fructo-oligosaccharides



Conditions
Column : MCI GEL™ CK04S
10mm I.D.×200mm
Eluent : H_2O
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

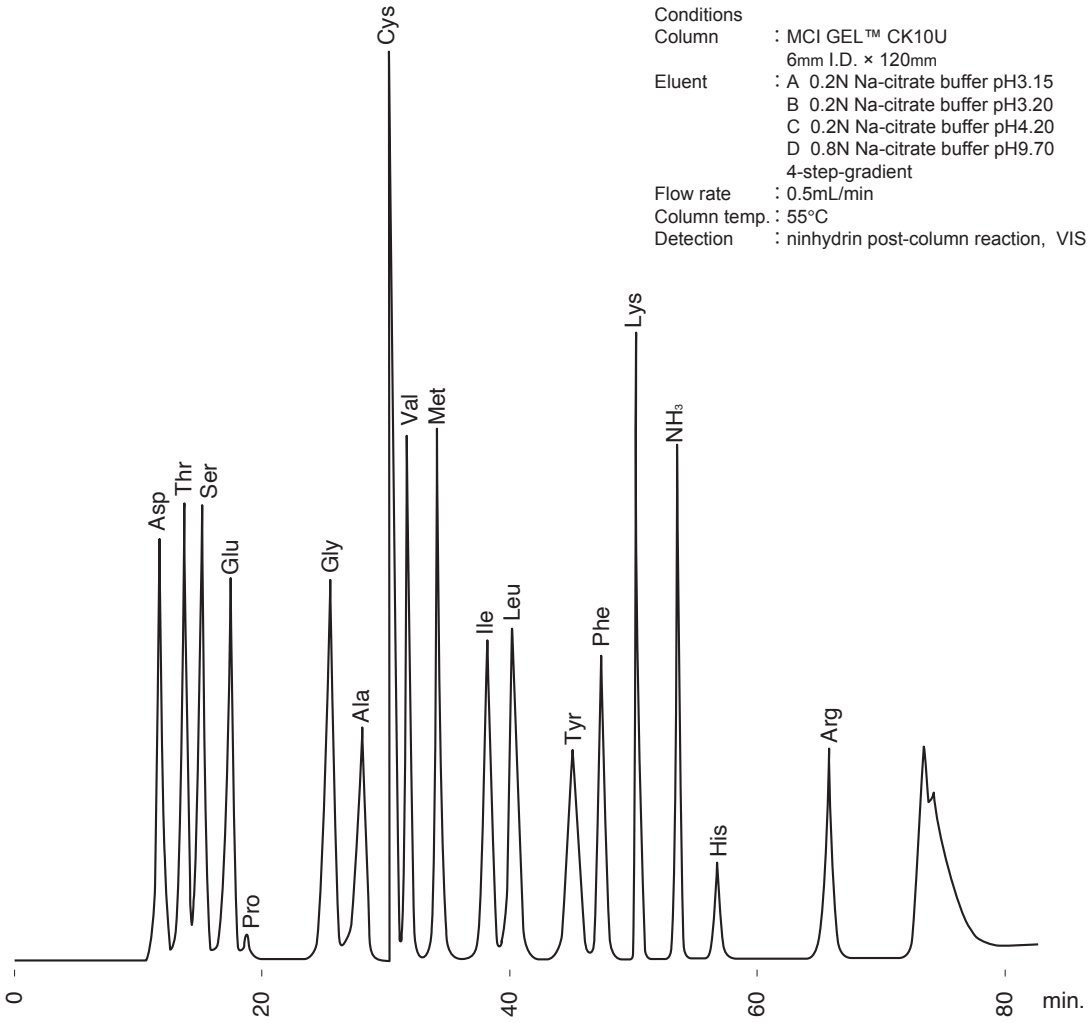
CK10U

High cross linkage cation exchange column
applications; amino acids, amines, etc

CK10U 6×120

Separation of amino acids

Fig. 2-31 Protein hydrolyzates amino acids



As for analysis of amino acids by a cation exchange column such as 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 ammonium in eluent is trapped in this column. The ammonium ion may disturb base line stability. The AFR2-PC should be installed between an outlet of HPLC pump and an inlet of sample injector. A gradient elution, commonly used for amino acid analysis, is influenced by HPLC instrument. So to obtain a satisfactory chromatogram, gradient conditions should be optimized in accordance with the HPLC equipment.

Separation of amino acids

Fig. 2-32 Valine, β-Alanine

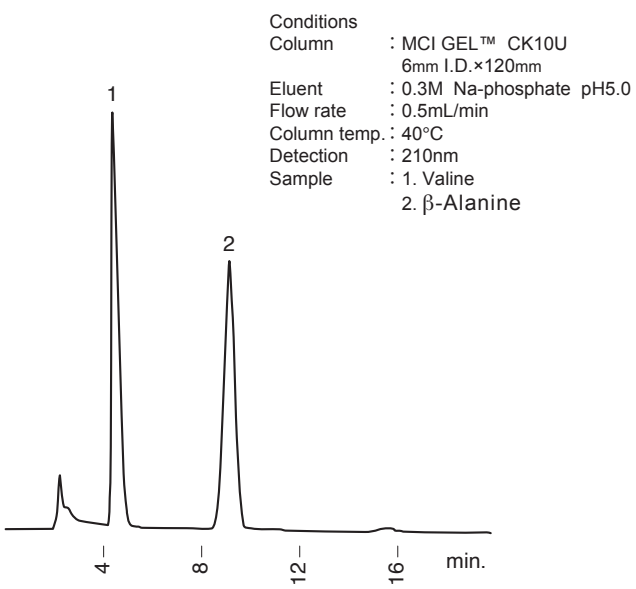


Fig. 2-33 γ-Aminobutyric acid

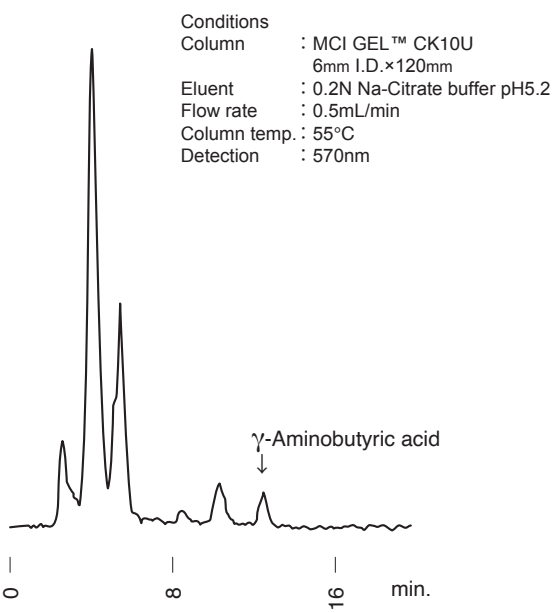


Fig. 2-34
cyclic amino acids

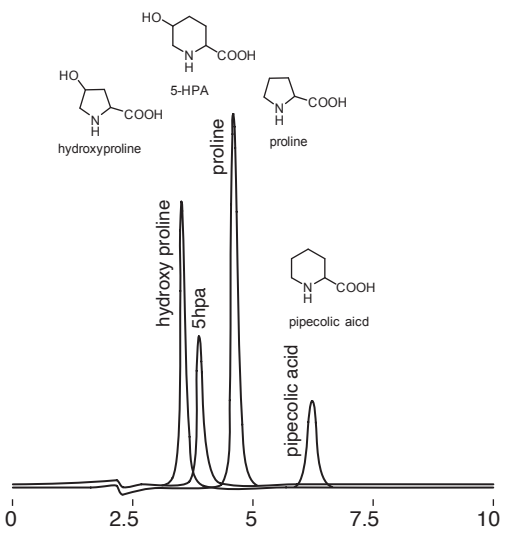


Fig. 2-35
alkyl amino acid

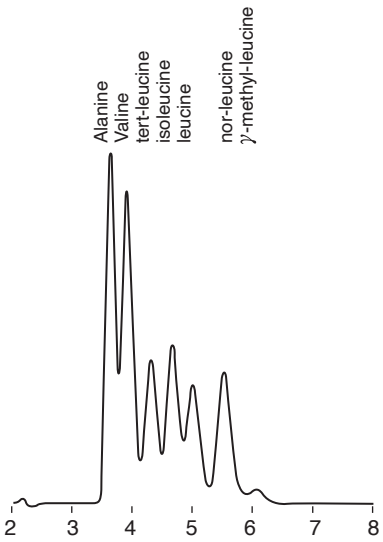
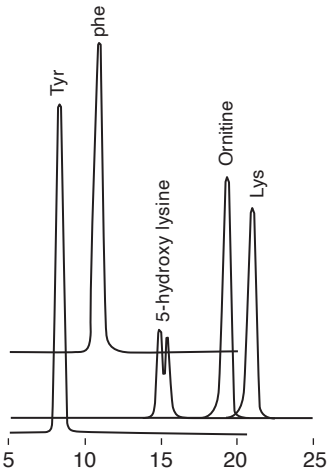


Fig. 2-36
basic amino acid and aromatic amino acids



Conditions
Column : MCI GEL™ CK10U
6mm I.D.×120mm
Eluent : 0.3M $NaSO_4$ (pH5.7)
Flow : 0.5mL/min
Temp. : 60°C
Detection : UV210nm

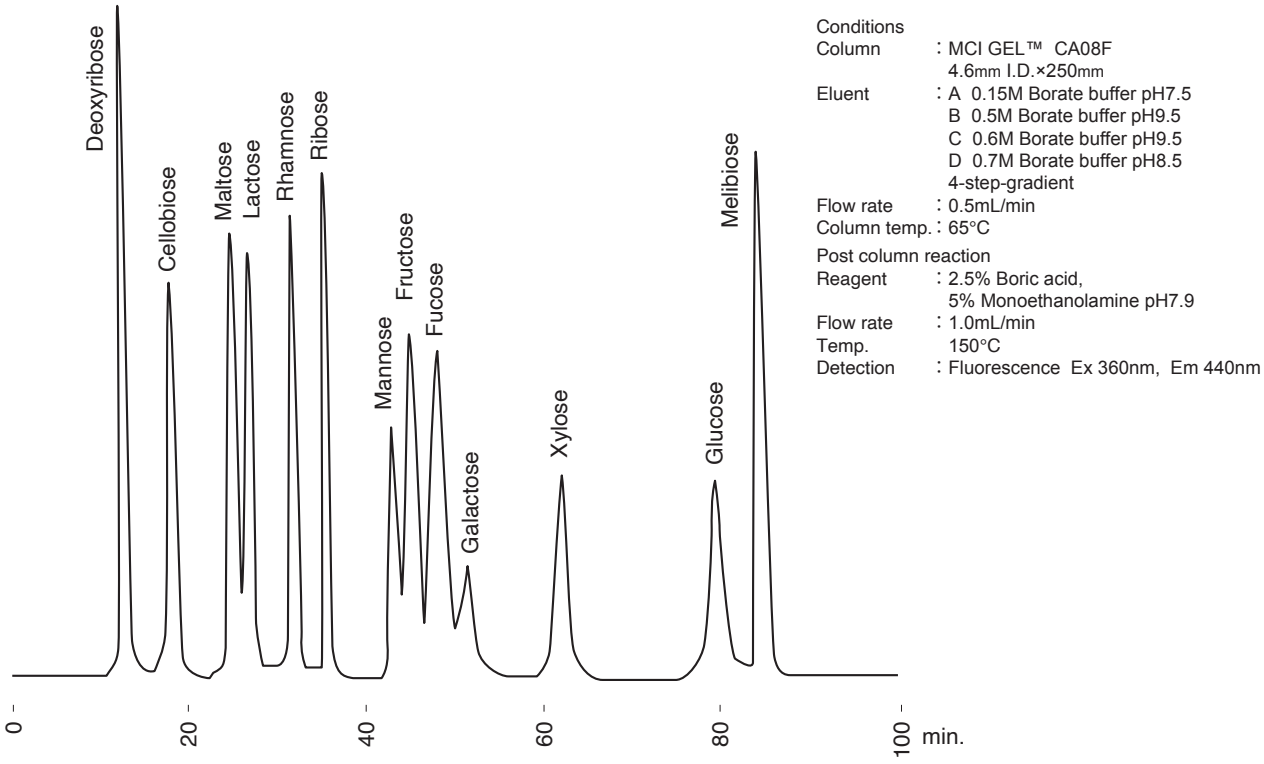
CA08F

Anion exchange column
applications; sugars, carboxylic acids, nucleotides

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.

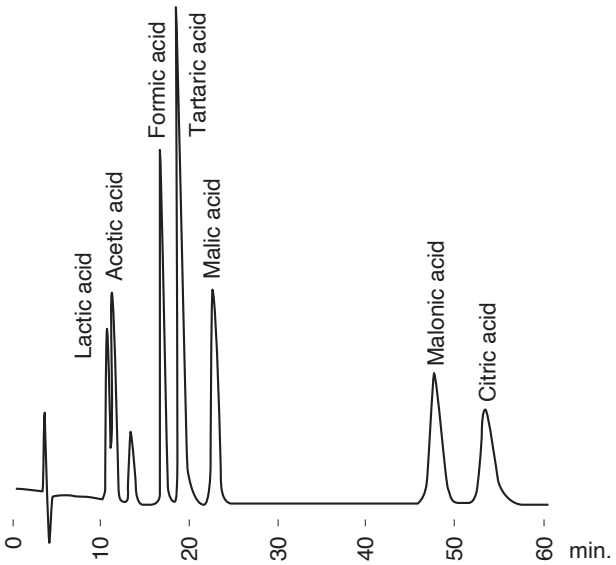
Application data of CA08F

Fig. 2-37 Sugars



Conditions
Column : MCI GEL™ CA08F
4.6mm I.D.×250mm
Eluent : A 0.15M Borate buffer pH7.5
B 0.5M Borate buffer pH9.5
C 0.6M Borate buffer pH9.5
D 0.7M Borate buffer pH8.5
4-step-gradient
Flow rate : 0.5mL/min
Column temp. : 65°C
Post column reaction
Reagent : 2.5% Boric acid,
5% Monoethanolamine pH7.9
Flow rate : 1.0mL/min
Temp. 150°C
Detection : Fluorescence Ex 360nm, Em 440nm

Fig. 2-38 Carboxylic acids



Conditions
Column : MCI GEL™ CA08F
4.6mm I.D.×250mm
Eluent : 0.6M Na_2SO_4 pH3.0
Flow rate : 0.5mL/min
Column temp. : 60°C
Detection : 210nm

Application data of CA08F

Fig. 2-39 Carboxylic acids

Conditions
Column : MCI GEL™ CA08F
4.6mm I.D × 250mm
Eluent : 0.6M Na_2SO_4 pH2.0
Flow rate : 0.5mL/min
Column temp. : 60°C
Detection : 210nm

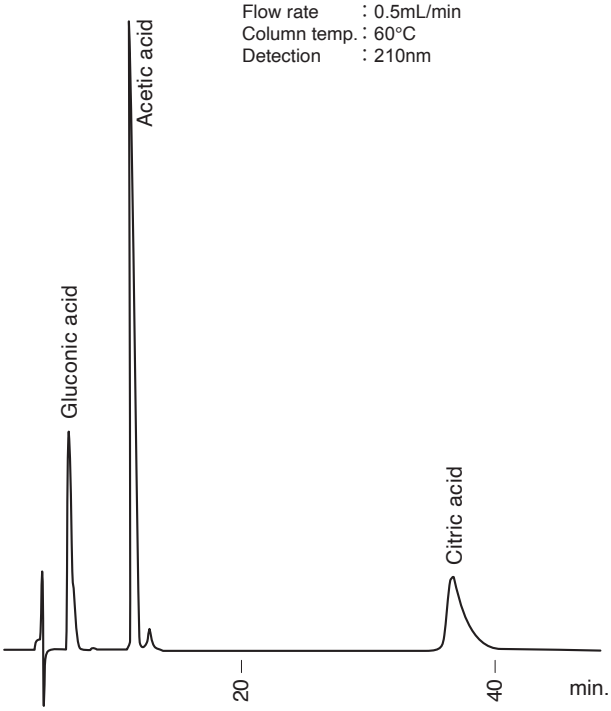


Fig. 2-40 Organic acid

Conditions
Column : MCI GEL™ CA08F
lot 5F1502
Eluent : 0.6M Na_2SO_4 8 (pH4)
Flow rate : 0.5mL/min
Temp : 60°C
Detection : 210nm

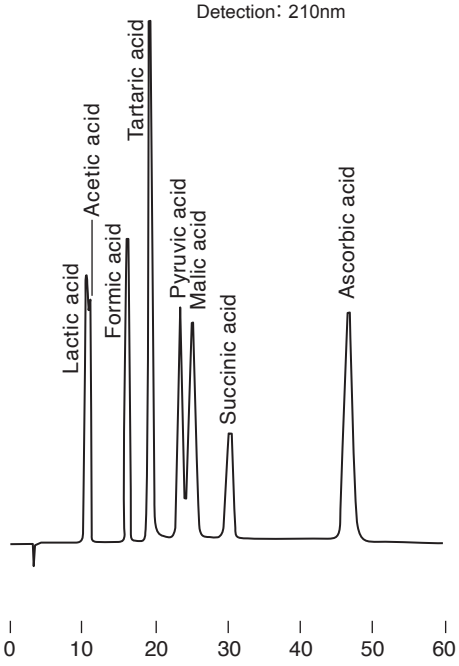
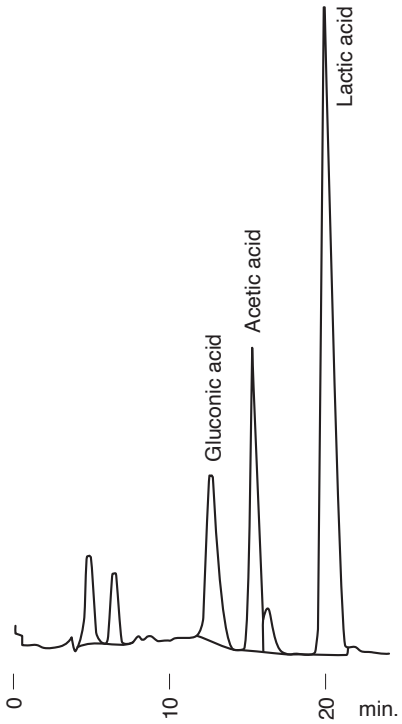


Fig. 2-41 Carboxylic acids



Conditions
Column : MCI GEL™ CA08F
4.6mm I.D × 250mm
Eluent : 0.1M NaH_2PO_4 pH3.3
Flow rate : 0.4mL/min
Column temp. : 55°C
Detection : 210nm

3 MCI GEL™ Ion chromatography columns and materials

◯Cation chromatography column MCI GEL™ SCK01
◯Cation chromatography column MCI GEL™ CHK45/C05
◯Anion chromatography column MCI GEL™ SCA04

The MCI GEL™ ion chromatography columns are based on surface functionalized cation and anion exchange resins designed for non-suppressed ion chromatography applications. The non-suppressed ion chromatography is an analysis technique of cations and anions with combination of a packed column of low capacity ion exchange resin and low concentration of electrolyte solution as an eluent. The advantage of the ion chromatography is that several ions can be analyzed by only one injection with free of complicated sample pre-treatment.

Cation chromatography column MCI GEL™ SCK01

Packing material of MCI GEL™ SCK01 is crosslinked polystyrene functionalized with sulfonic acid. This column is characterized by excellent resolution and rapid analysis for monovalent and divalent cations. Standard monovalent cations like Li+, Na+, NH4+, K+, Rb+, Cs+ and simple amines such as mono-, di- and trimethylamine can be resolved using a nitric acid solution as eluent. Divalent cations, such as alkaline earth metals and transition metal elements, can be efficiently resolved using tartaric acid and complexing reagent such as ethylene diamine to selectively elute the metals from the column.

■Note:
When using the MCI GEL™ SCK01 column for monovalent cations, it is recommended that a pre-column, MCI GEL™ SCK-PC, be used to trap heavy metals which might otherwise poison the SCK01 column resulting in a rapid loss of capacity and chromatographic performance.

Cation chromatography Column MCI GEL™ CHK45/C05

Packing material of MCI GEL™ CHK45/C05 is made of crosslinked polymethacylate functionalized with carboxylic acid. By use of simple eluent system, MCI GEL™ CHK45/C05 can separate both monovalent and divalent cations in tap water, river water and other environmental water samples.

Anion chromatography column MCI GEL™ SCA04

Packing material of MCI GEL™ SCA04 is based on a hydrophilic viniyl polymer matrix functionalized with quaternary ammonium group and particle size of 5 μm. A solution of potassium hydrogen phthalate and a vanilic acid (VA)/N-methyldiethanolamine (MDEA) solution both can be used as a mobile phase. The unique VA/MDEA eluent, is developed for the SCA04 column, which allows users to determine 7 standard anions in 14 minutes without system peak.

■Note:
A pre-column, MCI GEL™ SCA-PC is recommended for prevention of contamination to the SCA04 column when the VA/MDEA eluent is used. The SCA-PC is effectively prolong SCA04 column life. The SCA-PC should be installed between an outlet of HPLC pump and an sample injector.

SCA04 4.6×150 PEEK

Column list

Cation analysis	MCI GEL™ SCK01	6mm I.D×50mm	Stainless steel column
Cation analysis	MCI GEL™ SCK01	4.6mm I.D×150mm	Stainless steel column
Pre-column for cation analysis	MCI GEL™ SCK-PC	6mm I.D×50mm	Stainless steel column
Cation analysis	MCI GEL™ CHK45/C05	4.6mm I.D×150mm	Stainless steel column
Anion analysis	MCI GEL™ SCA04	4.6mm I.D×150mm	PEEK column
Pre-column for anion analysis	MCI GEL™ SCA-PC	8mm I.D×10mm	Stainless steel column

*USP L31 column

Application data of SCK01

Fig. 3-1 Monovalent cations

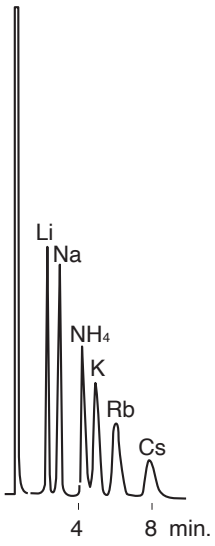


Fig. 3-2 Amines

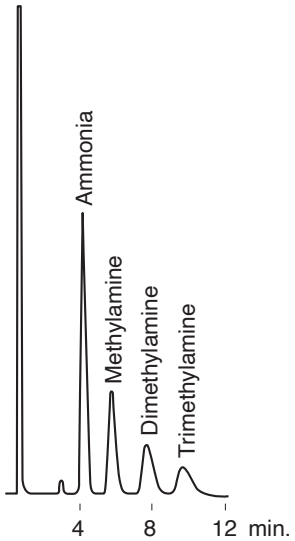


Fig. 3-3 Monovalent cations in rain

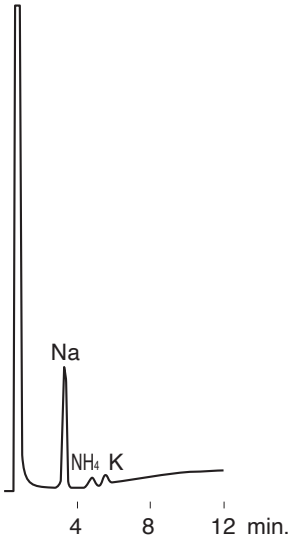


Fig. 3-4 Monovalent cations in tap water

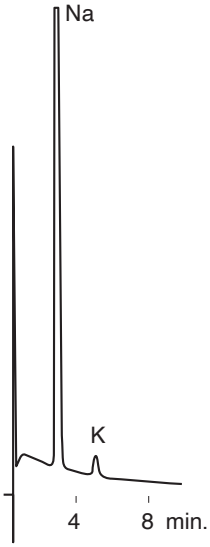


Fig. 3-5 Sports drink

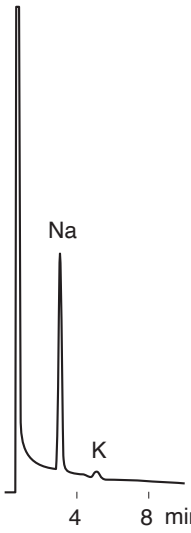
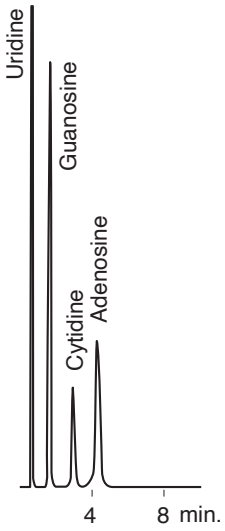


Fig. 3-6 Nucleoside



Conditions
Column : MCI GEL™ SCK01 6mm I.D.×50mm
Eluent : 5mM HNO_3
Flow rate : 1.0mL/min
Column temp. : 40°C
Detection : Conductivity (Fig. 3-1, 3-2, 3-3, 3-4, 3-5) 254nm (Fig. 3-6)

Application data of SCK01

Fig. 3-7 Alkaline earth metals

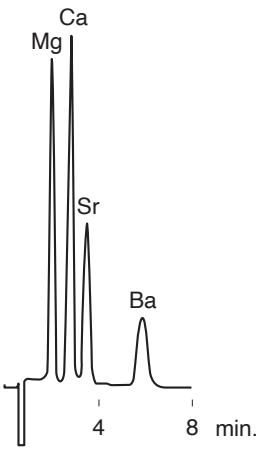


Fig. 3-8 Transition metals

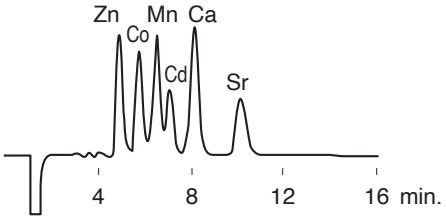
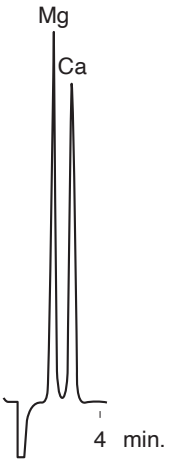


Fig. 3-9 Divalent cations

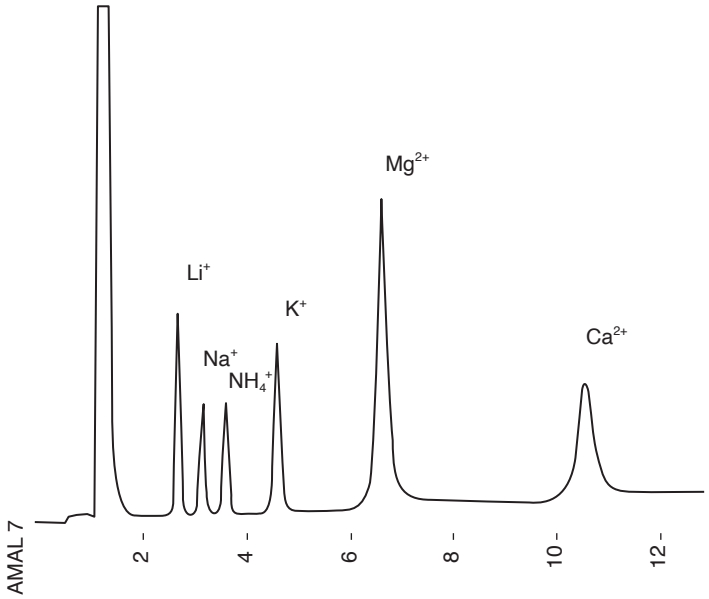


Conditions
Column : MCI GEL™ SCK01, 6mm I.D. ×50mm(Two columns are connected in series in Fig. 3-8)
Eluent : 2mM Tartaric acid / 1.5mM Ethylenediamine (Fig. 3-7, Fig. 3-9)
1.5mM Tartaric acid / 0.8mM Ethylenediamine(Fig. 3-8)
Flow rate : 1.0 mL/min
Temp. : 40°C
Detection : Conductivity

Application data of CHK45/C05

Fig. 3-10 Mono, Divalent cations

Conditions
Column : MCI GEL™ CHK45/C05 (SUS)
4.6mm I.D.×150mm
Eluent : 4mM H_2SO_4
Flow rate : 1.2mL/min
Temp. : 40°C
Detection : Conductivity
Sample inj : 100µL
Li (0.5ppm), Na (1ppm), NH4 (1ppm), K (4ppm), Mg (4ppm), Ca (4ppm)



(Data provided by Professor Yokoyama of Yokohama National University)

Application data of SCA04

Fig. 3-11 Standard anions
eluent ; VA/MDEA

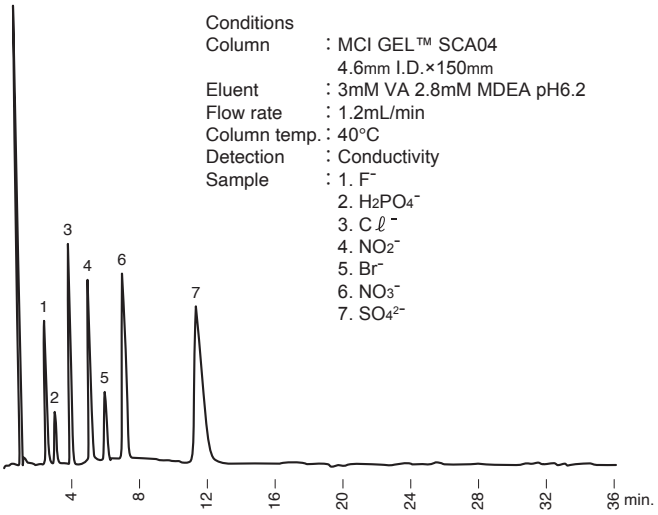


Fig. 3-12 Standard anions
eluent ; Potassium hydrogenphthalate

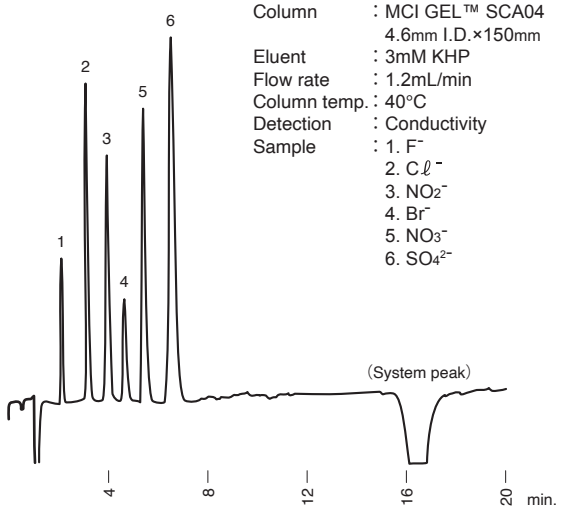
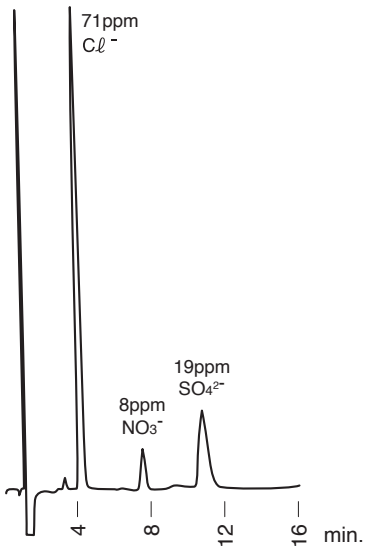
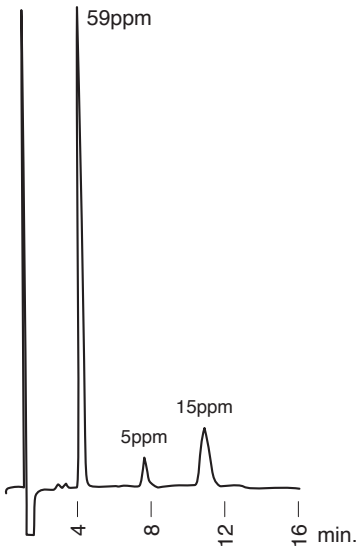


Fig. 3-13 Rain

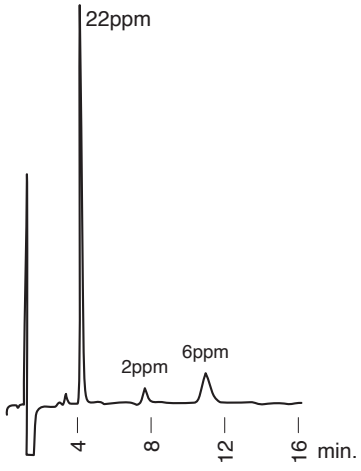
A; Beginning of rain fall



B; After 4 hours

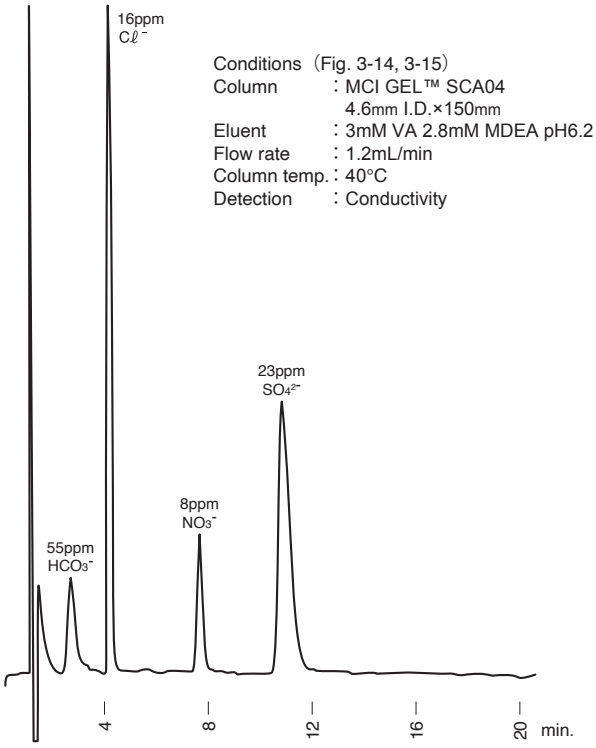


C; After 38 hours



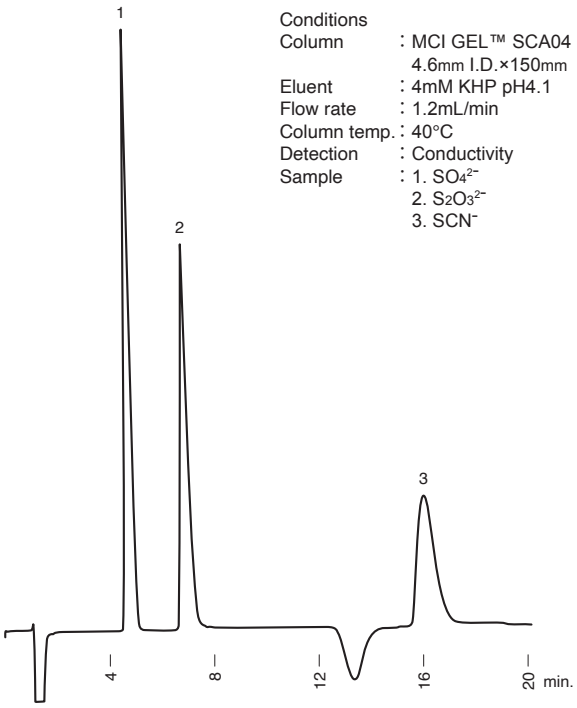
Application data of SCA04

Fig. 3-14 River water



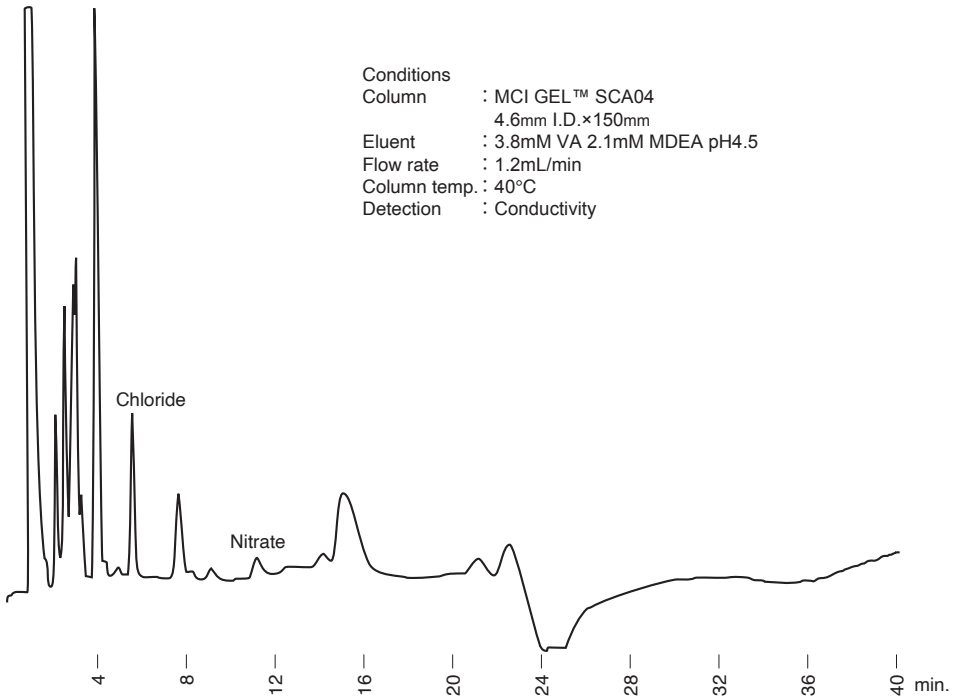
Conditions (Fig. 3-14, 3-15)
Column : MCI GEL™ SCA04
4.6mm I.D.×150mm
Eluent : 3mM VA 2.8mM MDEA pH6.2
Flow rate : 1.2mL/min
Column temp. : 40°C
Detection : Conductivity

Fig. 3-15 Sulfur compounds



Conditions
Column : MCI GEL™ SCA04
4.6mm I.D.×150mm
Eluent : 4mM KHP pH4.1
Flow rate : 1.2mL/min
Column temp. : 40°C
Detection : Conductivity
Sample : 1. SO_4^{2-}
2. $S_2O_3^{2-}$
3. SCN^-

Fig. 3-16 Instant coffee



Conditions
Column : MCI GEL™ SCA04
4.6mm I.D.×150mm
Eluent : 3.8mM VA 2.1mM MDEA pH4.5
Flow rate : 1.2mL/min
Column temp. : 40°C
Detection : Conductivity

◯Ion-exchange chromatography columns
XtalSpeed™ series

◯Size-exclusion chromatography columns
MCI GEL™ CQP series

Bioseparation columns

MCI GEL™ bioseparation columns are based on a hydrophilic, wide-pore, and rigid polymer designed for analytical chromatography of proteins, peptides, enzymes, and other biomolecules.

MCI GEL™ CQP series are used for size-exclusion chromatography.

XtalSpeed™ series are ion-exchange columns used for protein purification. High-quality target proteins are obtained with this column at a high recovery rate. XtalSpeed™ series are used for both analytical and preparative purpose in protein crystallography and NMR research.
XtalSpeed™ series are also used for antibody variant analysis and protein isoform analysis.

Column name	USP	Separation mode	Functional Group
XtalSpeed™ SP01	—	Cation exchange	Sulfopropyl(SP)
XtalSpeed™ DA01	—	Anion exchange	Diethyl amino ethyl(DEAE)
MCI GEL™ CQP06	L25	Size exclusion	—
MCI GEL™ CQP10	L38	Size exclusion	—
MCI GEL™ CQP30	L37, L38	Size exclusion	—

Ion exchange chromatography columns

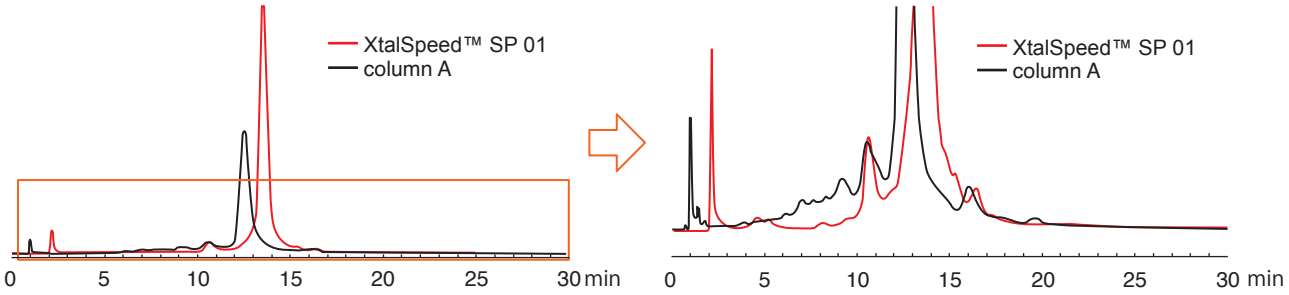
XtalSpeed™ series columns are ion-exchange columns used for protein purification. They have been designed especially for protein crystallography and NMR research, and enable to purify target proteins with high quality at a high recovery rate and in a very short time and obtain protein crystals for further analysis.
We developed hydrophilic and chemically stable polymer layers based on highly porous polymer beads, reducing non-specific binding to the lowest level.
To eliminate other interactions and allow target proteins participate only in the ion-exchange mechanism, this column was able to separate similar proteins that other columns never succeeded to separate.
Even under large sample loading, this column maintains excellent selectivity. Taking these aspects into consideration, XtalSpeed™ series can be used as preparative columns for protein.
XtalSpeed™ SP01 is also used for antibody variant analysis.

Column list

Column name	Column size	Code	Housing	Functional Group
SP01	Φ4.6mm×50mm	0-047-11	PEEK	Sulfopropyl (SP)
	Φ4.6mm×100mm	0-047-12		
	Φ7.5mm×100mm	0-047-13		
	Φ11.5mm×100mm	0-047-14		
DA01	Φ4.6mm×50mm	0-047-01	PEEK	Diethylaminoethyl (DEAE)
	Φ4.6mm×100mm	0-047-04		
	Φ7.5mm×100mm	0-047-02		
	Φ11.5mm×100mm	0-047-03		

Application data of XtalSpeed™ series

Fig. 4-1 Analysis of Rituximab



Conditions
Column : XtalSpeed™ SP01
100 x 4.6mmI.D
Column A (250 x 4mmI.D)
Eluent : A, 20mM Na phophate (pH7.0)
B, A + 1.0M NaCl
Flow rate : 0.529mL/min for XtalSpeed and 1.0mL/min for ProPac
Gradient : (A), 2.5-20.0%B over 30min + 20.0-100%B over 5min
(C), 2.5-5.0%B over 30min + 5.0-100%B over 5min

Fig. 4-2 Analysis of Hemoglobin A1C

Conditions
Column : XtalSpeed™ SP01
50 x 4.6mmI.D
Eluent : A, 20mM Bis-Tris-HCl
(pH6.0)
B, A + 1M NaCl
Flow rate : 0.5mL/min
Gradient : 5 - 40%B over 30min
Detection : VIS 415nm
Temperature : 35°C

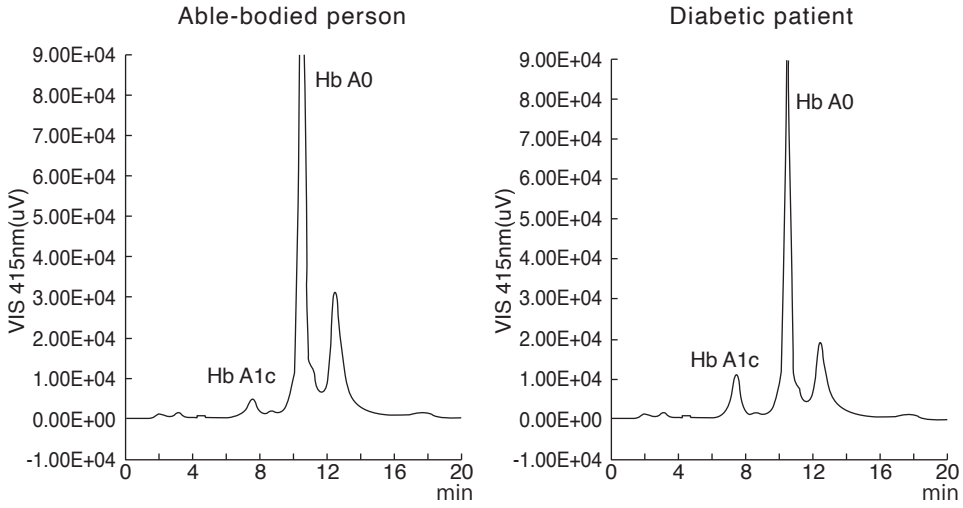
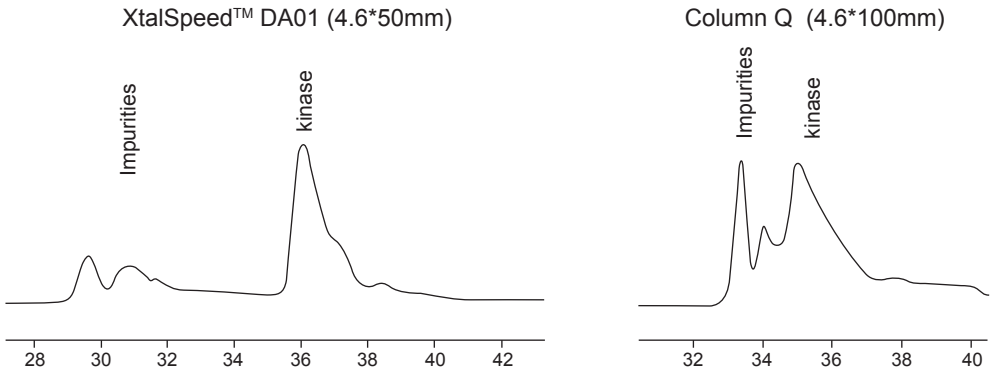


Fig. 4-3 Comparison of loadability



Conditions
Eluent : Buffer A:50mM HEPES-NaOH(pH7)
Buffer B:50mM HEPES-NaOH(pH7),1M NaCl
Flow rate : XtalSpeed™ DA01 :0.6mL/min
Competitor's Column Q:1mL/min
Gradient : 0-40%B (0-400mM NaCl)/40CV
Sample : 50 micro grams of human kinase

CQP series

Aqueous size exclusion columns

Size exclusion chromatography columns

Size exclusion chromatography is a liquid chromatographic technique which separates solute molecules according to their size in solution. The column is packed with porous particles and separation takes place as a result of the differential solute distribution outside and within the pores of the packing material. Solute molecules which are larger than the pores of the packing material will be excluded and therefore will elute first and have a lower retention time than the smaller one. The CQP series columns based on a hydrophilic polymer are designed for analysis of water soluble polymers such as oligosaccharides and PEG, etc.

Column list

●CQP series

MCI GEL™ column	USP	Column dimensions	Packing materials		Theoretical plates number [TP／column]	Exclusion limit [PEG]
			Particle size [μm]	Pore size [nm]		
MCI GEL™ CQP06	L25	7.5mm I.D. ×600mm	10	12	10000	～1×10^3
MCI GEL™ CQP10	L38	7.5mm I.D. ×600mm	10	20	6000	～1×10^4
MCI GEL™ CQP30	L37, L38	7.5mm I.D. ×600mm	10	60	6000	～1×10^6

●Guard columns

MCI GEL™ column	Column dimensions
MCI GEL™ CQP06G	4.0mm I.D.×50mm
MCI GEL™ CQP10G	4.0mm I.D.×50mm
MCI GEL™ CQP30G	4.0mm I.D.×50mm

Application data of CQP series

Fig. 4-4 Calibration curve

Conditions
Column : MCI GEL™ CQP06
MCI GEL™ CQP10
MCI GEL™ CQP30
7.5mm I.D.×600mm
Eluent : H_2O
Flow rate : 1.0mL/min
Column temp. : ambient
Detection : RI
Sample : PEG 100µl inj.

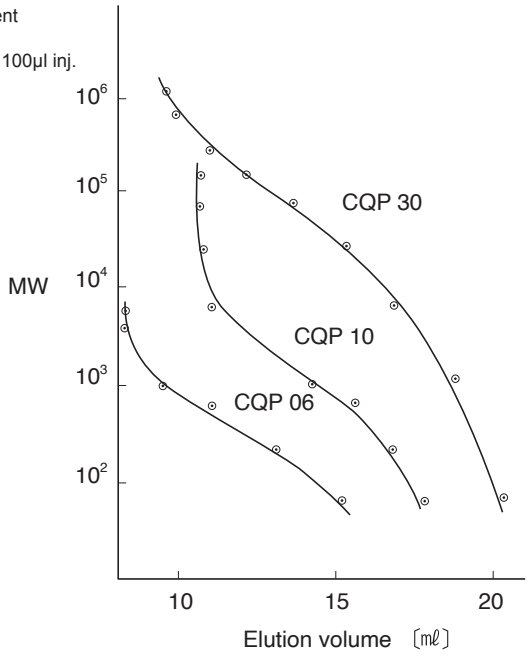


Fig. 4-5 Separation of PEG mixture

Conditions
Column : MCI GEL™ CQP30 7.5mm I.D.×600mm
Eluent : H_2O
Flow rate : 1.0mL/min
Column temp. : 25°C
Detection : RI
Sample : 1. PEG 145,000
2. 40,000
3. 6,000

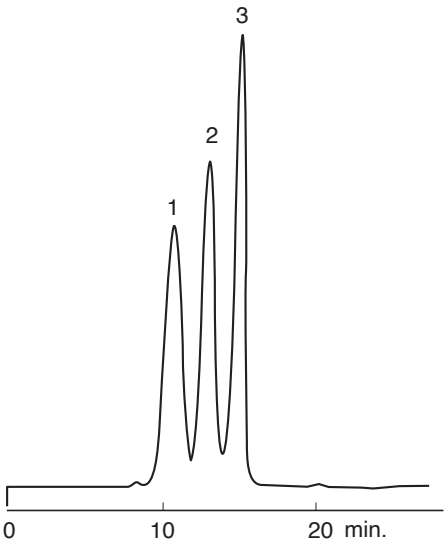


Fig. 4-6 Separation of protein mixture

Conditions
Column : MCI GEL™ CQP30 7.5mm I.D.×600mm
Eluent : 14mM Tris-HCℓO_4 buffer
Flow rate : 1.0mL/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Ferritin (MW440,000)
2. Ovalbumin (MW43,000)
3. Myoglobin (MW17,500)
4. Cytochrome c (MW12,400)

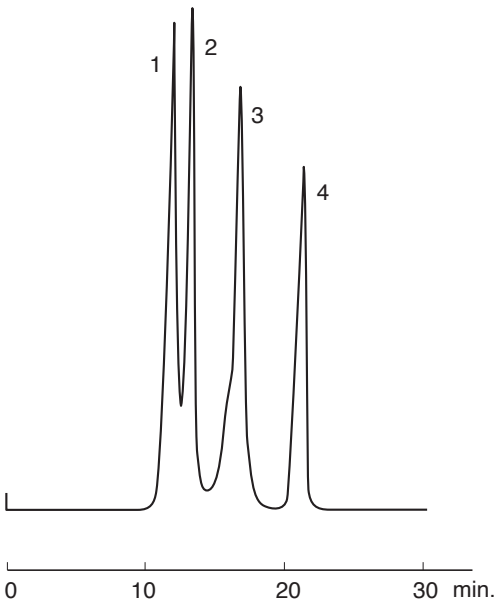
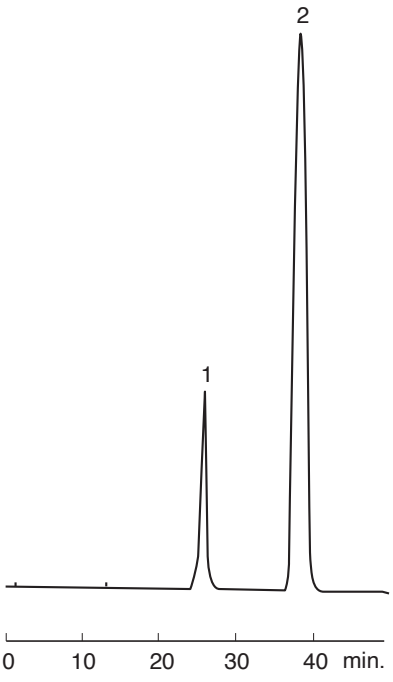


Fig. 4-7 Separation of gluconic acid and glucose

Conditions
Column : MCI GEL™ CQP06 7.5mm I.D.×600mm
Eluent : H_2O
Flow rate : 0.8mL/min
Column temp. : ambient
Detection : RI
Sample : 1. 5% Gluconic acid
2. 5% Glucose



5 MCI GEL™ Analytical and preparative chromatography columns and materials for pharmaceutical applications

○Polymeric partition chromatography columns and materials MCI GEL™ CHP series

Separation mechanism of CHP series

High performance liquid chromatography relies on one of the following physical phenomena for efficient separation of solutes: partition, adsorption, size exclusion, or ion exchange. Of these, partition chromatography is the most commonly used method, and it separates solutes based on their difference in partitioning between a stationary phase and a mobile phase. This technique has currently become the mainstay in industry for the separation of organic compounds such as pharmaceuticals, agricultural chemicals, and other intermediates. Practically, partition chromatography can be performed in two different modes depending on the relative polarities of the stationary and mobile phases. In the normal phase (NP) mode, the mobile phase is less polar than the stationary phase while the situation is reversed in the reverse phase (RP) mode, where the mobile phase is significantly more polar than the stationary phase.

MCI GEL™ specializes in polymer-based packing materials. The use of polymer-based columns has become more widespread thanks to the many advantages of the polymer matrix like excellent selectivity, the absence of specific adsorption which is found commonly with silica-based packing, operability in a wide pH range and good chemical stability due to the inert nature of polymeric materials. The MCI GEL™ partition chromatography columns are based on a polystyrene and polymethacrylate porous polymer. As RP columns, they are applied to the separation of a wide variety of organic compounds, both in the isocratic and gradient elution mode. The compounds include peptides, insulin, small molecule APIs, nutraceutical compounds, water-soluble vitamins and nucleotides. As NP columns, they are used in the separation of various carotenoids, fat-soluble vitamins, steroids, and food additives. These columns tolerate various organic solvents like hexane, heptane, methylene chloride, and alcohols.
As NP columns, they are used in the separation of various carotenoids, fat-soluble vitamins, steroids, and food additives. Various organic solvents like Hexane Heptane, methylene chloride and alcohols can be used.

The MCI GEL™ packing materials are based on the same chemistries offered in the Diaion™ and Sepabeads™ synthetic adsorbent resins. These polymer chemistries, like Diaion™ HP series and Sepabeads™ SP series, are widely used and documented in the biopharmaceutical industry for fermentation extraction, the food industry and in industrial chromatographic separations. The MCI GEL™ packing materials are available as packed columns for analytical applications, and as bulk packing materials for analytical, preparative and production chromatography applications.

●Description of MCI GEL™ columns and materials

MCI GEL™ CHP20/C04

- CHP: Matrix type
- 20: Particle size
- C: C=Column, P=Material

CHP column series

Analytical and preparative chromatography columns and materials for pharmaceutical applications

MCI GEL™ CHP series are suitable for RP and NP chromatography. There are four kinds of columns of various hydrophobicities; porous polystyrene, modified porous polystyrene, polymethacrylate, and modified porous polymethacrylate. This range of packing materials offers tremendous scope for a proper selection of columns based on the properties of the target compounds.

Polystyrene packing: MCI GEL™ CHP20/C04, CHP20/C10
Modified polystyrene packing: MCI GEL™ CHP07/C04, CHP07/C10, CHK40/C04
Polymethacrylate packing: MCI GEL™ CMG20/C10
Modified polymethacrylate packing: MCI GEL™ CHK45/C05

The hydrophobicities of the columns are in the following orders:

MCI GEL™ CHP07/C04, C10 > CHP20/C04, C10 > ODS columns ≥ CMG20/C04, C10

Polymer columns for HPLC, with their superior chemical resistance, can be used with various mobile phases of broad pH range, acidic through alkaline. They have the following advantages due to their high hydrophobicities:

1) In reverse phase chromatographic methods to separate acidic or alkaline compounds, eluents that can suppress the ionic properties of such compounds are generally used. Polymer columns can be applied in these cases where ODS columns would be unsuitable.
2) Some extremely hydrophilic compounds, e.g., oligosaccharides, can be separated using strongly hydrophobic CHP07/C04 or CHP07/C10 columns.
3) Polymer columns can be washed with acidic and/or basic solutions in case of contamination.

Polymethacrylate columns, CMG20/C04 and CMG20/C10, can be applied both for reverse phase and normal phase chromatography.

Modified polystyrene packing, CHK40/C04, is a mixed-mode type material; both hydrophobic and hydrophilic interactions occur between the packing material surface and the analytes. This material is useful for compounds that are difficult to separate using existing ODS or other polymer-based columns. This column is also used in the normal phase mode and shows a unique separation profile.

All polymeric columns exhibit superior stability and yield in comparison to ODS columns, which may have free silanol groups even when end-capping agents have been used.

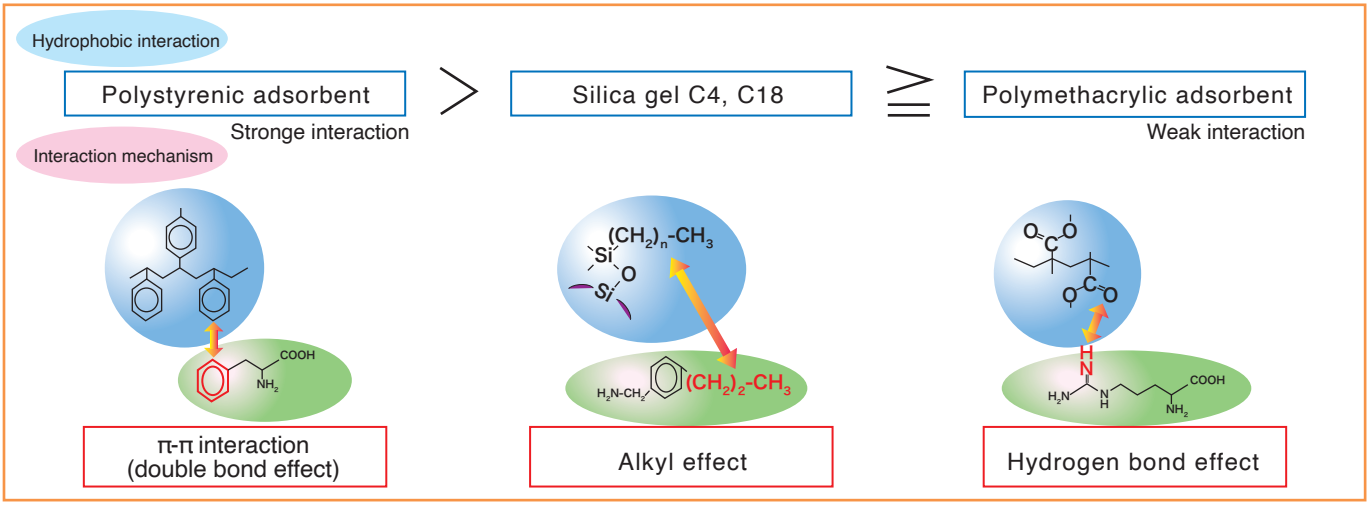
Column list

●CHP column series

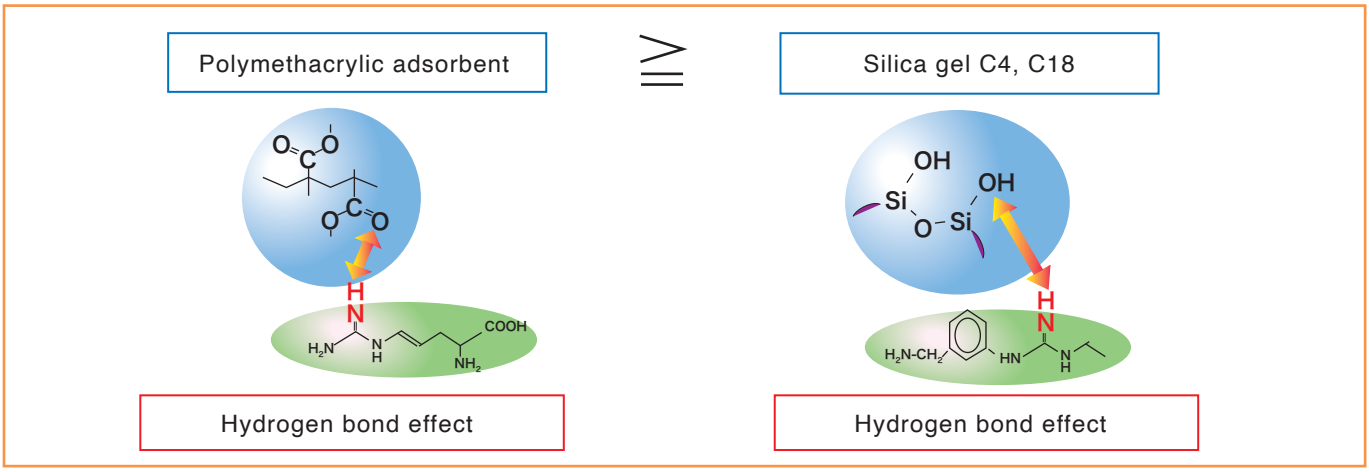
Matrix Type	Functinal group	Product name	Particle size [μm]	Column size [mm I.D.×mm]	pH range	USP
Styrene Divinylbenzene	None	CHP20/C04	4	4.6×150 20×150	Full range	L21
		CHP20/C10	10	4.6×150 4.6×250 10×250 20×150 20×250		
	Br	CHP07/C04	4	4.6×150 20×200		
		CHP07/C10	10	4.6×150 4.6×250 10×150 20×150 20×250		
	Cation exchange group	CHK40/C04	4	4.6×150		
Methacrylates	None	CMG20/C04	4	4.6×150 20×150	2～12	
		CMG20/C10	10	4.6×150 4.6×250 10×250 20×150 20×250		
	Weak cation exchange group	CHK45/C05	5	4.6×150		

*CHP20/C04, CHP20/C10: USP classification is L21

Retentiveness in reverse phase mode



Hydrophobic interaction Interaction mechanism

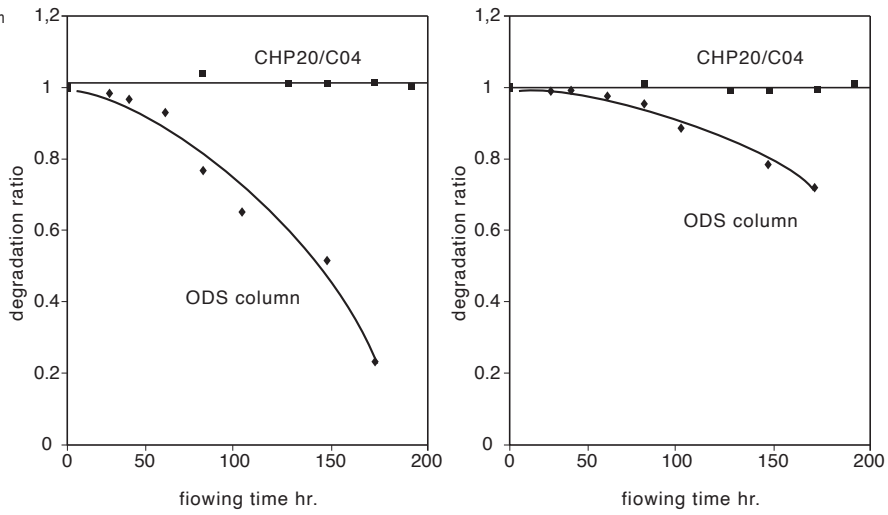


Durability of polymeric column

The polymeric RP columns are chemically stable. Specifically, the columns have resistance to an alkaline eluent. The following graphs demonstrate stability of the polymeric columns. After feeding a solution of pH 12 into the MCI GEL™ CHP20/C04, there is no change of column performance.

Fig. 5-1 Column durability at pH12 comparison between CHP20/C04 and an ODS column

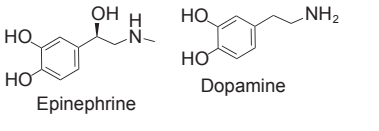
Conditions
Column : MCI GEL™ CHP20/C04 4.6mmI.D × 150mm
Eluent : 20mM Na_2HPO_4 pH12/CH3CN/=60/40
Flow rate : 0.4mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1000ppm Dimethyl phthalate 5μL

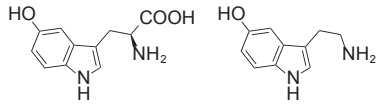


Application data of CHP series

Fig. 5-2 Separation of catecholamines

Conditions
Column : MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent : 50mM Na-phosphate pH2.0,
1.5% Hexanesulfonic acid /
CH_3CN=80/20
Flow rate : 0.25mL/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Epinephrine
2. Dopamine
3. 5-Hydroxy tryptophan
4. Serotonin
5. Tryptophan





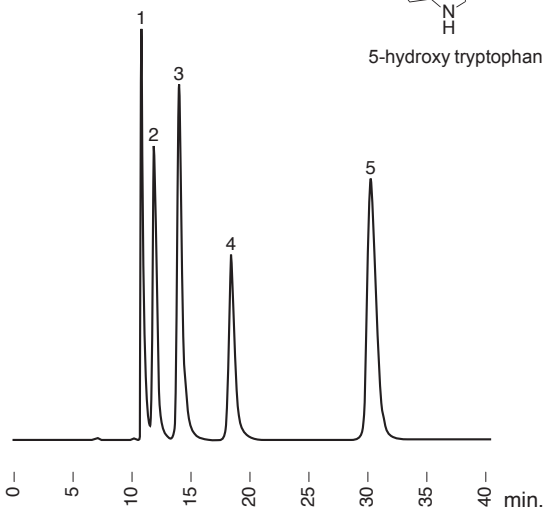
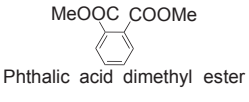
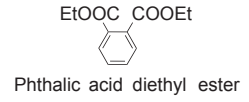


Fig. 5-3 Separation of phthalic acid esters

Conditions
Column : MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent : H_2O/CH_3CN=50/50
Flow rate : 0.75mL/min
Column temp. : 60°C
Detection : 254nm
Sample : 1. Dimethyl phthalate
2. Diethyl phthalate
3. Dipropyl phthalate





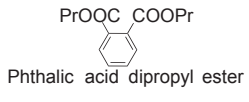


Fig. 5-4 Purine alkaloids

Conditions
Column : MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent : H_2O/CH_3CN=10/90
Flow rate : 0.4mL/min
Column temp. : 25°C
Detection : 275nm
Sample : 1.Theophylline
2.Theobromine
3.Caffeine

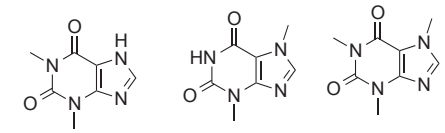
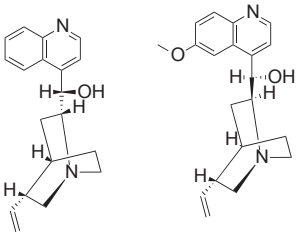
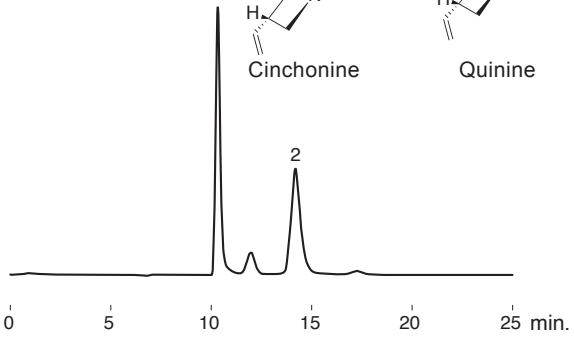


Fig. 5-5 Cinchona alkaloids

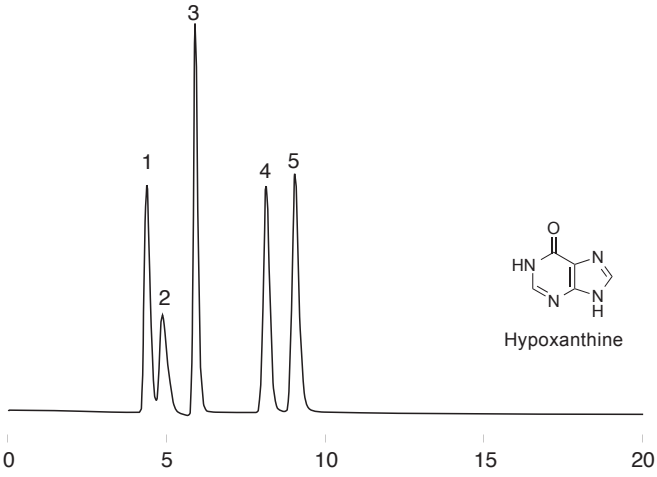
Conditions
Column : MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent : 0.1M NaH_2PO_4 pH2.0
CH_3CN=88/12
Flow rate : 0.3mL/min
Column temp. : 25°C
Detection : 275nm
Sample : 1.Cinchonine
2.Quinine



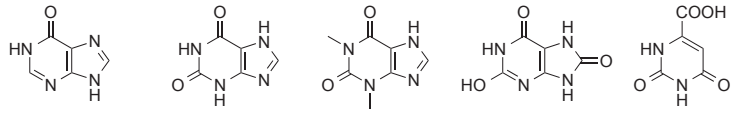


Application data of CHP series

Fig. 5-6 Uric acid and related compounds

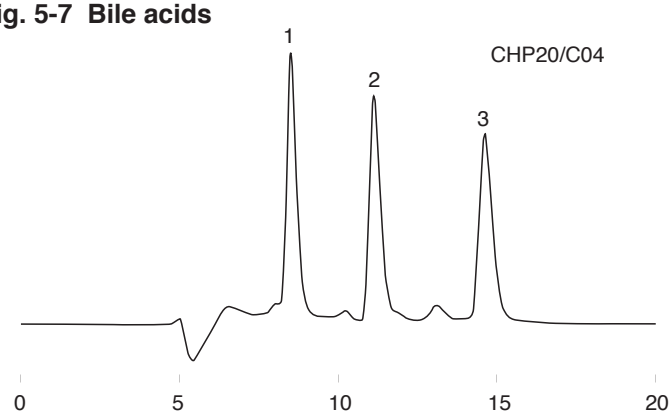


Conditions
Column : MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent : 10mM TBA/CH3CN=75/25
Flow rate : 0.4mL/min
Column temp. : 25°C
Detection : 284nm
Sample : 1.Hypoxanthine
2.Xanthine
3.Theophylline
4.Uric acid
5.Orotic acid

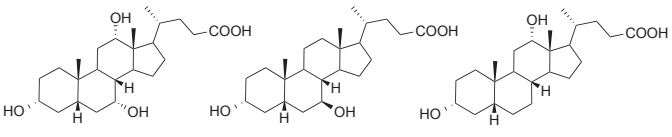


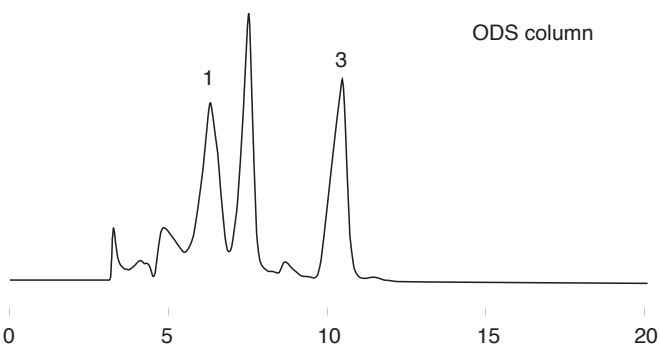
Comparison with an ODS column

Fig. 5-7 Bile acids



Conditions
Column : MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent : 50mM NaH_2PO_4 pH2.0
/CH_3CN=40/60
Flow rate : 0.3mL/min
Column temp. : 25°C
Detection : 210nm
Sample : 1.Cholic acid
2.Ursodeoxycholic acid
3.Deoxycholic acid

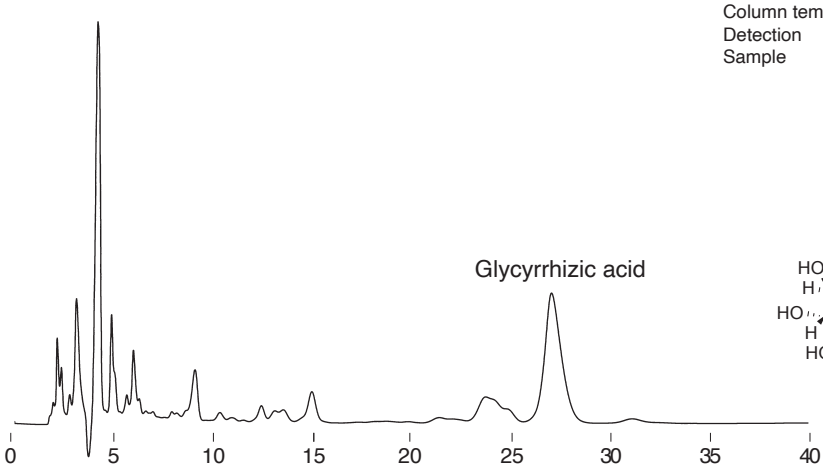




Conditions
Column : ODS column (5μm)
4.6mm I.D.×150mm
Eluent : 50mM NaH_2PO_4 pH6.0
/CH_3CN=40/60
Flow rate : 0.3mL/min
Column temp. : 25°C
Detection : 210nm
Sample : 1.Cholic acid
2.Ursodeoxycholic acid
3.Deoxycholic acid

Fig. 5-8 Glycyrrhizae radix

Conditions
Column : MCI GEL™ CHP20/C04 4.6mm I.D.×150mm
Eluent : 2.06% acetic acid/CH_3CN =63/37
Flow rate : 0.5mL/min
Column temp. : 45°C
Detection : 254nm
Sample : Extract of glycyrrhizae radix



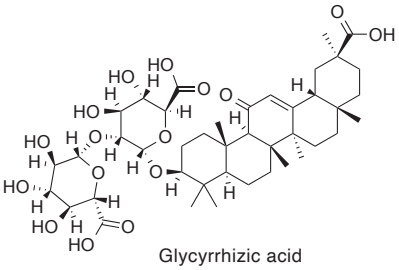
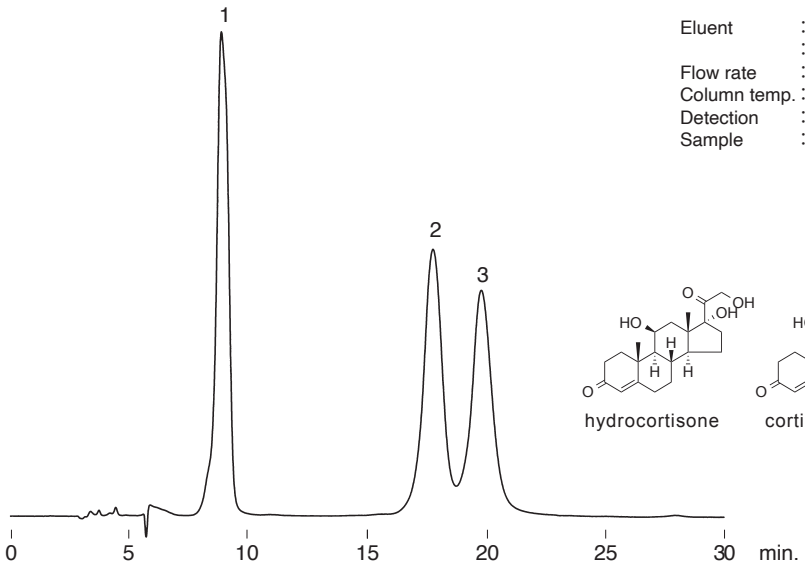
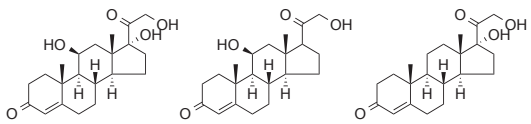


Fig. 5-9 Adrenal cortex hormones

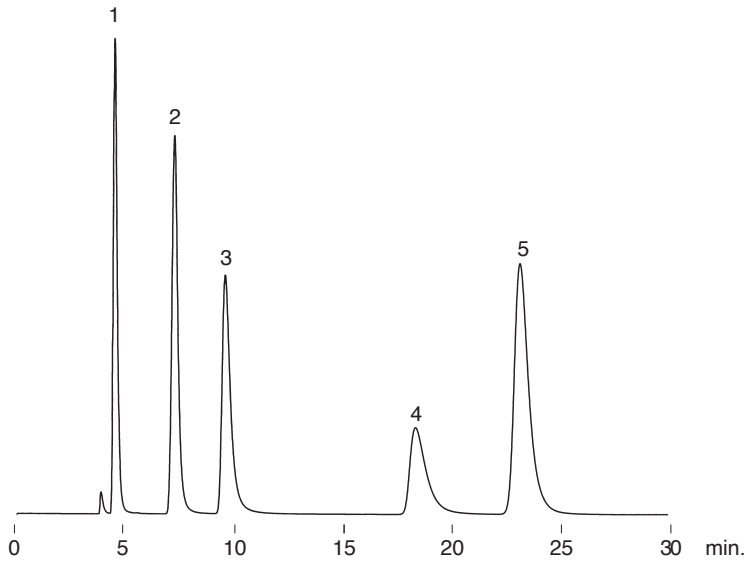
Conditions
Column : MCI GEL™ CHP20/C04 4.6mm I.D.×150mm
Eluent : H_2O/CH_3CN
: 60/40
Flow rate : 0.5mL/min
Column temp. : 45°C
Detection : 280nm
Sample : 1.Hydrocortisone
2.Corticosterone
3.11-Deoxycortisol



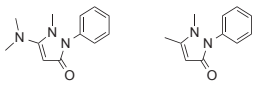


Application data of CHP series

Fig. 5-10 Ingredients of medicine



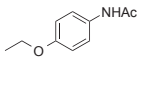
Conditions
Column : MCI GEL™ CMG20/C04
4.6mm I.D.×150mm
Eluent : 50mM phosphoric acid(pH2.0)/CH_3OH
=60/40
Flow rate : 0.5mL/min
Column temp. : 45°C
Detection : 254nm
Sample : 1.4-Dimethylaminoantipyrine
2.Antipyrine
3.Caffeine
4.Aspirin
5.Phenacetin


Dimethylaminoantipyrine
Aminopyrine

Antipyrine

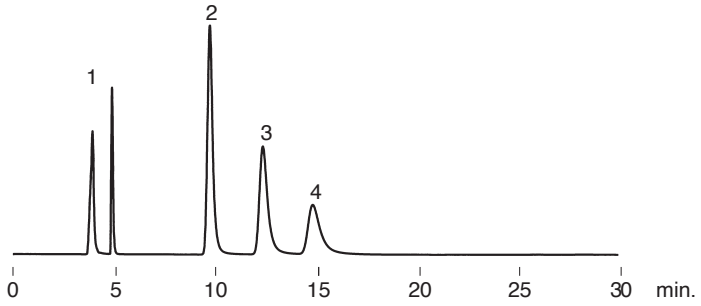

Caffeine


Aspirin

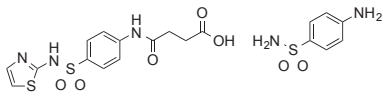

Phenacetin

Comparison with an ODS column

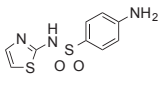
Fig. 5-11 Sulfa drugs

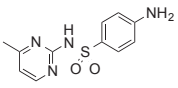


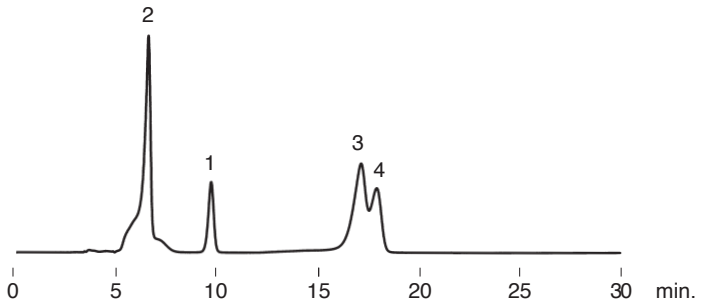
Conditions
Column : MCI GEL™ CMG20/C04
4.6mm I.D.×150mm
Eluent : 20mM phosphate pH6.8/CH_3CN
=82/18
Flow rate : 0.5mL/min
Column temp. : 45°C
Detection : 254nm
Sample : 1.Succinylsulfathiazole
2.Sulfanilamide
3.Sulfathiazole
4.Sulfamerazine


Succinylsulphathiazole

Sulfanilamide


sulphathiazole


Sulfamerazine

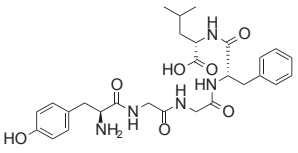


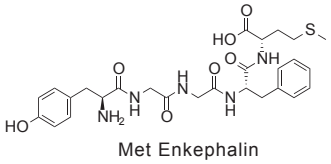
Conditions
Column : ODS column
4.6mm I.D.×150mm
Eluent : 20mM phosphate pH6.8/CH_3CN
=90/10
Flow rate : 0.5mL/min
Column temp. : 45°C
Detection : 254nm
Sample : 1.Succinylsulfathiazole
2.Sulfanilamide
3.Sulfathiazole
4.Sulfamerazine

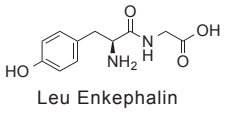
Application data of CHP series

Fig. 5-12 Peptides

Conditions
Column : MCI GEL™ CMG20/C04 4.6mm I.D.×150mm
Eluent : 0.1%TFA/CH_3CN =70/30
Flow rate : 0.5mL/min
Column temp. : 25°C
Detection : 220nm
Sample : 1.Gly-Tyr
2.Met Enkephalin
3.Leu Enkephalin
4.Angiotensin II


Gly-Tyr


Met Enkephalin


Leu Enkephalin

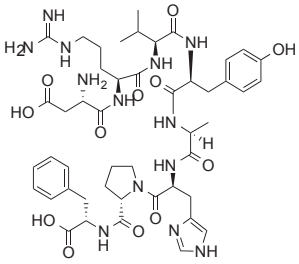

Angiotensin II

Fig. 5-13 Proteins

Conditions
Column : MCI GEL™ CMG20/C04 4.6mm I.D.×150mm
Eluent : A;0.05%TFA/CH_3CN =80/20
B;0.05%TFA/CH_3CN =20/80
A→B 30min.linear
Flow rate : 0.5mL/min
Column temp. : 25°C
Detection : 280nm
Sample : 1.Ribonuclease A
2.Cytochrome c
3.α-Chymotrypsinogen A

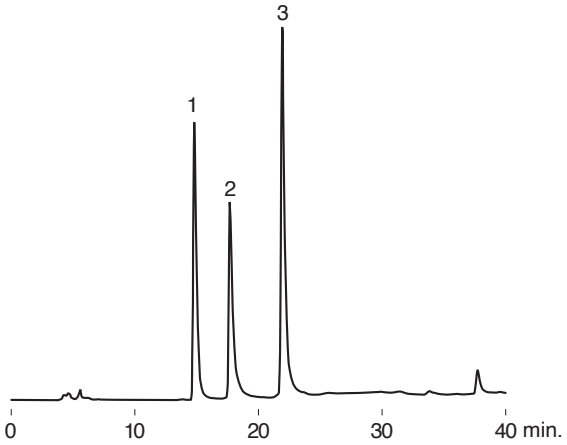
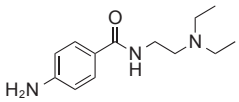


Fig. 5-14 Procainamide, Procaine

Conditions
Column : MCI GEL™ CMG20/C04 4.6mm I.D.×150mm
Eluent : 20mM phosphate pH7.2/CH_3CN =65/35
Flow rate : 0.5mL/min
Column temp. : 45°C
Detection : 254nm
Sample : 1.Procainamide
2.Procaine


Procainamide

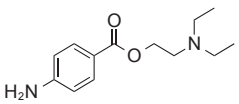
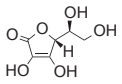
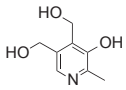
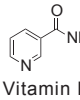

Procaine

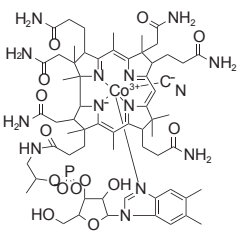
Fig. 5-15 Water-soluble vitamins

Conditions
Column : MCI GEL™ CMG20/C04 4.6mm I.D.×150mm
Eluent : 8mM Na_2HPO_4 pH7.0/CH_3CN =85/15
Flow rate : 0.5mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1.Vitamin C
2.Vitamin B6
3.Vitamin B3
4.Vitamin B12


Vitamin C


Vitamin B6

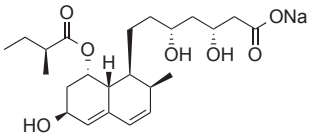

Vitamin B3


Vitamin B12

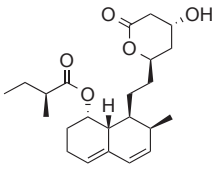
Application data of CHP series

Fig. 5-16 Pravastatin sodium

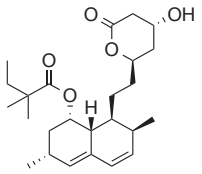
Conditions
Column : MCI GEL™ CHP20/C10 (10μm 250 ×4.6mm I.D.) and ODS (10μm 250 ×4.6mm I.D.)
Eluent : A :0.1% Formic acid; B :0.1% Formic acid in AcCN;
Gradient : 45%B-95%B over 29min.
Flow rate : 1.00mL/min
Column temp. : 25℃
Detection : UV238nm
Sample : Pravastatin sodium, Mevastatin and Simvastatin, 1mg/ml each;.
Injection : 5μL



Pravastatin sodium



(+)-Compactin; Mevastatin



(+)-Simvastatin, Simvastatin

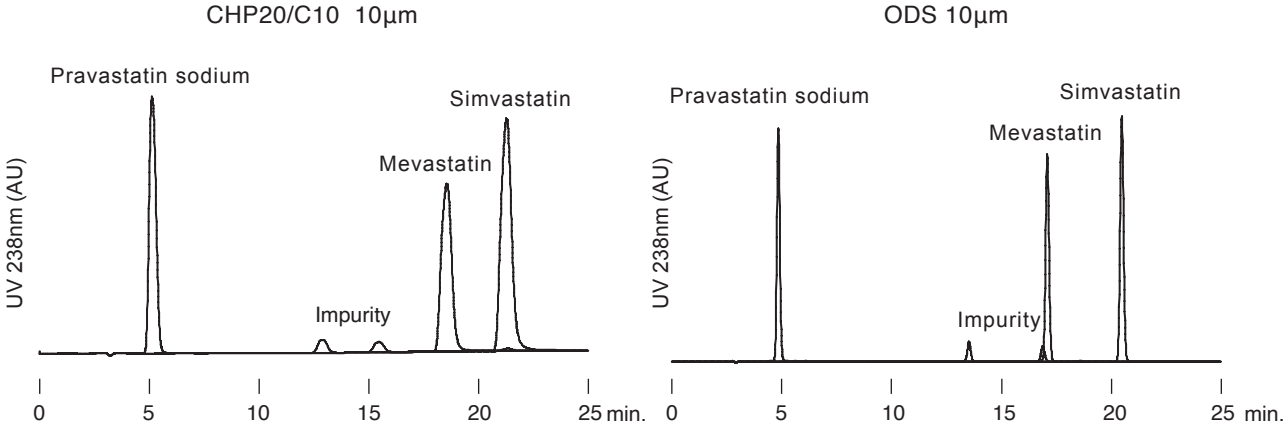
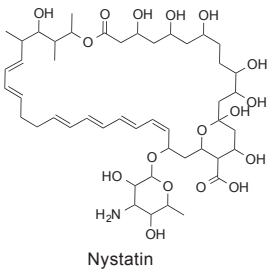
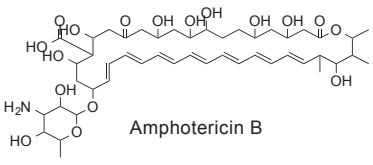


Fig. 5-17 Polyene antibiotics

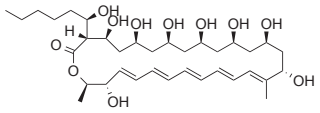
Conditions
Column : MCI GEL™ CHP20/C10 (10μm 250 ×4.6mm I.D.) and ODS (10μm 250 ×4.6mm I.D.)
Eluent : A :0.1% Formic acid; B :0.1% Formic acid in AcCN; A/B=60/40;
Flow rate : 1.00mL/min
Column temp. : 25℃
Detection : UV305nm for Nystatin, VIS405nm for Amphotericin B and UV340nm for Filipin;
Sample : Pravastatin sodium, Mevastatin and Simvastatin, 1mg/ml each;.
Injection : 10μL



Nystatin



Amphotericin B



Filipin

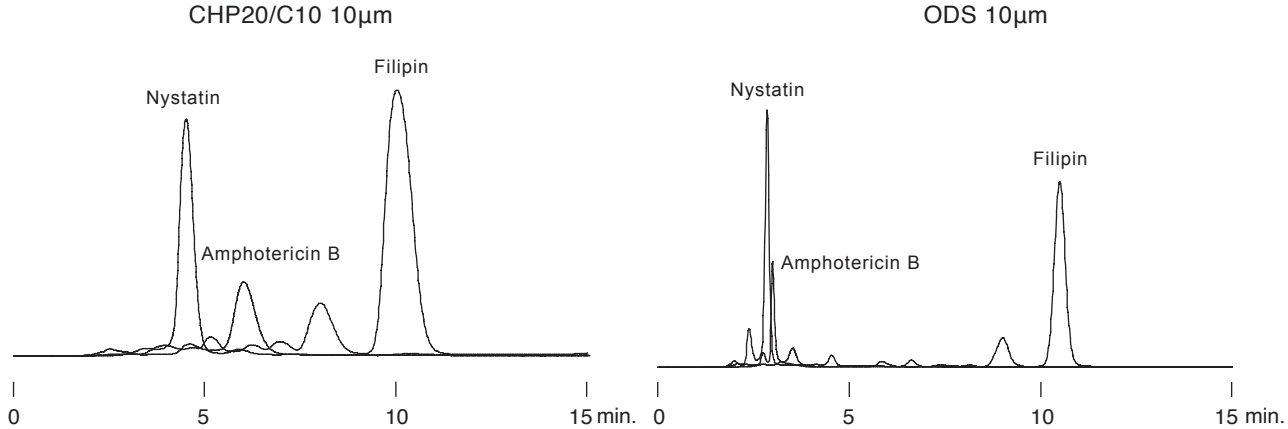


Fig. 5-18 Proteins

Conditions
Column : MCI GEL™ CMG20/C10
4.6mm I.D.×250mm
Eluent : A 0.05% TFA/CH_3CN=80/20
B 0.05% TFA/CH_3CN=30/70
A → B 45min linear gradient
Flow rate : 0.5mL/min
Column temp. : 25°C
Detection : 280nm
Sample : 1. Ribonuclease A
2. Cytochrome C
3. Transferrin
4. α-Chymotrypshinogen A
5. β-Lactoglobulin

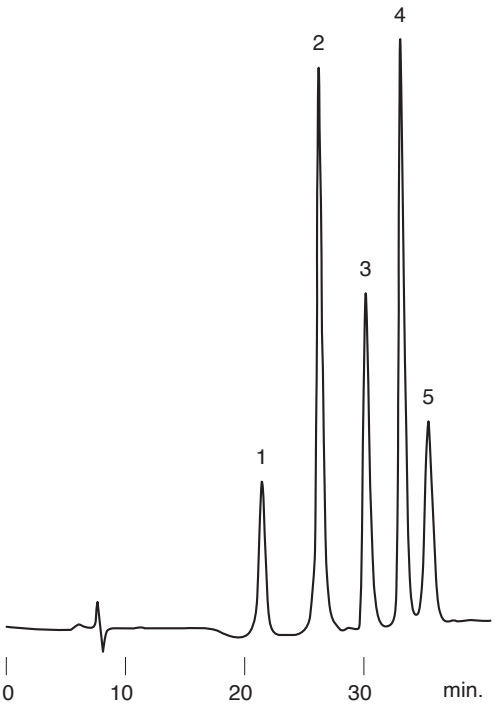
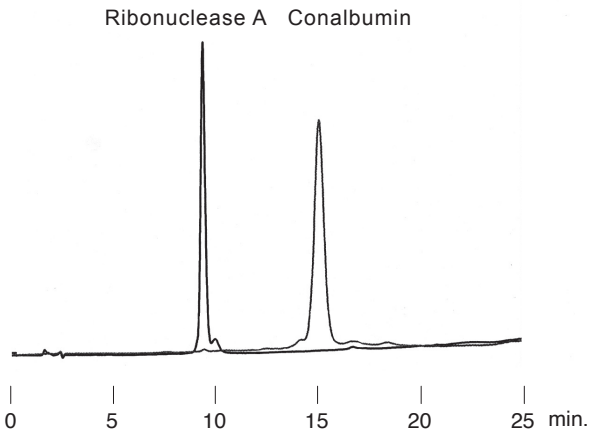
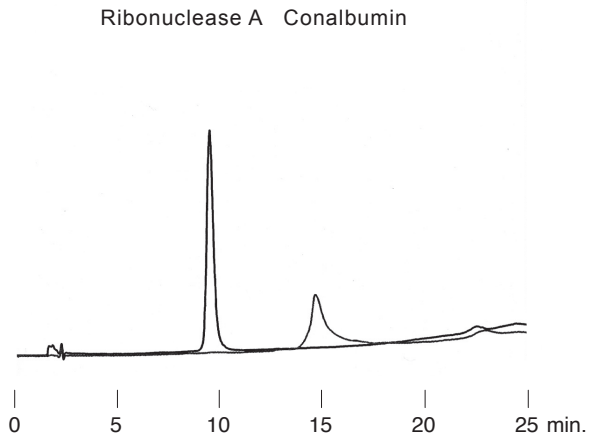


Fig. 5-19 Proteins

CHP20/C10 10μm



ODS 10μm



Conditions
Column : 150 ×4.6mm I.D.
Eluent : A :0.1% TFA;
B :0.1% TFA in AcCN
Flow rate : 1.00mL/min
Column temp. : 20%B-60%B over 20min;
Detection : UV280nm;
Sample : Ribonuclease A and Conalbumin 2mg/ml;.
Injection : 10μL

Application data of CHP series

Fig. 5-20 Insulin

Conditions
Column : MCI GEL™ CHP20/C10
MCI GEL™ CMG20/C10
ODS 10µm
4.6mm I.D.×150mm
Eluent : A) 0.1%TFA, H_2O
B) 0.1%TFA, CH_3OH
Gradient : 20%B→60%B over 20min.
Flow rate : 1.0mL/min
Column temp. : 40°C
Detection : 280nm
Sample : Insulin Glargine and human recombinant , 1mg/mL each
Injection : 10µL

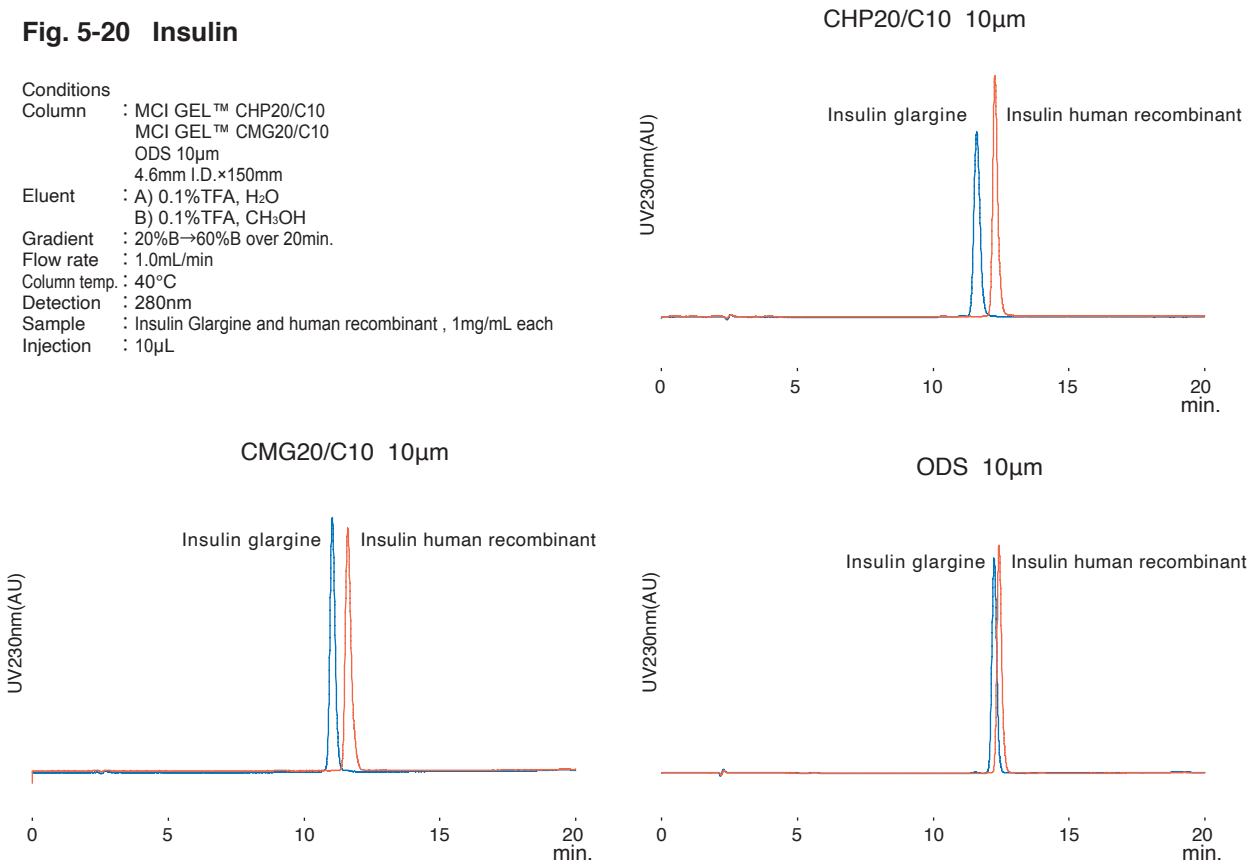
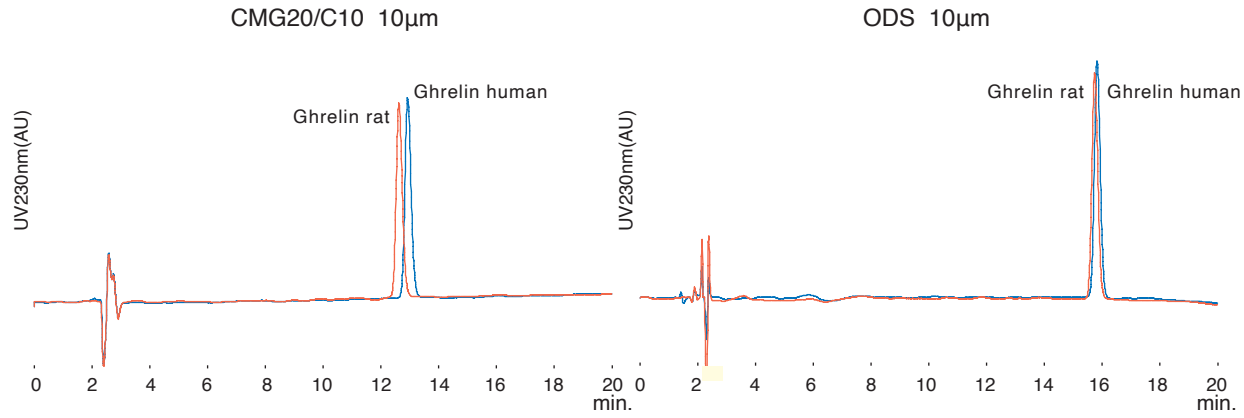


Fig. 5-21 Ghrelin

Conditions
Column : MCI GEL™ CMG20/C10
ODS 10µm
4.6mm I.D.×150mm
Eluent : A) 0.1%TFA, H_2O
B) 0.1%TFA, AcCN
Gradient : 10%B→60%B over 25min.
Flow rate : 1.0mL/min
Column temp. : 40°C
Detection : 230nm
Sample : Ghrelin rat and Ghrelin human ,0.1mmol/l each
Injection : 10µL

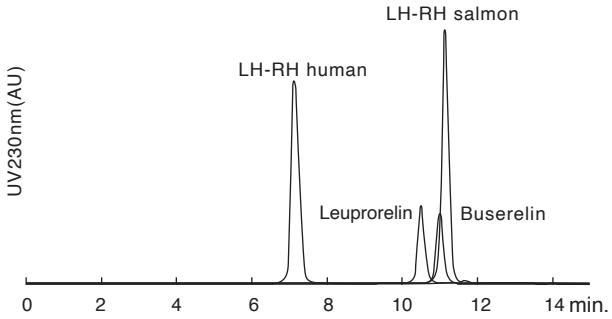


Application data of CHP series

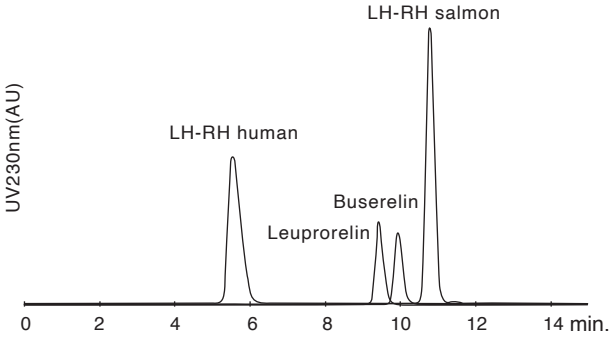
Fig. 5-22 Leuprorelin

Conditions
Column : MCI GEL™ CHP20/C10
MCI GEL™ CMG20/C10
ODS 10μm
4.6mm I.D.×150mm
Eluent : A) 0.1%TFA, H_2O
B) 0.1%TFA, AcCN
Gradient : 20%B→60%B over 20min.
Flow rate : 1.0mL/min
Column temp. : 40°C
Detection : 280nm
Sample : Leuprorelin,LHRH human, LHRH salmon and Buserelin ,1mg/mL each
Injection : 10μL

CHP20/C10 10μm



CMG20/C10 10μm



ODS 10μm

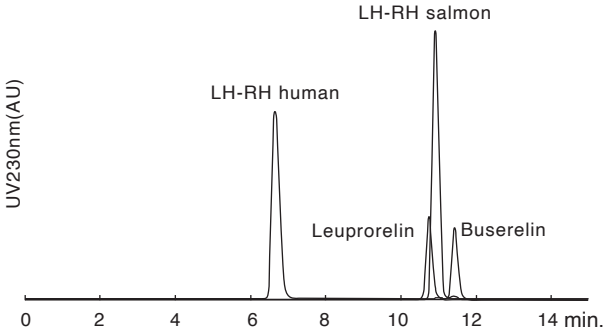
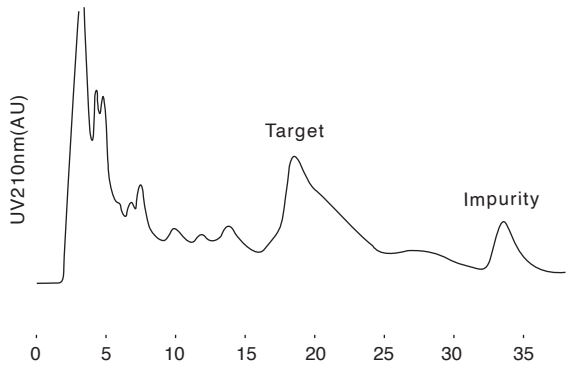


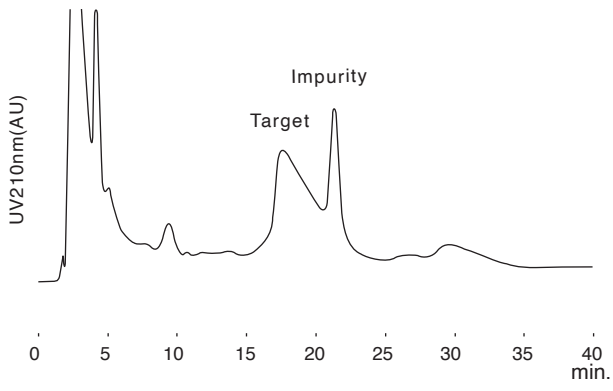
Fig. 5-23 Sifuvirtide

Conditions
Column : MCI GEL™ CMG20/C10
ODS 10μm
4.6mm I.D.×150mm
Eluent : 0.1%TFA,/CH3CN=68/32
Flow rate : 1.0mL/min
Column temp. : 40°C
Detection : 210nm
Sample : Sifuvirtide crude(purity 35.5%) 2.1mg/mL
Injection : 0.4mL

CMG20/C10 10μm



ODS 10μm



Application data of CHP series

Fig. 5-24 ssRNA Ladder Marker

Conditions
Column : MCI GEL™ CMG20/C10
ODS 10μm
4.6mm I.D.×150mm
Eluent : A)100mM TEAA, H_2O
B)100mM TEAA, CH_3CN
Gradient : CHP10/C10 10%B→40%B over 30min
ODS 10μm 8%B→40%B over 30min
Flow rate : 1.0mL/min
Column temp. : 40°C
Detection : 260nm
Sample : 14-30 ssRNA Ladder Marker [max.0.04mg/mL]
Injection : 5μL

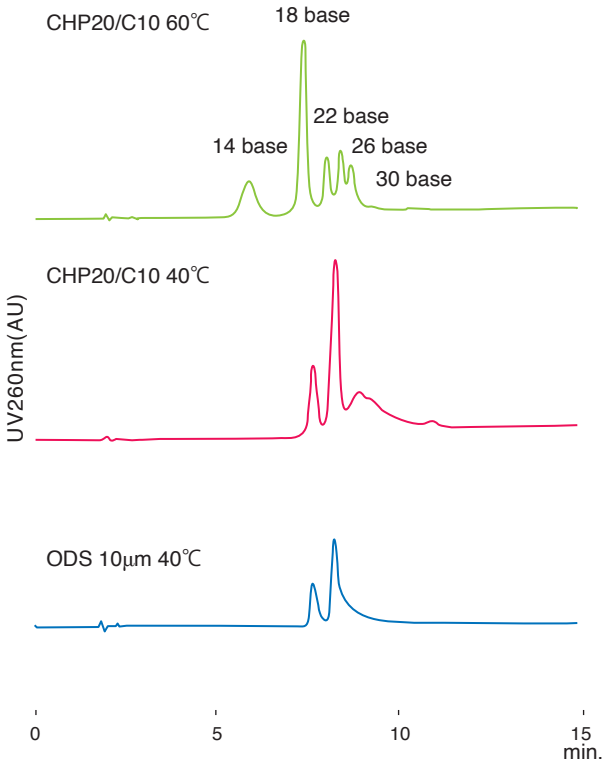
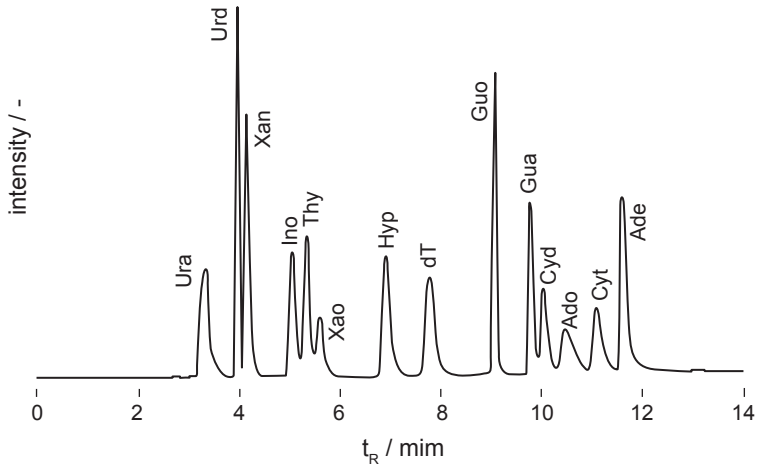


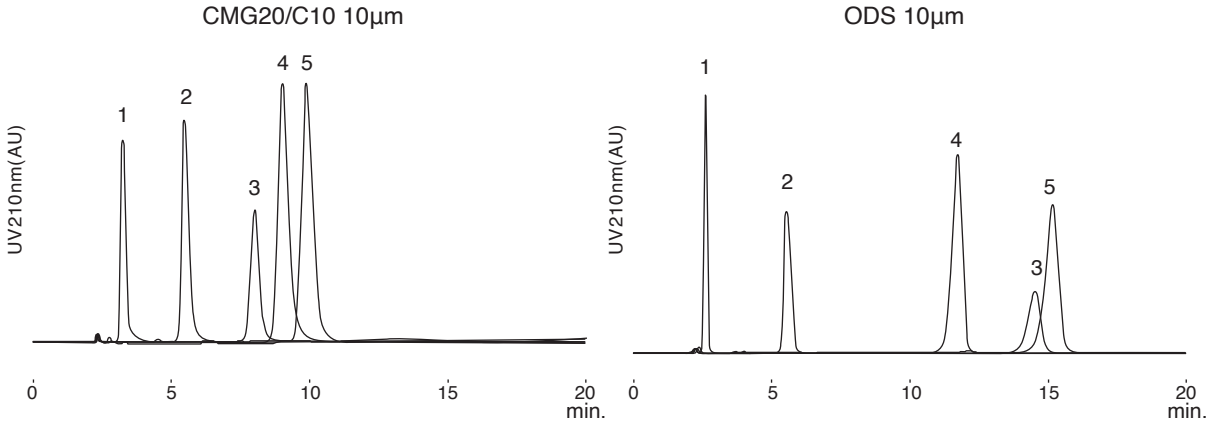
Fig. 5-25 Nucleotide

Conditions
Column : MCI GEL™ CHK40/C04
4.6mm I.D.×150mm
Eluent : A)19 mM H_3PO_4 / 1 mM NaH_2PO_4 / 5.0% ACN
B)20 mM Na_2HPO_4 / 100 mM $NaClO_4$ / 30% ACN
Gradient : 0-4.0min 0%B 4.0-5.0min 0→30%B 5.0min-6.0min 30%B 6.0min-7.0min 30→50%B
7.0min-10.0min 50→65%B 10.0min-11.0min 65%B 11.0min- 0%B
Flow rate : 0.8mL/min
Column temp. : 50℃
Detection : UV260nm
Sample : 1.Ura, 2.Xan, 3.Thy, 4.Hyp, 5.Gua, 6.Cyt, 7.Ade, 8.Urd, 9.Xao, 10.dT, 11.Ino, 12.Guo, 13.Cyd, 14.Ado
Injection : 20μL



(Data provided by Professor Yokoyama of Yokohama National University)

Fig. 5-26 Linalool



Conditions

Column	:	MCI GEL™ CMG20/C10 ODS 10µm 4.6mm I.D.×150mm
Eluent	:	Hexan/Ethanol=99.5/0.5
Flow rate	:	1.0mL/min
Column temp.	:	40°C
Detection	:	210nm
Sample	:	1:Linalyl Acrtate 1mg/mL 2:Linalool 1mg/mL 3:β-Citronellool 1mg/mL 4:Nerol 0.5mg/mL 5:Geraniol 0.5mg/mL
Injection	:	10µL

Fig. 5-27 Coriander

Conditions

Column	:	MCI GEL™ CMG20/C10 4.6mm I.D.×150mm
Eluent	:	Hexan/Ethanol=99.5/0.5
Flow rate	:	1.0mL/min
Column temp.	:	40°C
Detection	:	210nm
Sample	:	Coriander
Injection	:	10µL

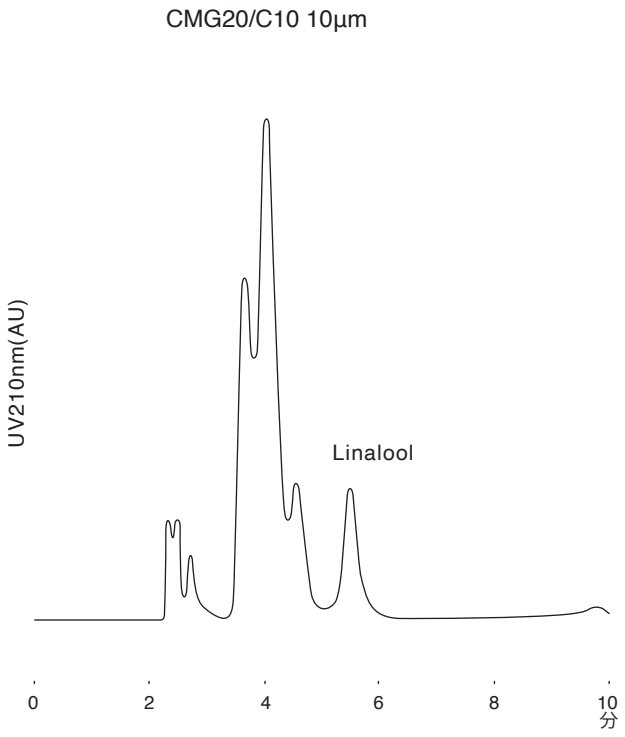
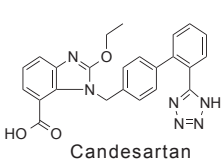
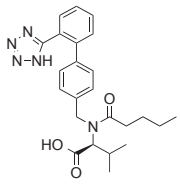
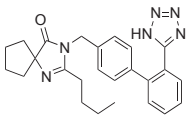


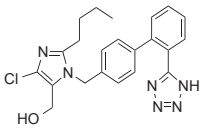
Fig. 5-28 Application data of CHK40/C04：Sepatation of Sartans

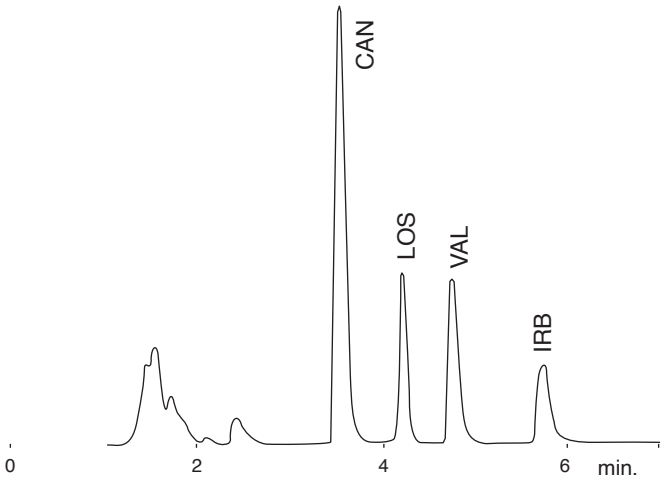
Conditions
Column ：MCI GEL™ CHK40/C04
4.6mm I.D.×150mm
Eluent ：A) 10 mM NaH_2PO_4 +0.2 mM Na_2HPO_4 (25%ACN)
B) 10 mM NaH_2PO_4 +1.0 mM Na_2HPO_4 (40%ACN)
Gradient ：0.5min 0%B 0.5-2.0min 50%B
2.0min-- 90%B
Flow rate ：1.0mL/min
Column temp. ：50°C
Detection ：UV
Sample ：Candesartan(CAN),Losartan(LOS),
Valsartan(VAL), Irbesartan(IRB)
Injection ：20μL


Candesartan


Valsartan


Irbesartan


Losartan



(Data provided by Professor Yokoyama of Yokohama National University)

(Polyphenon 60)

Fig. 5-29 Modified Styrene Divinylbenzene CHP07/C04

Conditions
Column ：MCI GEL™ CHP07/C04
4.6mm I.D.×150mm
Eluent ：CH_3OH/10mM-Acetic acid＝60/40
Flow rate ：0.46mL/min
Column temp. ：60°C
Detection ：280nm
Sample ：Polyphenon 60(10mg/mL) each 10μL

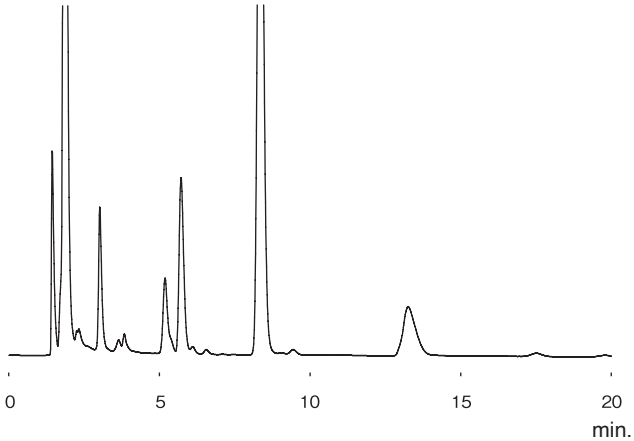


Fig. 5-30 Styrene Divinylbenzene CHP20/C04

Conditions
Column ：MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent ：CH_3OH/10mM-Acetic acid＝60/40
Flow rate ：0.46mL/min
Column temp. ：60°C
Detection ：280nm
Sample ：Polyphenon 60(10mg/mL) each 10μL

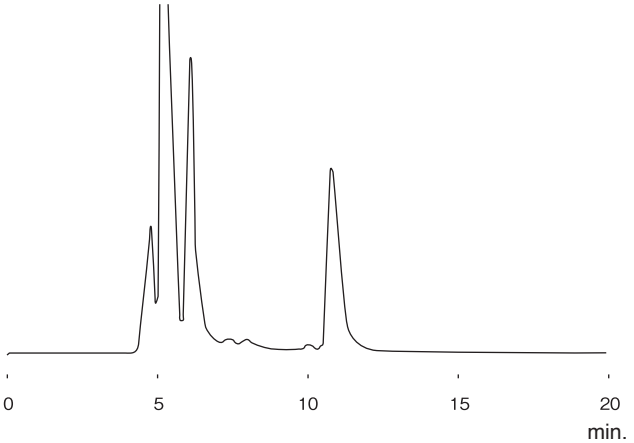
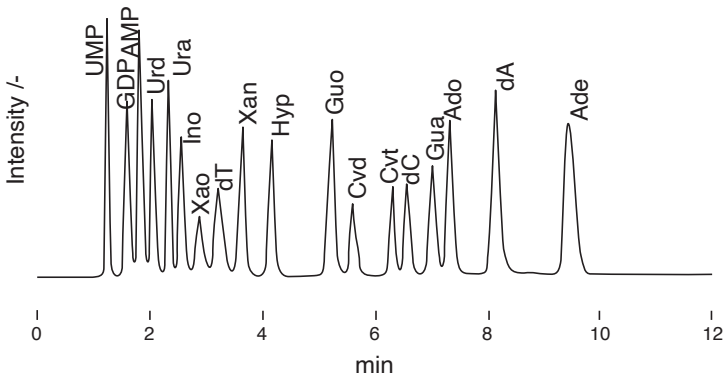
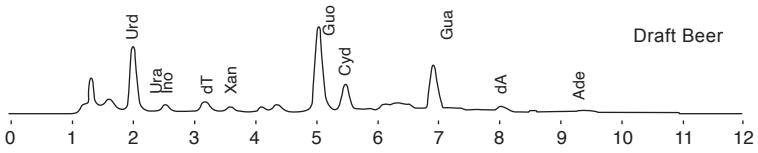


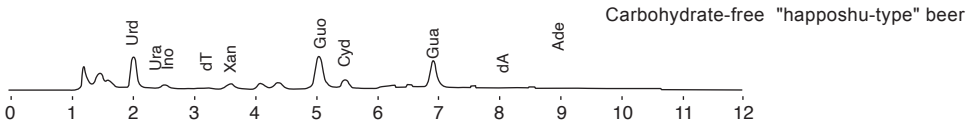
Fig. 5-31 Application data of Nucleic base/Nucleoside and Beer

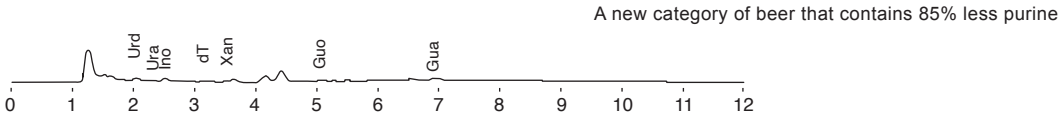
Conditions
Column : MCI GEL™ CHK45/C05
4.6mm I.D.×150mm
Eluent : A) 8 mM H_3PO_4
B) 10 mM H_3PO_4 /30% ACN
Gradient 0-0.7min 0%B 0.7-3.0min 0→40%B 3.0-3.2min 40%B
3.2-3.5min 40→80%B 3.5-8.0min 80%B 8.0min- 0%B
Flow rate : 1.3mL/min
Column temp. : 45°C
Detection : UV260nm
Injection : 20µL



Analysis of various category beer







(Data provided by Professor Yokoyama of Yokohama National University)

CHP material series

Analytical and preparative chromatography columns and materials for pharmaceutical applications

MCI GEL™ CHP material series are chromatography materials of porous type polymers.

Because polymeric materials are chemically stable, wide pH range, from acidic to alkaline eluents are able to be applied to MCI GEL™ CHP material series.

MCI GEL™ CHP50 series and CHP20 series are both ST/DVB polymers, but they differences in porosity. Pore size of CHP20 series is fairly larger than that of CHP50 series. Appropriate packing material can be selected in accordance with molecular size of injection samples.

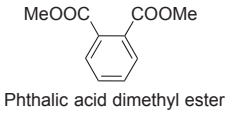
●CHP material series

Base polymer	Functional group	Product name	Particle size [μm]	Pore diameter [nm]	Main application	Equivalent HPLC column
Styrene Divinylbenzene	None	CHP20/P20	20	45	drug compounds Peptides Proteins	CHP20/C04 CHP20/C10
		CHP20/P30	30			
		CHP20/P50	50			
		CHP20/P70	70			
		CHP20/P120	120			
		CHP50/P20	20	25		—
		CHP50/P30	30			
	Br	CHP07/P120	120	25		CHP07/C04 CHP07/C10
Polymethacrylate	None	CMG20/P10	10	25		CMG20/C04 CMG20/C10
		CMG20/P30	30			

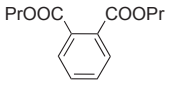
Application data of CHP 50

Fig. 5-32 Phthalic acid esters

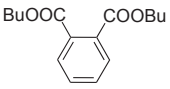
Conditions
Column : MCI GEL™ CHP50/P20, 10mmI I.D.×250mmL
Eluent : H_2O/CH_3CN=20/80
Flow rate : 0.75mL/min
Column temp. : 25°C
Detection : 254nm,
Sample : 1.Dimethyl phthalate 0.5%
2.Dipropyl phthalate 0.5%
3.Dibutyl phthalate 0.5%
Injection : 100μL



Phthalic acid dimethyl ester



Phthalic acid dipropyl ester



Phthalic acid dibutyl ester

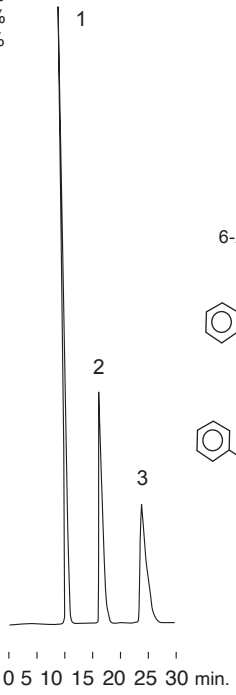
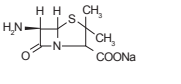
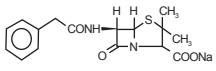
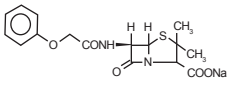


Fig. 5-33 Penicilin antibiotics

Conditions
Column : MCI GEL™ CHP series, 10mmI I.D.×250mmL
Eluent : CH_3OH/0.05M Phosphate buffer (pH8.0)=60/40
Flow rate : 2.18mL/min
Column temp. : 25°C
Detection : 254nm,
Sample : 1.6-Aminopenicillanic acid
2.Penicillin G
3.Penicillin V
Injection : 100μL


6-Aminopenicillanic acid


Penicllin G


Penicllin V

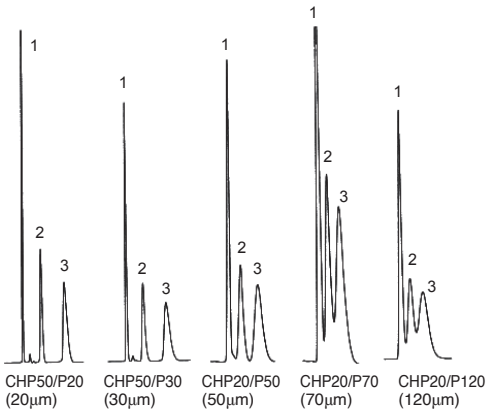
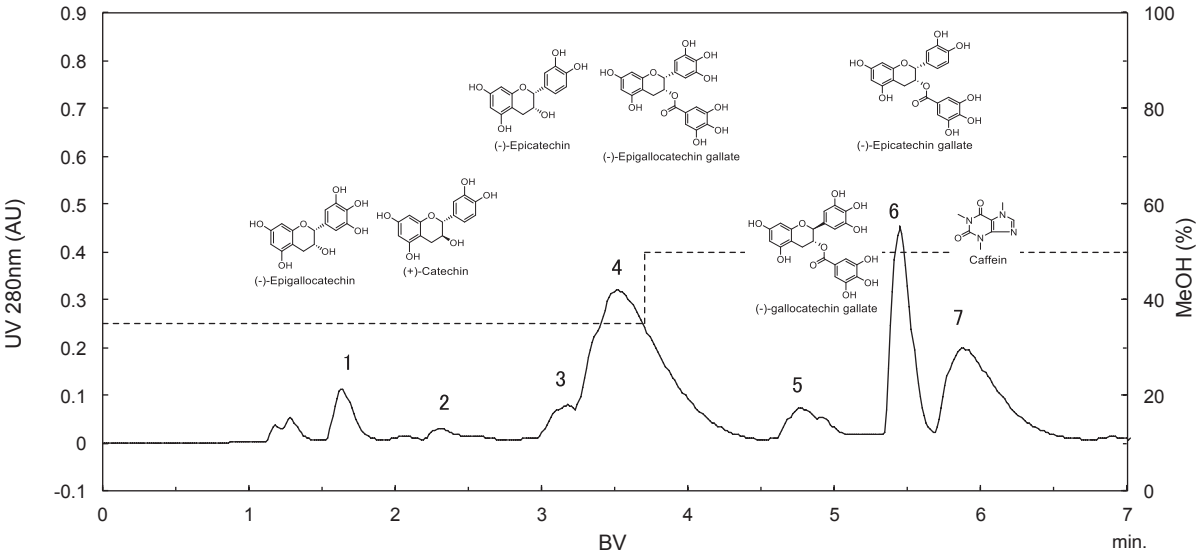


Fig. 5-34 Extract of green tea leaves

Conditions
Column : MCI GEL™ CHP50/P20, 32mmI.D×465mm
Eluent : 0–185min, CH_3OH:0.01M Acetic acid(35:65)
185–350min, CH_3OH:0.01M Acetic acid(50:50)
Flow rate : 7.48mL/min
Detection : 280nm
Sample : extract of green tea leaves, injection volumn 18.7mL
1. Epigallocatechin
2. Catechin
3. Epicatechin
4. Epigallocatechin gallate
5. Gallocatechin
6. Epicatechin gallate
7. Caffeine



Application data of CHP 20

Fig.5-35 Senna pulv. extract

Conditions

	Chromatogram A	Chromatogram B	Chromatogram C
Column	: MCI GEL™ CHP20/C10 4.6mm I.D.×250mm	: MCI GEL™ CHP20/P20 10.0mm I.D.×250mm	: MCI GEL™ CHP20/P30 10.0mm I.D.×250mm
Eluent	: CH_3OH/1% Acetic acid = 60/40 (vol.)	: CH_3OH/1% Acetic acid = 60/40 (vol.)	: CH_3OH/1% Acetic acid = 60/40 (vol.)
Flow rate	: 0.5mL/min	: 2.4mL/min	: 2.4mL/min
Detection	: 270nm	: 270nm	: 270 nm
Sample	: Extract of senna pulv. 10µL	: Extract of senna pulv. 80µL	: Extract of senna pulv. 80µL

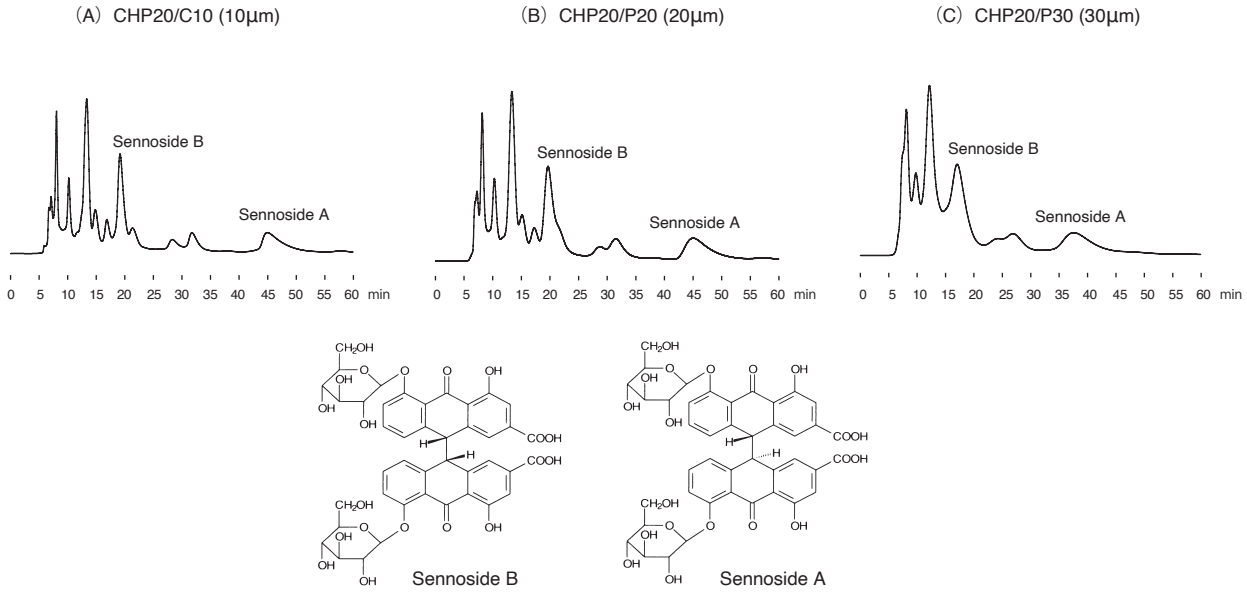


Fig. 5-36 Elution profile of senna pulv. extract separated on MCI GEL™ CHP20/P30

Conditions

Column	: MCI GEL™ CHP20/P30 32mm I.D.×490mm
Eluent	: CH_3OH + 1% Acetic acid = 60 + 40 (vol.)
Flow rate	: 7.88mL/min
Detection	: 270 nm
Sample	: Extract of senna pulv., partially purified by Diaion HP20
Injected amount	: 39.4mL

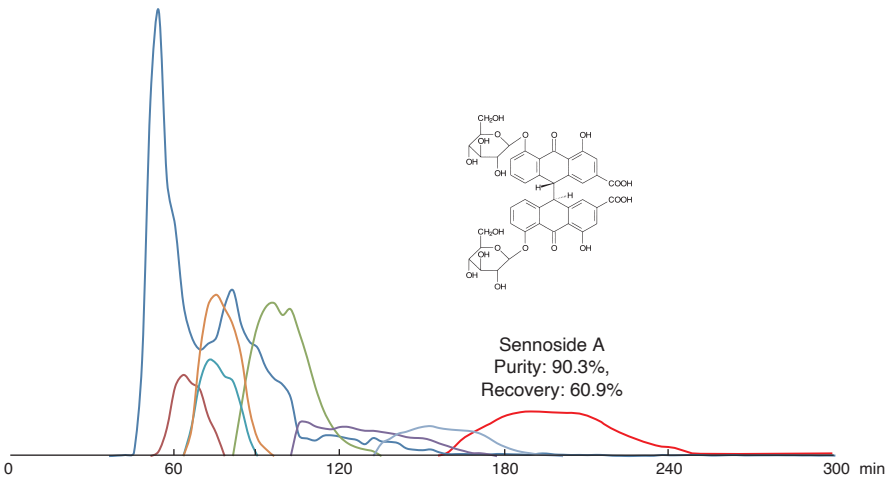


Fig. 5-37 Elution profile of gardenia fructus extract separated on MCI GEL™ CHP20/P30

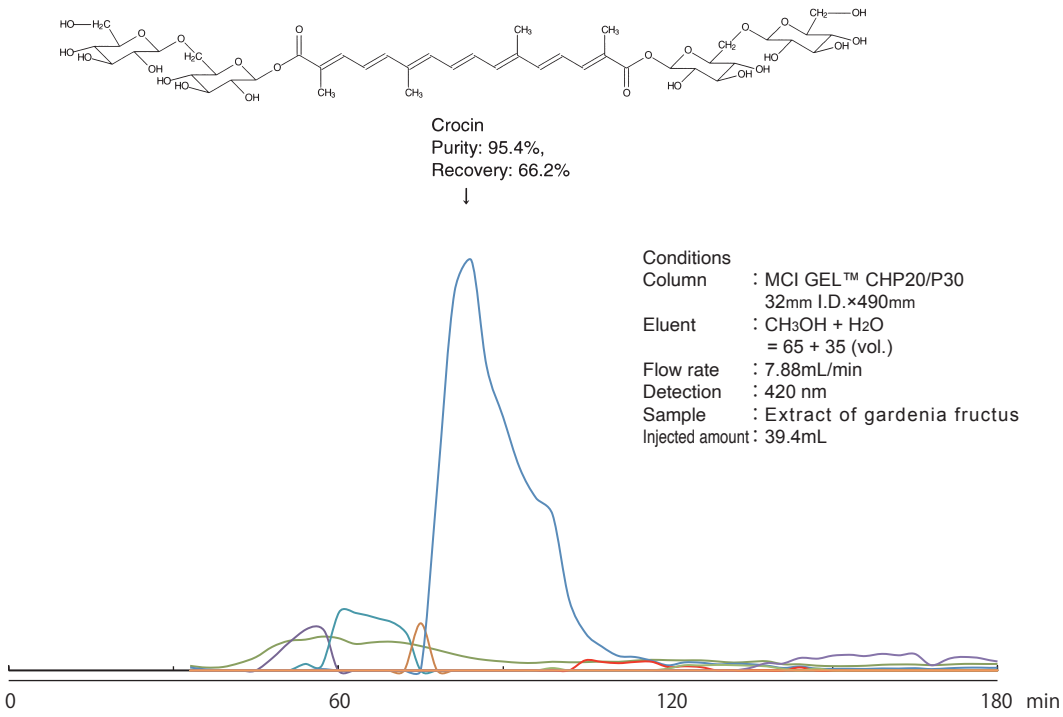
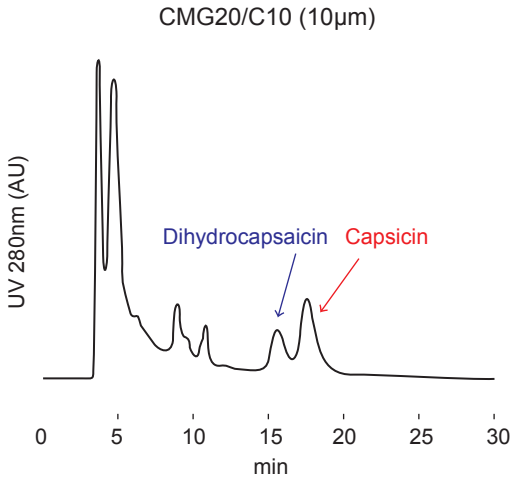


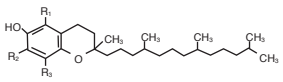
Fig. 5-38 Capsicin



Conditions
Column : MCI GEL™ CMG20/C10, 4.6mmI.D.×250mm
Eluent : Hexane/EtOH=87.5/12.5;
Flow rate : 1.00mL/min
Column temp. : 25°C
Detection : UV 280nm
Sample : Capsici Fructus extract;
Injection : 20mL

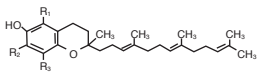
Application data of CHP series

Tocopherol



	R_1	R_2	R_3
1. α-tocopherol	CH_3	CH_3	CH_3
2. β-tocopherol	CH_3	H	CH_3
3. γ-tocopherol	H	CH_3	CH_3
4. δ-tocopherol	H	H	CH_3

Tocotrienol



	R_1	R_2	R_3
5. α-tocotrienol	CH_3	CH_3	CH_3
6. β-tocotrienol	CH_3	H	CH_3
7. γ-tocotrienol	H	CH_3	CH_3
8. δ-tocotrienol	H	H	CH_3

Fig. 5-39 Vitamin E in Rice Bran Oil

Conditions
Column : MCI GEL™ CMG20/C10
4.6mm I.D.×150mm
Eluent : Hexane-EtOH = 98/2 (vol.)
Flow rate : 0.5mL/min
Detection : 295nm
Sample : Rice Bran Oil, 50mg/mL
Injection : 10μL

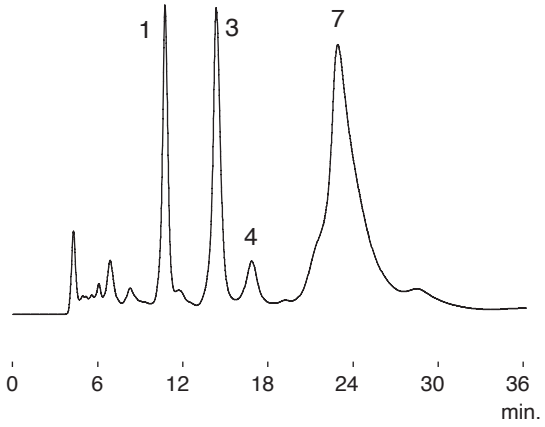


Fig. 5-40 Elution profile of Rice Bran Oil in preparative scale

Conditions
Column : MCI GEL™ CMG20/P30
20mm I.D.×500mm
Eluent : Hexane/C_2H_5OH = 98/2 (vol.)
Flow rate : 4.7mL/min
Detection : 295 nm
Sample : Rice Bran Oil, 50mg/mL
Injection : 1260μL

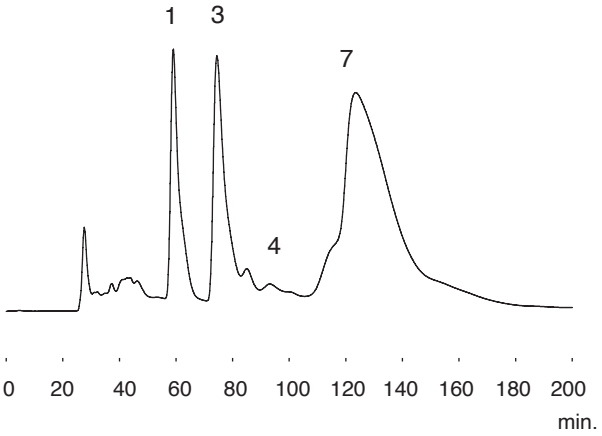
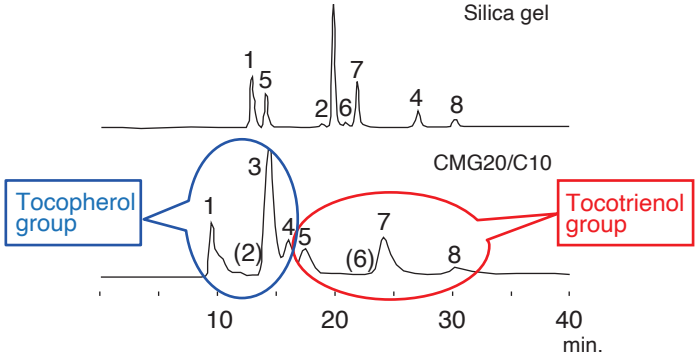


Fig. 5-41 Mixture of tocopherol and tocotrienol : Comparison with silica gel column

Conditions
Column : 1. Silica gel 5SIL, 4.6mmI.D.×250mm
2. MCI GEL™ CMG20/C04, 4.6mmI.D.×150mm
Eluent : 1. Hexane/EtOH = 99/1
2. Hexane/EtOH = 98/2
Flow rate : 1.0mL/min
Column temp. : 25°C
Detection : UV 292nm
Sample : Mixture of tocopherol and tocotrienol
Injection : 10μL (1mg/mL)



○Chiral separation columns MCI GEL™ CRS10W (DLAA)
MCI GEL™ CRS15W (LDAA)

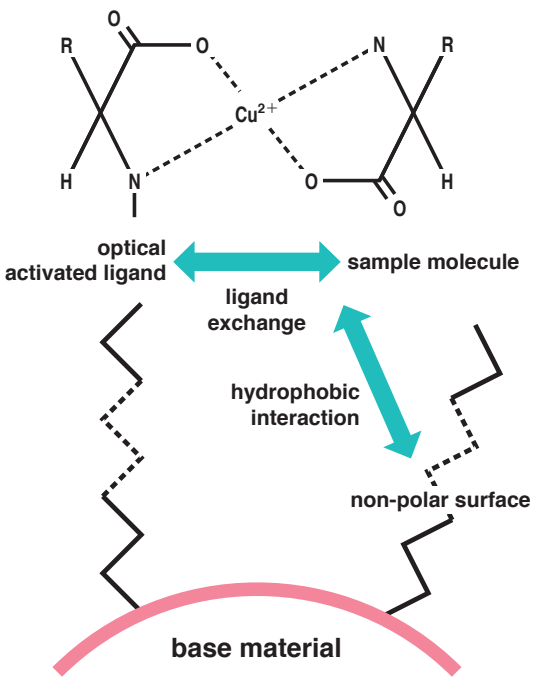
CRS10W 4.6×50

CRS15W 4.6×50

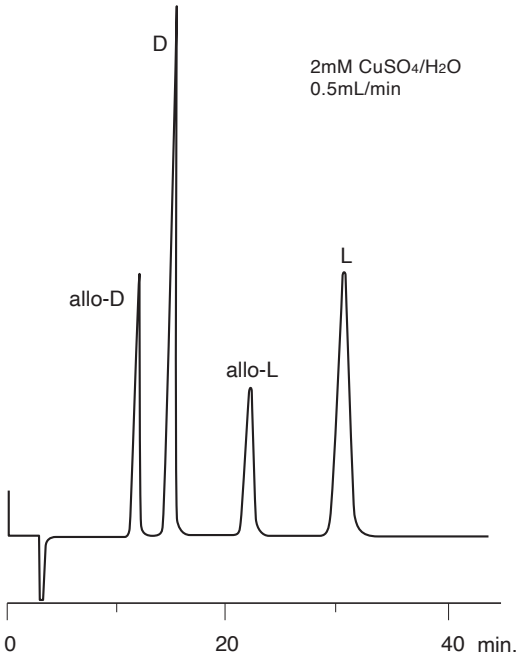
MCI GEL™ column	Column dimensions	Particle size (μm)	USP
MCI GEL™ CRS10W	4.6×50mm	3	L32
MCI GEL™ CRS15W	4.6×50mm	3	L32

Separation mechanism and performance of MCI GEL™ CRS series

Separation mechanism



Application of CRS10W
Fig. 6-1 DL-Isoleucine



●Separation mechanism

MCI GEL™ CRS10W and its companion product MCI GEL™ CRS15W (an optical isomer of CRS10W) are based on a 3μm with 10nm mean pore diameter of silica gel coated with N,N-Dioctyl -L(or D)-alanine which is a novel optical activated ligand. The chiral resolution mechanism is a combination of ligand exchange and hydrophobic interaction. A copper sulfate aqueous solution is used as an eluent. Elution samples are directly detected at wave length of 254 nm because complex compound, composed of sample molecule and copper in the eluent, are object of detection. With the CRS10W, D-isomers generally elute in front of L-isomers while L-isomers elute ahead of D-isomers on the CRS15W. The hydrophobic interaction mechanism allows hydrophilic samples to elute faster than hydrophobic molecules. Long alkyl chain or aromatic compounds will elute late or require an organic solvent (CH_3CN or CH_3OH, max. of 15v/v%) to prevent adsorption onto the stationary phase.

●Separation performance

1. The CRS series columns separate over 20 D,L-α-Amino acids by only single column. The columns separate not only α-Amino acids but also α-Hydroxy carboxylic acids and derivative amino acids such as Acetylated amino acids.
2. The columns provide excellent resolution operated at room temperature.
3. The columns show high durability.

●USP L32 column

Application data of CRS10W

For all chromatograms, column temperature is room temperature and wave length is 254nm.
All eluents are $CuSO_4$ aqueous solution except for Fig. 6-9 and Fig. 6-10.

Fig. 6-2 Separation of amino acids mixture

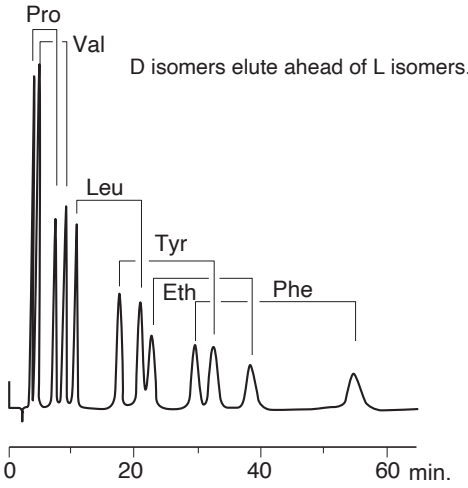


Fig. 6-3 Separation of amino acids mixture

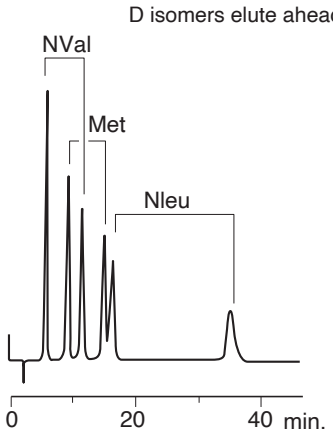


Fig. 6-4 Separation of DL-Ser.

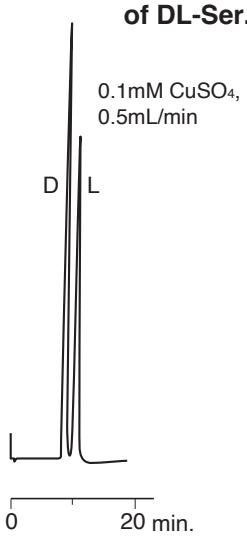


Fig. 6-5 Separation of DL-aspartic acid

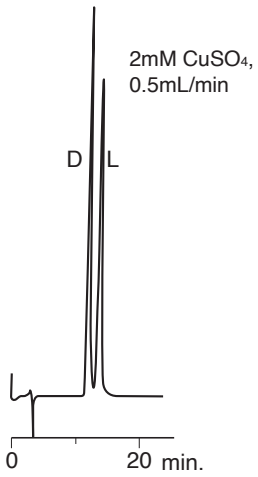


Fig. 6-6 Separation of DL-glutamic acid

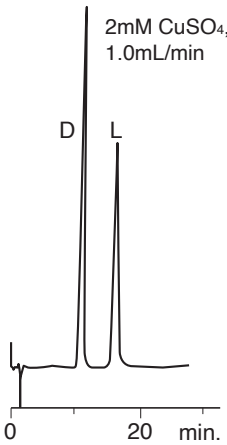


Fig. 6-7 Separation of DL-histidine

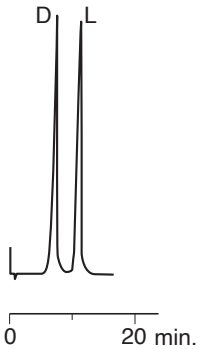


Fig. 6-8 Separation of DL-lysine

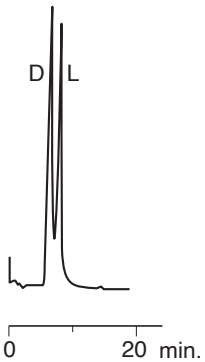


Fig. 6-9 Separation of DL-phenylalanine

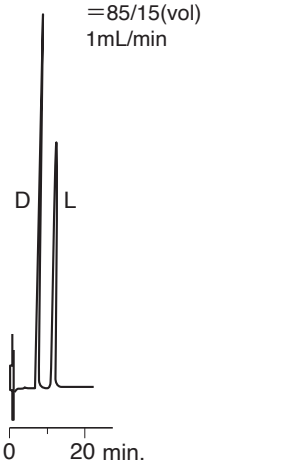


Fig. 6-10 Separation of DL-tryptophan

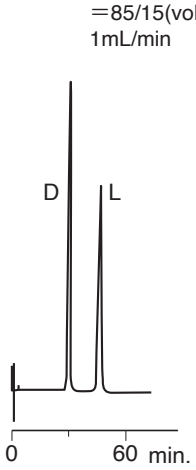


Fig. 6-11 Separation of DL-lactic acid

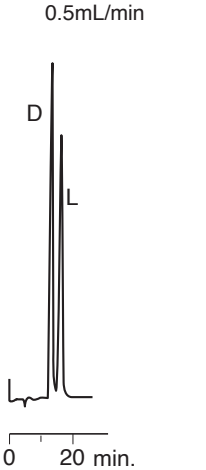
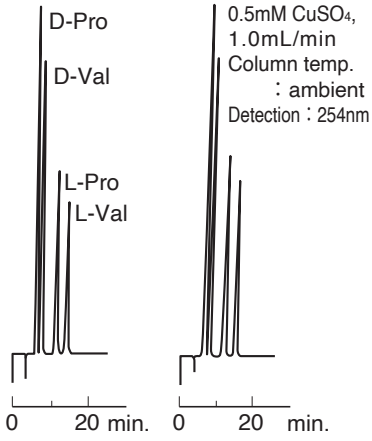


Fig. 6-12 Durability test

The sample was continuously injected 800 times for approximately 500 hrs. Changes of retention times and separation ability are not observed.



Application data of CRS10W

Fig. 6-13 Separation of DL-α-Phenylglycine

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM $CuSO_4$/CH_3OH=85/15
Flow rate : 1.0mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1. D-α-Phenylglycine
2. L-α-Phenylglycine

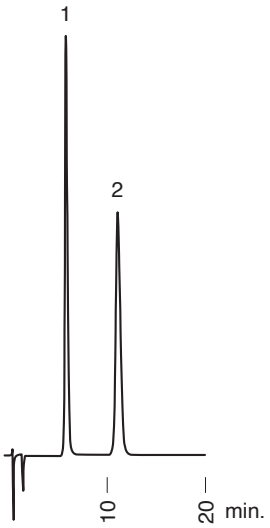


Fig. 6-14 Separation of methionine and acetylmethionine

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM $CuSO_4$/CH_3CN=90/10
Flow rate : 1.0mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1. D-Met
2. L-Met
3. Acetyl-D-Met
4. Acetyl-L-Met

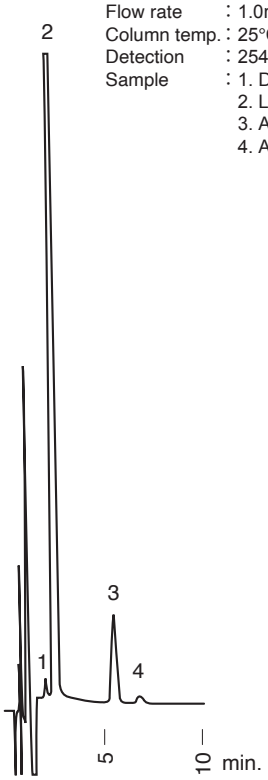


Fig. 6-15 D/L-Aspartic acid

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 0.4mM$CuSO_4$
Flow rate : 1.0mL/min
Temp. : ambient
Detection : UV 254nm
Sample : D/L Aspartic acid

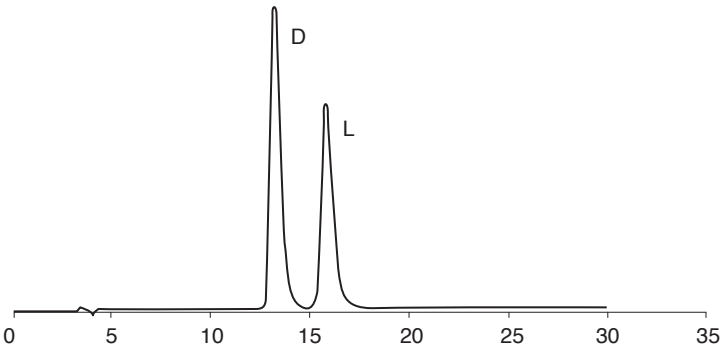
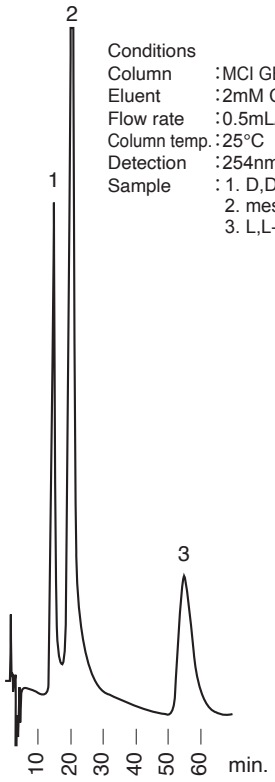


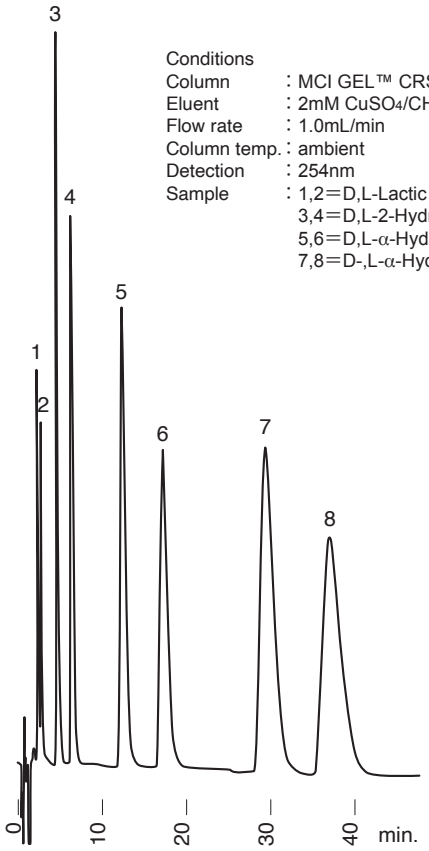
Fig. 6-16 Separation of diaminopimelic acid

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM $CuSO_4$
Flow rate : 0.5mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1. D,D-2,6-Diaminopimelic acid
2. meso-2,6-Diaminopimelic acid
3. L,L-2,6-Diaminopimelic acid



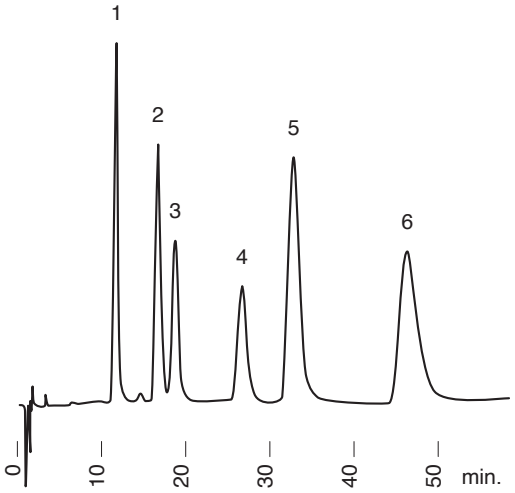
Application data of CRS10W

Fig. 6-17 Separation of 2-hydroxy carboxylic acids



Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM $CuSO_4/CH_3CN$=90/10
Flow rate : 1.0mL/min
Column temp. : ambient
Detection : 254nm
Sample : 1,2=D,L-Lactic acid
3,4=D,L-2-Hydroxy-n-butyric acid
5,6=D,L-α-Hydroxy-n-valeric acid
7,8=D-,L-α-Hydroxy isocaproic acid

Fig. 6-18 Separation of 2-hydroxy carboxylic acids



Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM $CuSO_4/CH_3CN$=90/10
Flow rate : 1.0mL/min
Column temp. : ambient
Detection : 254nm
Sample : 1,2=D,L-p-Hydroxymandelic acid
3,4=D,L-m-Hydroxymandelic acid
5,6=D,L-Mandelic acid

Fig. 6-19 D/L Alanine

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 0.1mM$CuSO_4$
Flow rate : 1.0mL/min
Temp. : 30°C
Detection : UV 254nm
Sample : D/L Alanine

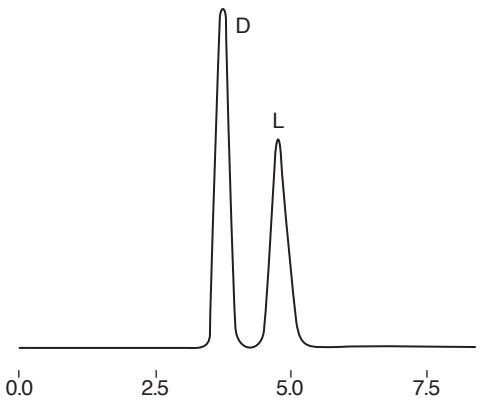


Fig. 6-20 DL-P-Hydroxyphenylglycine

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM$CuSO_4$:MeOH=85:15
Flow rate : 1.0mL/min
Temp. : 30°C
Detection : UV 254nm
Sample : DL-P-ydroxyphenylglycine

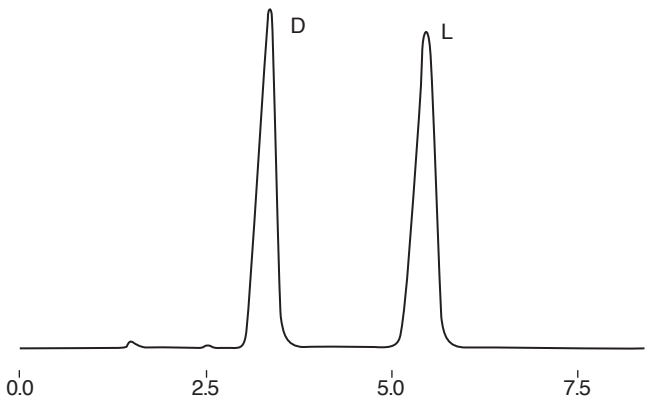


Fig. 6-21 Separation of DL-alanine

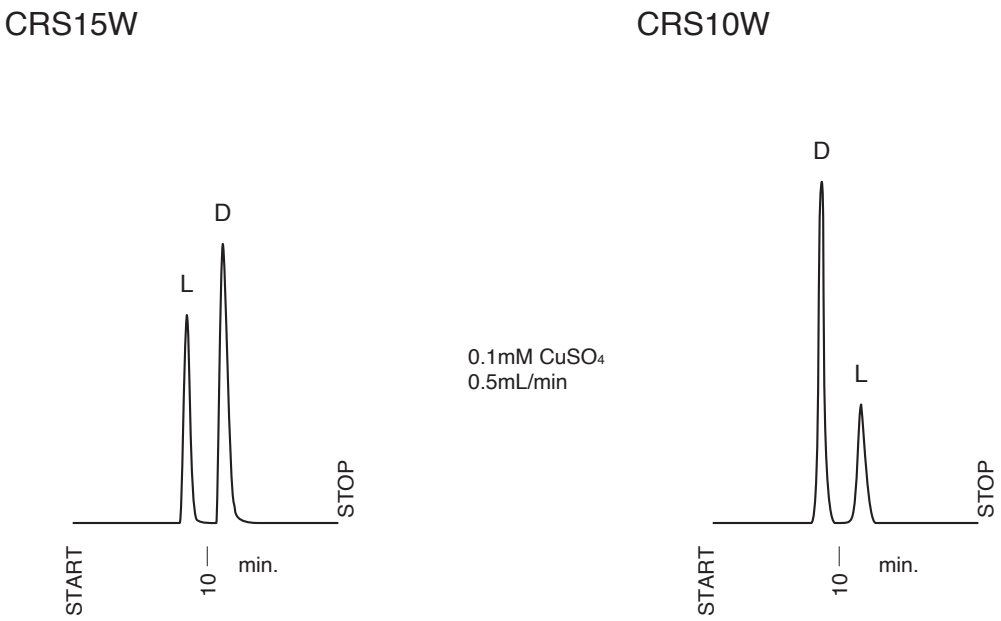
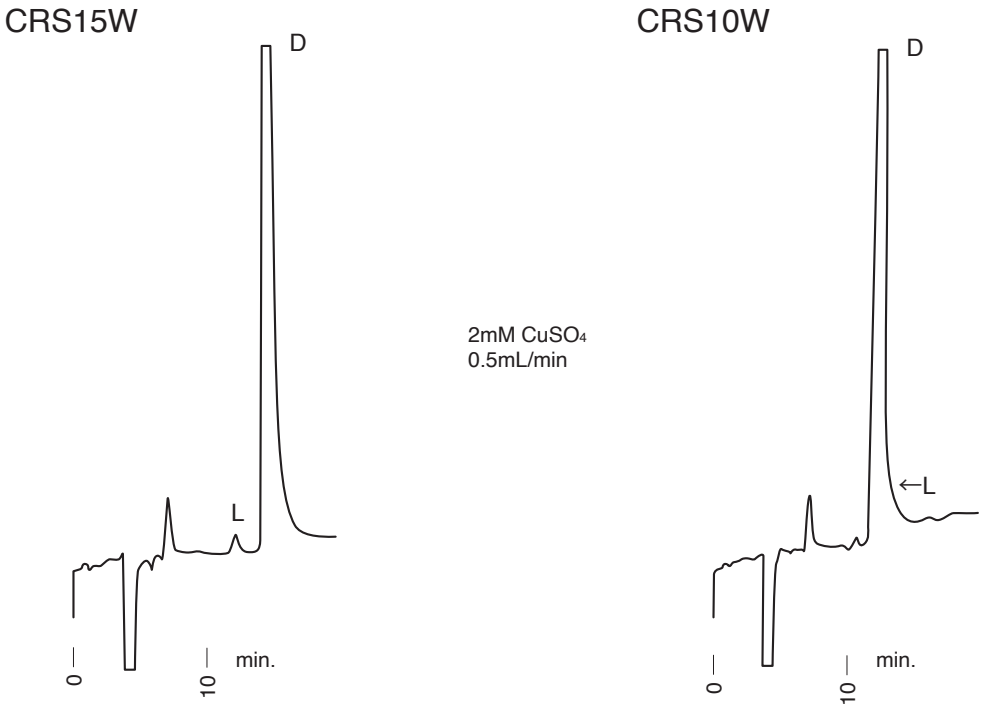


Fig. 6-22 Analysis of a trace of L-lactic acid in 50 ppm D-lactic acid

The CRS15W is recommended for analysis of a trace of L-isomer in a principal D-isomer when the CRS10W does not provide an adequate chromatogram.



Examples of chromatographic conditions and datas

	Amino acids	$CuSO_4$ aq. soln. [mM]	Flow rate [mL/min]	Retention time; L-isomers [min]	Separation factor [α]	Separation rate [Rs]
1	Orn•HCl	0.1	0.2	6.8	1.26	＜1
2	Lys•HCl	0.1	0.2	7.7	1.45	＜1
3	Ala	0.1	0.5	11.0	1.39	1.4
4	His•HCl	0.1	0.5	10.5	1.63	1.7
5	Ser	0.1	0.5	10.1	1.25	1.0
6	Thr	0.1	0.5	11.3	1.29	1.3
7	Cit	0.5	0.5	10.4	1.75	2.3
8	Hyp	1.0	0.2	23.8	1.23	1.1
9	Pro	1.0	1.0	7.3	2.13	4.5
10	Val	1.0	1.0	8.9	2.04	5.0
11	Nval	1.0	1.0	11.5	2.07	4.7
12	Asp	2.0	0.5	13.2	1.18	0.8
13	Glu	2.0	1.0	16.2	1.54	2.3
14	Ileu(DL)	2.0	0.5	30.4	2.14	6.5
15	Ileu(allo)	2.0	0.5	21.9	1.97	6.0
16	Leu	2.0	1.0	14.6	1.97	4.6
17	Nleu	2.0	1.0	24.1	2.16	6.5
18	Met	2.0	1.0	10.3	1.64	2.6
19	Tyr	2.0	1.0	22.5	1.85	5.3
20	Eth	2.0	1.0	26.4	1.69	5.0
21	Phe	2.0	1.0	37.8	1.84	6.3

1. Column temperature; ambient　　Detection; 254nm
2. These are example data and do not guarantee the column specifications.
3. Improved resolution or appropriate chromatogram can be obtained by further investigating chromatographic conditions.
4. For each amino acid in the table, D-isomer elutes ahead of L-isomer except for Hydroxyproline.

Notes

1. It will take hours for equilibrium between ligand of stationary phase and copper ion of eluent. Two to three hours of conditioning the column with the eluent is advised before sample injection or after changing concentration of $CuSO_4$ of eluent.
2. For acidic amino acids, higher $CuSO_4$ concentration of eluent provides better resolution.
3. For weakly retained hydrophilic amino acids, low flow rate (0.2-0.5 mL/min) yields better resolution.
4. Peak area may decrease with continuous injection of samples, when the concentration of amino acids in sample solution is much higher than that of $CuSO_4$ in the eluent.
5. Please be careful not to flow both water soluble organic solvents (CH_3CN, CH_3OH, etc) and non water soluble organic solvents (n-hexane, chloroform, etc) into the column. The column will be fatally damaged and will never separate optical isomers. Please be particularly careful if HPLC equipment is used together with RP mode and NP mode.
6. Please do not use acid or alkali solutions to adjust pH of eluent. And also do not use buffer solutions. These solutions may cause forming precipitation, hence cause of blockage of the column.
7. For strongly retained hydrophobic amino acids, addition of CH_3CN or CH_3OH in the eluent enables faster elution. The concentration of these organic solvents should be below 15 v/v%.
8. DOPA and other non-polar amino acids will be strongly adsorbed on the packing material and will cause contamination of the column.
9. Regeneration of contaminated column is difficult.

7 MCI GEL™ SPE sorbent series

Solid phase extraction sorbents

For a pretreatment of analytical sample, we provide various SPE sorbents with various chemical structure, hydrophobicity, and micro-pore sizes. You can select our SPE sorbents depending on your molecule nature.

- SFP08/P25: SPE sorbents dedicated for small drug molecules extraction.
  Superior purity of this SPE extracts offers easier and faster sample preparation.

Material list

●Synthetic adsorbents and reversed-phase materials

Name	Particle size [μm]	Pore size	Surface area [m^2/g]	pH range	Typical Application
SFP08/P25	25	middle	＞1000	full range	Small molecules extraction

8 MCI GEL™ column list

Main column				Guard/Pre-column		
Code No.	Name	Column dimensions [mm]	USP	Code No.	Name	Column dimensions [mm]
Ion exchange chromatography cation exchange resin for amino acids						
0-019-01	CK10U	6×120		0-033-21	AFR2-PC	6×50
Ion exchange chromatography cation exchange resin for sugars						
0-009-01	CK08S	8×500	L58	0-009-11	CK08SG	6×50
0-010-01	CK08E	8×300	L58	0-010-11	CK08EG	6×50
0-010-06		7.8×300				
0-010-02	CK08EC	8×300	L19	0-010-12	CK08ECG	6×50
0-010-07		7.8×300				
Ion exchange chromatography cation exchange resin for carboxylic acids						
0-010-05	CK08EH	8×300	L17	0-010-15	CK08EHG	6×50
0-010-08		7.8×300				
Ion exchange chromatography cation exchange resin for oligosaccharides						
0-001-01	CK02A	20×250	L58	0-001-11	CK02AG	8×10
0-001-02	CK02AS	20×250		0-001-12	CK02ASG	8×10
0-003-01	CK04S	10×200	L58	0-017-11	CK10SG	6×50
				0-003-11	CK04SG	8×10
0-003-02	CK04SS	10×200		0-017-11	CK10SG	6×50
				0-003-12	CK04SSG	8×10
Ion exchange chromatography anion exchange resin for carboxylic acids and sugars						
0-111-01	CA08F	4.6×250		0-111-11	CA08FG	4×10
Ion chromatography for cations						
0-034-01	SCK01	6×50		0-034-21	SCK-PC	6×50
0-034-04	SCK01	4.6×150				
0-407-01	CHK45/C05	4.6×150				
Ion chromatography for anions						
0-133-02	SCA04/PEEK	4.6×150	L31	0-133-12	SCA04G	4.6×30
				0-130-22	SCA-PC	8×10
Bioseparation for size exclusion						
0-213-01	CQP06	7.5×600	L25	0-213-11	CQP06G	4×50
0-214-01	CQP10	7.5×600	L38	0-214-11	CQP10G	4×50
0-215-01	CQP30	7.5×600	L37, 38	0-215-11	CQP30G	4×50

Main column				Main column			
Code No.	Name	Column dimensions [mm]	USP	Code No.	Name	Column dimensions [mm]	USP
Analytical and preparative chromatography columns for pharmaceutical applications [CHP column series]							
0-401-05	CHP20/C04	4.6X150	L21				
0-401-03	CHP20/C04	20X150	L21				
0-403-05	CHP20/C10	4.6X150	L21				
0-403-01	CHP20/C10	4.6X250	L21				
0-403-02	CHP20/C10	10X250	L21				
0-403-03	CHP20/C10	20X150	L21				
0-403-04	CHP20/C10	20X250	L21				
0-405-01	CHP07/C04	4.6X150					
0-405-04	CHP07/C04	20X200					
0-405-05	CHP07/C10	4.6X150					
0-406-01	CHP07/C10	4.6X250					
0-406-02	CHP07/C10	10X150					
0-406-03	CHP07/C10	20X150					
0-406-04	CHP07/C10	20X250					
0-402-05	CMG20/C04	4.6X150	L39				
0-402-03	CMG20/C04	20X150	L39				
0-202-06	CMG20/C10	4.6X150	L39				
0-202-05	CMG20/C10	4.6X250	L39				
0-202-02	CMG20/C10	10X250	L39				
0-202-03	CMG20/C10	20X150	L39				
0-202-04	CMG20/C10	20X250	L39				
0-404-01	CHK40/C04	4.6X150					
0-407-01	CHK45/C05	4.6X150					
XtalSpeed™ series							
0-047-01	DA01	4.6X50					
0-047-04	DA01	4.6X100					
0-047-02	DA01	7.5X100					
0-047-03	DA01	11.5X100					
0-047-11	SP01	4.6X50					
0-047-12	SP01	4.6X100					
0-047-13	SP01	7.5X100					
0-047-14	SP01	11.5X100					

MCI GEL™

9 MCI GEL™ material list

Characteristics

1. Excellent performance

Sphere packing and sharp particle size distribution provide high performance.

2. Persistence and highest quality

Produced with Mitsubishi Chemical's excellent technology, experience and under strict quality control.

3. Wide range of product line

MCI GEL™ packing materials include ion exchange resins (cation and anion), non-functionalized polymer used for reversed phase chromatography and other varieties of products. Also MCI GEL™ offers particle size of 4 μm to approximately 120 μm packing materials, this means that MCI GEL™ products are applied to analysis use and preparative use.

4. Abundant experience

Mitsubishi Chemical has been supplying packing materials for more than 50 years.

●Ion exchange chromatography cation exchange resins［CK series, AFR series］

Code No.	Name	Packing size [g]	Base material	Functional group	Counter ion	Particle size [μm]	Cross linkage [%]	Ion exchange capacity [meq／g]	Typical Application
1-001-01	CK02A	10	ST/DVB	RSO_3^-	Na^+	20	2	＞4.5	Oligosaccharides
1-003-01	CK04S	10	ST/DVB	RSO_3^-	Na^+	11	4	＞4.5	Oligosaccharides
1-003-02	CK04S	25							
1-003-03	CK04S	50							
1-009-01	CK08S	10	ST/DVB	RSO_3^-	Na^+	11	8	＞4.40	Sugars, Carboxylic acids
1-009-02	CK08S	25							
1-009-03	CK08S	50							
1-010-01	CK08E	10	ST/DVB	RSO_3^-	Na^+	9	8	＞4.40	Sugars, Carboxylic acids
1-010-02	CK08E	25							
1-010-03	CK08E	50							
1-014-01	CK08P	100 mL	ST/DVB	RSO_3^-	H^+	120	8	＞1.8 (meq/mL)	Sugars, Carboxylic acids
1-017-01	CK10S	10	ST/DVB	RSO_3^-	Na^+	11	10	＞4.3	Carboxylic acids, Amino acids
1-017-02	CK10S	25							
1-017-03	CK10S	50							
1-018-01	CK10F	5	ST/DVB	RSO_3^-	Na^+	7	10	＞4.3	Amino acids
1-018-02	CK10F	10							
1-019-01	CK10U	3	ST/DVB	RSO_3^-	Na^+	5	10	＞4.3	Amino acids
1-019-03	CK10U	5							
1-019-04	CK10U	10							
1-020-05	CK10M	5	ST/DVB	RSO_3^-	Na^+	4	10	＞4.3	Amino acids
1-020-06	CK10M	3							
1-024-02	CK12U	5	ST/DVB	RSO_3^-	Na^+	5	12	＞4.3	Amino acids
1-021-01	CK10Y	50	ST/DVB	RSO_3^-	Na^+	25	10	＞4.3	Amino acids
1-033-01	AFR2	5	ST/DVB	RSO_3^-	H^+	25	–	＞2.7	Ammonia trap

Abbreviation; ST/DVB ＝ Styrene-divinylbenzene copolymer

●Ion exchange chromatography anion exchange resins［CA series］

Code No.	Name	Packing size [g]	Base material	Functional group	Counter ion	Particle size [μm]	Cross linkage [%]	Ion exchange capacity [meq/mL]	Typical Application
1-109-01	CA08S	10	ST/DVB	QA	Cl^-	11	8	＞1.2	Sugars, Carboxylic acids
1-109-02	CA08S	25							
1-109-03	CA08S	50							
1-111-01	CA08F	5	ST/DVB	QA	Cl^-	7	8	＞1.2	Sugars, Carboxylic acids
1-111-02	CA08F	10							
1-112-01	CA08Y	50	ST/DVB	QA	Cl^-	25	8	＞1.2	Sugars, Carboxylic acids
1-113-01	CA08P	100 mL	ST/DVB	QA	Cl^-	120	8	＞1.3	Sugars, Carboxylic acids

Abbreviations； ST/DVB＝styrene-divinyl benzene copolymer　QA；Quaternary ammonium

●Ion chromatography materials［SCA, SCK series］

Code No.	Name	Packing size [g]	Base material	Functional group	Counter ion	Particle size [μm]	Ion exchange capacity [μeq/g]	Typical Application
1-034-01	SCK01	5	ST/DVB	RSO_3^-	H^+	11	25	Cation analysis
1-034-02	SCK01	10						
1-133-01	SCA04	5	HMA	QA	Cl^-	5	30	Anion analysis
1-133-02	SCA04	10						

Abbreviations; ST/DVB ＝ Styrene-divinylbenzene copolymer　HMA ＝ Polyhydroxymethacrylate　QA ＝ Quaternary ammonium

●Bioseparation columns –Size exclusion chromatography materials–［CQP series］

Code No.	Name	Packing size [g]	Base material	Particle size [μm]	Pore size [nm]	Exclusion limit	Typical Application
1-213-01	CQP06	10	HMA	10	12	1×10^3	Water soluble polymer
1-213-02	CQP06	25					
1-213-03	CQP06	50					
1-214-01	CQP10	10	HMA	10	20	1×10^4	Water soluble polymer
1-214-02	CQP10	25					
1-214-03	CQP10	50					
1-215-01	CQP30	10	HMA	10	60	1×10^6	Water soluble polymer
1-215-02	CQP30	25					
1-215-03	CQP30	50					
1-222-01	CQP30P	100 mL	HMA	30	60	1×10^6	Water soluble polymer

Abbreviation; HMA ＝ Polyhydroxymethacrylate

●Analytical and preparative chromatography materials for pharmaceutical applications [CHP material series]

Code No.	Product Name	Packing size [mL]	Base material	Particle size [μm]	Pore size [nm]	pH range	Typical Application
1-307-06	CHP20/P20	25	ST/DVB	20	45	full range	Reversed-phase chromatography
1-307-07	CHP20/P20	100					
1-307-08	CHP20/P20	1,000					
1-305-06	CHP20/P30	25	ST/DVB	30	45	full range	Reversed-phase chromatography
1-305-07	CHP20/P30	100					
1-305-08	CHP20/P30	1,000					
1-310-01	CHP20/P50	100g	ST/DVB	50	45	full range	Reversed-phase chromatography
1-313-02	CHP20/P70	500	ST/DVB	70	45	full range	Reversed-phase chromatography
1-313-03	CHP20/P70	1,000					
1-313-04	CHP20/P70	10,000					
1-311-01	CHP20/P120	100	ST/DVB	120	45	full range	Reversed-phase chromatography
1-311-02	CHP20/P120	500					
1-311-03	CHP20/P120	1,000					
1-311-04	CHP20/P120	10,000					
1-311-05	CHP20/P120	50,000					
1-304-06	CHP50/P20	25	ST/DVB	20	25	full range	Reversed-phase chromatography
1-304-07	CHP50/P20	100					
1-304-08	CHP50/P20	1,000					
1-303-06	CHP50/P30	25	ST/DVB	30	25	full range	Reversed-phase chromatography
1-303-07	CHP50/P30	100					
1-303-08	CHP50/P30	1,000					
1-314-02	CHP07/P120	100	ST/DVB	120	25	full range	Reversed-phase chromatography
1-314-03	CHP07/P120	1,000					
1-314-04	CHP07/P120	10,000					
1-314-05	CHP07/P120	50,000					
1-309-01	CMG20/P10	10g	MA	10	25	2～12	Reversed-phase chromatography
1-309-03	CMG20/P10	1,000					
1-306-06	CMG20/P30	25	MA	30	25	2～12	Reversed-phase chromatography
1-306-07	CMG20/P30	100					
1-306-08	CMG20/P30	1,000					

Abbreviations; MA＝Polymethacrylate　　ST/DVB＝Styrene-divinylbenzene copolymer

●Synthetic adsorbent and reversed-phase materials

Code No.	Product Name	Packing size	Particle size [μm]	Pore size	pH range	Typical Application
1-317-01	SFP08/P25	50g	25	Middle	Full range	Small molecules extraction

10 MCI GEL™ Compounds index

Compound	Classification	MCI GEL™ column	Figure	Page
Acetic acid	Acetic acid	CK08EH	2-13	11
Acetic acid	Acetic acid	CK08EH	2-16	12
Acetic acid	Acetic acid	CK08EH	2-18	12
Acetic acid	Acetic acid	CA08F	2-38	19
Acetic acid	Acetic acid	CA08F	2-39	20
Acetic acid	Acetic acid	CA08F	2-40	20
Acetic acid	Acetic acid	CA08F	2-41	20
N-Acetylgalactosamine	N-Acetylgalactosamine	CK08EH	2-14	11
N-Acetylglucosamine	N-Acetylglucosamine	CK08EH	2-14	11
Acetyl-D-Met.	Acetyl-D-Met.	CRS10W	6-14	54
Acetyl-L-Met.	Acetyl-L-Met.	CRS10W	6-14	54
Adenine	Nucleic base	CHK40/C04	5-25	43
Adenine	Nucleic base	CHK45/C05	5-31	46
Adenosine	Nucleoside	SCK01	3-6	22
Adenosine	Nucleoside	CHK40/C04	5-25	43
Adenosine	Nucleoside	CHK45/C05	5-31	46
Adonitol	Adonitol	CK08EC	2-1	7
Alanine	Alanine	CK10U	2-31	17
Alanine	Amino acid	CK10U	2-35	18
β-Alanine	β-Alanine	CK10U	2-32	18
D-Alanine	D-Alanine	CRS10W/CRS15W	6-21	56
D-Alanine	D-Amino acid	CRS10W	6-19	55
L-Alanine	L-Alanine	CRS10W/CRS15W	6-21	56
L-Alanine	L-Amino acid	CRS10W	6-19	55
γ-Aminobutyric acid	γ-Aminobutyric acid	CK10U	2-33	18
6-Aminopenicillanic acid	6-Aminopenicillanic acid	CHP50/P20	5-33	48
Ammonia	Ammonia	SCK01	3-2	22
Ammonium ion	Cation	SCK01	3-1	22
Ammonium ion	Cation	SCK01	3-3	22
Ammonium ion	Cation	CHK45/C05	3-10	23
AMP	Nucleotide	CHK45/C05	5-31	46
Amphotericin B	Amphotericin B	CHP20/C10	5-17	39
Angiotensin II	Angiotensin II	CMG20/C04	5-12	38
Antipyrine	Antipyrine	CMG20/C04	5-10	37
Arginine	Arginine	CK10U	2-31	17
Ascorbic acid	Carboxylic acid	CA08F	2-40	20
Aspartic acid	Aspartic acid	CK10U	2-31	17
D-Aspartic acid	D-Aspartic acid	CRS10W	6-5	53
D-Aspartic acid	D-Amino acid	CRS10W	6-15	54
L-Aspartic acid	L-Aspartic acid	CRS10W	6-5	53
L-Aspartic acid	L-Amino acid	CRS10W	6-15	54
Aspirin	Aspirin	CMG20/C04	5-10	37
Barium ion	Barium ion	SCK01	3-7	23
Bromide ion	Bromide ion	SCA04	3-11	24
Bromide ion	Bromide ion	SCA04	3-12	24
Buserelin	Buserelin	CHP20/C10	5-22	42
Buserelin	Buserelin	CMG20/C10	5-22	42
n-Butyl alcohol	n-Butyl alcohol	CK08EH	2-15	11
sec-Butyl alcohol	sec-Butyl alcohol	CK08EH	2-15	11
Cadmium ion	Cadmium ion	SCK01	3-8	23
Caffeine	Caffeine	CHP20/C04	5-4	34
Caffeine	Caffeine	CMG20/C04	5-10	37
Caffeine	Caffeine	CHP50/P20	5-34	48
Calcium ion	Calcium ion	SCK01	3-7	23
Calcium ion	Calcium ion	SCK01	3-8	23
Calcium ion	Calcium ion	SCK01	3-9	23
Calcium ion	Cation	CHK45/C05	3-10	23
Candesartan	Candesartan	CHK40/C04	5-28	45
Capsaicin	Alkaloid	CMG20/C10	5-38	50
Carbonate ion	Carbonate ion	SCA04	3-14	25

Compound	Classification	MCI GEL™ column	Figure	Page
Catechin	Catechin	CHP50/P20	5-34	48
Cellobiose	Cellobiose	CA08F	2-37	19
Cesium ion	Cation	SCK01	3-1	22
Chloride ion	Anion	SCA04	3-11	24
Chloride ion	Anion	SCA04	3-12	24
Chloride ion	Anion	SCA04	3-13	24
Chloride ion	Anion	SCA04	3-14	25
Chloride ion	Anion	SCA04	3-16	25
Chloroacetic acid	Carboxylic acid	CK08EH	2-16	12
Chloroacetic acid	Carboxylic acid	CK08EH	2-18	12
Cholic acid	Bile acid	CHP20/C04	5-7	35
α-Chymotrypsinogen A	Protein	CMG20/C04	5-13	38
α-Chymotrypsinogen A	Protein	CMG20/C10	5-18	40
Cinchonine	Cinchona alkaloid	CHP20/C04	5-5	34
Citric acid	Carboxylic acid	CK08EH	2-13	11
Citric acid	Carboxylic acid	CA08F	2-38	19
Citric acid	Carboxylic acid	CA08F	2-39	20
Cobalt ion	Cation	SCK01	3-8	23
Conalbumin	Protein	CHP20/C10	5-19	40
Corticosterone	Adrenal cortical hormone	CHP20/C04	5-9	36
Crocin	Crocin	CMG20/P30	5-37	50
Cystine	Amino acid	CK10U	2-31	17
Cytidine	Nucleoside	SCK01	3-6	22
Cytidine	Nucleoside	CHK40/C04	5-25	43
Cytidine	Nucleoside	CHK45/C05	5-31	46
Cytosine	Nucleic base	CHK40/C04	5-25	43
Cytosine	Nucleic base	CHK45/C05	5-31	46
Cytochrome c	Protein	CQP30	4-6	30
Cytochrome c	Protein	CMG20/C04	5-13	38
Cytochrome c	Protein	CMG20/C10	5-18	40
β-Citronellool	Perfume	CMG20/C10	5-26	44
Deoxycholic acid	Bile acid	CHP20/C04	5-7	35
11-Deoxycortisol	Adrenal cortical hormone	CHP20/C04	5-9	36
Deoxyribose	Deoxysugar	CA08F	2-37	19
D,D-2,6-Diaminopimelic acid	D,D-Diamino carboxylic acid	CRS10W	6-16	54
L,L-2,6-Diaminopimelic acid	L,L-Diamino carboxylic acid	CRS10W	6-16	54
meso-2,6-Diaminopimelic acid	meso-Diamino carboxylic acid	CRS10W	6-16	54
Dibutyl phthalate	Aromatic ester	CHP50/P20	5-32	48
Dichloroacetic acid	Carboxylic acid	CK08EH	2-16	12
Dichloroacetic acid	Carboxylic acid	CK08EH	2-18	12
Diethylene glycol	Polyalcohol	CK08EH	2-17	12
Diethyl phthalate	Aromatic ester	CHP20/C04	5-3	34
Dihydrocapsaicin	Alkaloid	CMG20/C10	5-38	50
Dimethylamine	Amine	SCK01	3-2	22
4-Dimethylaminoantipyrine	Medicine	CMG20/C04	5-10	37
Dimethyl phthalate	Aromatic ester	CHP20/C04	5-3	34
Dimethyl phthalate	Aromatic ester	CHP50/P20	5-32	48
Dipropyl phthalate	Aromatic ester	CHP20/C04	5-3	34
Dipropyl phthalate	Aromatic ester	CHP50/P20	5-32	48
Dopamine	Catecholamine	CHP20/C04	5-2	34
Epicatechin	Catechol	CHP50/P20	5-34	48
Epicatechin gallate	Catechol	CHP50/P20	5-34	48
Epigallocatechin	Catechol	CHP50/P20	5-34	48
Epigallocatechin gallate	Catechol	CHP50/P20	5-34	48
Epinephrine	Catecholamine	CHP20/C04	5-2	34
Erythritol	Sugar alcohol	CK08EC	2-8	8
Erythritol	Sugar alcohol	CK08EC	2-9	9
Erythritol	Sugar alcohol	CK08EC	2-10	9
meso-Erythritol	Sugar alcohol	CK08EC	2-1	7
D-Ethionine	D-Amino acid	CRS10W	6-2	53
L-Ethionine	L-Amino acid	CRS10W	6-2	53
Ethyl alcohol	Alcohol	CK08EC	2-8	8
Ethyl alcohol	Alcohol	CK08EH	2-15	11
Ethyl alcohol	Alcohol	CK08EC	2-9	9
Ethylene glycol	Polyalcohol	CK08EH	2-15	11

Compound	Classification	MCI GEL™ column	Figure	Page
Ethylene glycol	Polyalcohol	CK08EH	2-17	12
Ferritin	Protein	CQP30	4-6	30
Filipin	Antibiotic	CHP20/C10	5-17	39
Fluoride ion	Anion	SCA04	3-11	24
Fluoride ion	Anion	SCA04	3-12	24
Formic acid	Carboxylic acid	CK08EH	2-13	11
Formic acid	Carboxylic acid	CA08F	2-38	19
Formic acid	Carboxylic acid	CA08F	2-40	20
Fructose	Sugar	CK08EC	2-1	7
Fructose	Sugar	CK08EC	2-2	7
Fructose	Sugar	CK08EC	2-4	8
Fructose	Sugar	CK08EC	2-5	8
Fructose	Sugar	CK08EC	2-6	8
Fructose	Sugar	CK08EC	2-7	8
Fructose	Sugar	CK08EC	2-8	8
Fructose	Sugar	CK08EC	2-9	9
Fructose	Sugar	CK08EC	2-10	9
Fructose	Sugar	CK08EC	2-11	10
Fructose	Sugar	CK04S	2-27	16
Fructose	Sugar	CK04S	2-28	16
Fructose	Sugar	CK04S	2-29	16
Fructose	Sugar	CA08F	2-37	19
Fructo-oligosaccharide	Fructo-oligosaccharide	CK04S	2-29	16
Fucose	Sugar	CA08F	2-37	19
Galactose	Sugar	CK08EC	2-3	7
Galactose	Sugar	CK08EC	2-11	10
Galactose	Sugar	CA08F	2-37	19
Gallocatechin	Catechol	CHP50/P20	5-34	48
GDP	Nucleotide	CHK45/C05	5-31	46
Gentiobiose	Disaccharide	CK08EC	2-1	7
Gentiobiose	Disaccharide	CK08EC	2-10	9
Geraniol	Perfume	CMG20/C10	5-26	44
Ghrelin human	Peptide	CMG20/C10	5-21	41
Ghrelin rat	Peptide	CMG20/C10	5-21	41
Gluconic acid	Carboxylic acid	CA08F	2-39	20
Gluconic acid	Carboxylic acid	CA08F	2-41	20
Gluconic acid	Carboxylic acid	CQP06	4-7	30
Glucose	Sugar	CK08EC	2-1	7
Glucose	Sugar	CK08EC	2-2	7
Glucose	Sugar	CK08EC	2-4	8
Glucose	Sugar	CK08EC	2-5	8
Glucose	Sugar	CK08EC	2-6	8
Glucose	Sugar	CK08EC	2-7	8
Glucose	Sugar	CK08EC	2-8	8
Glucose	Sugar	CK08EC	2-9	9
Glucose	Sugar	CK08EC	2-10	9
Glucose	Sugar	CK08E	2-12	10
Glucose	Sugar	CK08EH	2-14	11
Glucose	Sugar	CK04S	2-27	16
Glucose	Sugar	CK04S	2-28	16
Glucose	Sugar	CK04S	2-29	16
Glucose	Sugar	CA08F	2-37	19
Glucose	Sugar	CQP06	4-7	30
Glutamic acid	Amino acid	CK10U	2-31	17
D-Glutamic acid	D-Amino acid	CRS10W	6-6	53
L-Glutamic acid	L-Amino acid	CRS10W	6-6	53
Glycerol	Polyalcohol	CK08EC	2-8	8
Glycerol	Polyalcohol	CK08EC	2-9	9
Glycerol	Polyalcohol	CK08EH	2-15	11
Glycine	Amino acid	CK10U	2-31	17
Glycolic acid	Carboxylic acid	CK08EH	2-13	11
Glycolic acid	Carboxylic acid	CK08EH	2-18	12
Glycyrrhizic acid	Glycyrrhizic acid	CHP20/C04	5-8	36
Gly-Tyr	Peptide	CMG20/C04	5-12	38
Guanosine	Nucleoside	SCK01	3-6	22

Compound	Classification	MCI GEL™ column	Figure	Page
Guanosine	Nucleoside	CHK40/C04	5-25	43
Guanosine	Nucleoside	CHK40/C04	5-25	43
Guanosine	Nucleoside	CHK45/C05	5-31	46
Guanosine	Nucleoside	CHK45/C05	5-31	46
Histidine	Amino acid	CK10U	2-31	17
D-Histidine	D-Amino acid	CRS10W	6-7	53
L-Histidine	L-Amino acid	CRS10W	6-7	53
Hemoglobin A0	Protein	SP01	4-2	28
Hemoglobin A1c	Protein	SP01	4-2	28
5-HPA	Amino acid	CK10U	2-34	18
Hydrocortisone	Adrenal cortical hormone	CHP20/C04	5-9	36
5-Hydroxytryptophan	Amino acid	CHP20/C04	5-2	34
D-2-Hydroxy-n-butyric acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	55
L-2-Hydroxy-n-butyric acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	55
D-α-Hydroxy isocaproic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	55
L-α-Hydroxy isocaproic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	55
5-hydroxy lysine	Amino acid	CK10U	2-36	18
D-α-Hydroxy-n-valeric acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	55
L-α-Hydroxy-n-valeric acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	55
D-m-Hydroxymandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-18	55
L-m-Hydroxymandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-18	55
D-p-Hydroxymandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-18	55
L-p-Hydroxymandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-18	55
D-P-Hydroxy phenylglycine	D-Amino acid	CRS10W	6-20	55
L-P-Hydroxy phenylglycine	L-Amino acid	CRS10W	6-20	55
Hydroxy proline	Amino acid	CK10U	2-34	18
Hypoxanthine	6-Hydroxypurine	CHP20/C04	5-6	35
Hypoxanthine	Nucleic base	CHK40/C04	5-25	43
Hypoxanthine	Nucleic base	CHK45/C05	5-31	46
Inosine	Nucleoside	CHK40/C04	5-25	43
Inosine	Nucleoside	CHK45/C05	5-31	46
Insulin human recombinant	Peptide	CHP20/C10	5-20	41
Insulin glargine	Peptide	CHP20/C10	5-20	41
Insulin human recombinant	Peptide	CMG20/C10	5-20	41
Insulin glargine	Peptide	CMG20/C10	5-20	41
Irbesartan	Sartan	CHK40/C04	5-28	45
Isoleucine	Amino acid	CK10U	2-31	17
Isoleucine	Amino acid	CK10U	2-35	18
D-Isoleucine	D-Amino acid	CRS10W	6-1	52
L-Isoleucine	L-Amino acid	CRS10W	6-1	52
allo-D-Isoleucine	D-Amino acid	CRS10W	6-1	52
allo-L-Isoleucine	L-Amino acid	CRS10W	6-1	52
Isopropyl alcohol	Alcohol	CK08EH	2-15	11
Kinase	Enzyme	DA01	4-3	28
Lactic acid	Carboxylic acid	CK08EH	2-13	11
Lactic acid	Carboxylic acid	CA08F	2-38	19
Lactic acid	Carboxylic acid	CA08F	2-40	20
Lactic acid	Carboxylic acid	CA08F	2-41	20
D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-11	53
L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-11	53
D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	55
L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	55
D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W/CRS15W	6-22	56
L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W/CRS15W	6-22	56
β-Lactoglobulin	Protein	CMG20/C10	5-18	40
Lactose	Disaccharide	CK08EC	2-1	7
Lactose	Disaccharide	CK08EC	2-3	7
Lactose	Disaccharide	CA08F	2-37	19
Lactose monohydrate	Disaccharide	CK08EC	2-10	9
Lactulose	Disaccharide	CK08EC	2-3	7
Leucine	Amino acid	CK10U	2-31	17
Leucine	Amino acid	CK10U	2-35	18
Nor-Leucine	Amino acid	CK10U	2-35	18
D-Leucine	D-Amino acid	CRS10W	6-2	53
L-Leucine	L-Amino acid	CRS10W	6-2	53

Compound	Classification	MCI GEL™ column	Figure	Page
Leu-Enkephalin	Peptide	CMG20/C04	5-12	38
Leuprorelin	Peptide	CHP20/C10	5-22	42
Leuprorelin	Peptide	CMG20/C10	5-22	42
LH-RH human	Peptide	CHP20/C10	5-22	42
LH-RH human	Peptide	CMG20/C10	5-22	42
LH-RH salmon	Peptide	CHP20/C10	5-22	42
LH-RH salmon	Peptide	CMG20/C10	5-22	42
Linalool	Perfume	CMG20/C10	5-26	44
Linalool	Perfume	CMG20/C10	5-27	44
Linalyl acetate	Perfume	CMG20/C10	5-26	44
Lithium ion	Cation	SCK01	3-1	22
Lithium ion	Cation	CHK45/C05	3-10	23
Losartan	Sartan	CHK40/C04	5-28	45
Lysine	Amino acid	CK10U	2-31	17
Lysine	Amino acid	CK10U	2-36	18
D-Lysine	D-Amino acid	CRS10W	6-8	53
L-Lysine	L-Amino acid	CRS10W	6-8	53
Magnesium ion	Cation	SCK01	3-7	23
Magnesium ion	Cation	SCK01	3-9	23
Magnesium ion	Cation	CHK45/C05	3-10	23
Malic acid	Carboxylic acid	CK08EH	2-13	11
Malic acid	Carboxylic acid	CA08F	2-38	19
Malic acid	Carboxylic acid	CA08F	2-40	20
Malonic acid	Carboxylic acid	CK08EH	2-13	11
Malonic acid	Carboxylic acid	CA08F	2-38	19
Maltose	Disaccharide	CA08F	2-37	19
Maltose	Disaccharide	CK08E	2-12	10
Maltotriose	Disaccharide	CK08E	2-12	10
D-Mandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-18	55
L-Mandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-18	55
Manganese ion	Cation	SCK01	3-8	23
Mannitol	Sugar alcohol	CK08EC	2-1	7
Mannitol	Sugar alcohol	CK08EC	2-8	8
Mannitol	Sugar alcohol	CK08EC	2-9	9
Mannitol	Sugar alcohol	CK08EC	2-10	9
Mannose	Sugar	CK08EC	2-1	7
Mannose	Sugar	CK08EC	2-10	9
Mannose	Sugar	CA08F	2-37	19
Melibiose	Disaccharide	CA08F	2-37	19
Met-Enkephalin	Peptide	CMG20/C04	5-12	38
Methionine	Amino acid	CK10U	2-31	17
D-Methionine	D-Amino acid	CRS10W	6-3	53
L-Methionine	L-Amino acid	CRS10W	6-3	53
D-Methionine	D-Amino acid	CRS10W	6-14	54
L-Methionine	L-Amino acid	CRS10W	6-14	54
Methyl alcohol	Alcohol	CK08EH	2-15	11
Methylamine	Amine	SCK01	3-2	22
γ-methyl leuicine	Amino acid	CK10U	2-35	18
Mevastatin	Medicine	CHP20/C10	5-16	39
Myoglobin	Protein	CQP30	4-6	30
Nerol	Perfume	CMG20/C10	5-26	44
Nitrate ion	Anion	SCA04	3-11	24
Nitrate ion	Anion	SCA04	3-12	24
Nitrate ion	Anion	SCA04	3-13	24
Nitrate ion	Anion	SCA04	3-14	25
Nitrate ion	Anion	SCA04	3-16	25
Nitrate ion	Anion	SCA04	3-11	24
Nitrate ion	Anion	SCA04	3-12	24
D-Norleucine	D-Amino acid	CRS10W	6-3	53
L-Norleucine	L-Amino acid	CRS10W	6-3	53
D-Norvaline	D-Amino acid	CRS10W	6-3	53
L-Norvaline	L-Amino acid	CRS10W	6-3	53
Nystatin	Antibiotic	CHP20/C10	5-17	39
Oligosaccharide	Dp1-Dp9	CK04S	2-20	15
Oligosaccharide	Dp1-Dp13	CK04SS	2-21	15

Compound	Classification	MCI GEL™ column	Figure	Page
Oligosaccharide	Dp1-Dp16	CK02A	2-22	15
Oligosaccharide	Dp1-Dp20	CK02AS	2-23	15
Oligosaccharide	Dp1-Dp7	CK04S	2-24	16
Oligosaccharide	Dp1-Dp7	CK04SS	2-25	16
Oligosaccharide	Dp1-Dp7	CK02AS	2-26	16
Ornithine	Amino acid	CK10U	2-36	18
Orotic acid	Carboxylic acid	CHP20/C04	5-6	35
Ovalbumin	Protein	CQP30	4-6	30
Oxalic acid	Carboxylic acid	CK08EH	2-13	11
PEG MW 145,000	PEG	CQP30	4-5	30
PEG MW 40,000	PEG	CQP30	4-5	30
PEG MW 6,000	PEG	CQP30	4-5	30
Penicillin G	Antibiotic	CHP50/P20	5-33	48
Penicillin V	Antibiotic	CHP50/P20	5-33	48
Phenacetin	Medicine	CMG20/C04	5-10	37
Phenylalanine	Amino acid	CK10U	2-31	17
Phenylalanine	Amino acid	CK10U	2-36	18
D-Phenylalanine	D-Amino acid	CRS10W	6-2	53
L-Phenylalanine	L-Amino acid	CRS10W	6-2	53
D-Phenylalanine	D-Amino acid	CRS10W	6-9	53
L-Phenylalanine	L-Amino acid	CRS10W	6-9	53
D-α-Phenylglycine	D-Amino acid	CRS10W	6-13	54
L-α-Phenylglycine	L-Amino acid	CRS10W	6-13	54
Phosphate ion	Anion	SCA04	3-11	24
Pipecolic acid	Amino acid	CK10U	2-34	18
Polyphenon 60	Polyphenol	CHP07/C04	5-29	45
Polyphenon 60	Polyphenol	CHP20/C04	5-30	45
Potassium ion	Cation	SCK01	3-1	22
Potassium ion	Cation	SCK01	3-3	22
Potassium ion	Cation	SCK01	3-4	22
Potassium ion	Cation	SCK01	3-5	22
Potassium ion	Cation	CHK45/C05	3-10	23
Pravastatin Na	Medicine	CHP20/C10	5-16	39
Procainamide	Anesthetic	CMG20/C04	5-14	38
Procaine	Anesthetic	CMG20/C04	5-14	38
Proline	Amino acid	CK10U	2-31	17
Proline	Amino acid	CK10U	2-34	18
D-Proline	D-Amino acid	CRS10W	6-2	53
L-Proline	L-Amino acid	CRS10W	6-2	53
n-Propyl alcohol	Alcohol	CK08EH	2-15	11
Pyruvic acid	Carboxylic acid	CA08F	2-40	20
Quinine	Cinchona alkaloid	CHP20/C04	5-5	34
Rhamnose	Sugar	CA08F	2-37	19
Ribitole(Adnitole)	Sugar alcohol	CK08EC	2-10	9
Ribonuclease A	Protein	CMG20/C04	5-13	38
Ribonuclease A	Protein	CMG20/C10	5-18	40
Ribonuclease A	Protein	CHP20/C10	5-19	40
Ribose	Sugar	CK08EC	2-1	7
Ribose	Sugar	CK08EC	2-10	9
Ribose	Sugar	CA08F	2-37	19
Rituximab	Monoclonal antibody	SP01	4-1	28
Rubidium ion	Cation	SCK01	3-1	22
Salicin	Phenol glycoside	CK08EC	2-1	7
Salicin	Phenol glycoside	CK08EC	2-10	9
Sennoside A	Sennoside A	CHP20/C10	5-35	49
Sennoside B	Sennoside B	CHP20/C10	5-35	49
Sennoside A	Sennoside A	CHP20/P20	5-35	49
Sennoside B	Sennoside B	CHP20/P20	5-35	49
Sennoside A	Sennoside A	CHP20/P30	5-35	49
Sennoside B	Sennoside B	CHP20/P30	5-35	49
Sennoside A	Sennoside A	CHP20/P30	5-36	49
Serine	Amino acid	CK10U	2-31	17
D-Serine	D-Amino acid	CRS10W	6-4	53
L-Serine	L-Amino acid	CRS10W	6-4	53
Serotonin	Catecholamine	CHP20/C04	5-2	34

Compound	Classification	MCI GEL™ column	Figure	Page
Sifuvirtide	Peptide	CMG20/C10	5-23	42
Simvastatin	Medicine	CHP20/C10	5-16	39
Sodium ion	Cation	SCK01	3-1	22
Sodium ion	Cation	SCK01	3-3	22
Sodium ion	Cation	SCK01	3-4	22
Sodium ion	Cation	SCK01	3-5	22
Sodium ion	Cation	CHK45/C05	3-10	23
Sorbitol	Sugar alcohol	CK08EC	2-2	7
ssRNA	RNA	CHP20/C10	5-24	43
Stachyose	Tetrasaccharide	CK08EC	2-1	7
Stachyose hydrate	Sugar	CK08EC	2-10	9
Strontium ion	Cation	SCK01	3-7	23
Strontium ion	Cation	SCK01	3-8	23
Succinic acid	Carboxylic acid	CA08F	2-40	20
Succinylsulfathiazole	Sulfa drug	CMG20/C04	5-11	37
Sucrose	Disaccharide	CK08EC	2-2	7
Sucrose	Disaccharide	CK08EC	2-4	8
Sucrose	Disaccharide	CK08EC	2-5	8
Sucrose	Disaccharide	CK08EC	2-11	10
Sucrose	Disaccharide	CK04S	2-29	16
Sulfate ion	Anion	SCA04	3-11	24
Sulfate ion	Anion	SCA04	3-12	24
Sulfate ion	Anion	SCA04	3-13	24
Sulfamerazine	Sulfa drug	CMG20/C04	5-11	37
Sulfanilamide	Sulfa drug	CMG20/C04	5-11	37
Sulfathiazole	Sulfa drug	CMG20/C04	5-11	37
Tartaric acid	Carboxylic acid	CK08EH	2-13	11
Tartaric acid	Carboxylic acid	CA08F	2-38	19
Tartaric acid	Carboxylic acid	CA08F	2-40	20
Tert-leuicine	Amino acid	CK10U	2-35	18
Theobromine	Purine alkaloid	CHP20/C04	5-4	34
Theophylline	Purine alkaloid	CHP20/C04	5-4	34
Theophylline	Purine alkaloid	CHP20/C04	5-6	35
Thiocyanic ion	Anion	SCA04	3-15	25
Thiosulfuric ion	Anion	SCA04	3-15	25
Threonine	Amino acid	CK10U	2-31	17
Thymidine	Nucleoside	CHK40/C04	5-25	43
Thymidine	Nucleoside	CHK45/C05	5-31	46
Thymine	Nucleic base	CHK40/C04	5-25	43
D-α-Tocopherol	Vitamin	CMG20/C04	5-39	51
D-γ-Tocopherol	Vitamin	CMG20/C04	5-39	51
D-δ-Tocopherol	Vitamin	CMG20/C04	5-39	51
D-α-Tocopherol	Vitamin	CMG20/P30	5-40	51
D-γ-Tocopherol	Vitamin	CMG20/P30	5-40	51
D-δ-Tocopherol	Vitamin	CMG20/P30	5-40	51
D-α-Tocopherol	Vitamin	CMG20/C04	5-41	51
D-β-Tocopherol	Vitamin	CMG20/C04	5-41	51
D-γ-Tocopherol	Vitamin	CMG20/C04	5-41	51
D-δ-Tocopherol	Vitamin	CMG20/C04	5-41	51
D-α-Tocopherol	Vitamin	CMG20/C10	5-39	51
D-γ-Tocopherol	Vitamin	CMG20/C10	5-39	51
D-δ-Tocopherol	Vitamin	CMG20/C10	5-39	51
D-γ-Tocotrienol	Vitamin	CMG20/C04	5-39	51
D-γ-Tocotrienol	Vitamin	CMG20/P30	5-40	51
D-α-Tocotrienol	Vitamin	CMG20/C04	5-41	51
D-β-Tocotrienol	Vitamin	CMG20/C04	5-41	51
D-γ-Tocotrienol	Vitamin	CMG20/C04	5-41	51
D-δ-Tocotrienol	Vitamin	CMG20/C04	5-41	51
D-γ-Tocotrienol	Vitamin	CMG20/C10	5-39	51
Transferrin	Protein	CMG20/C10	5-18	40
Trichloroacetic acid	Carboxylic acid	CK08EH	2-16	12
Triethylene glycol	Polyalcohol	CK08EH	2-17	12
Trimethylamine	Amine	SCK01	3-2	22
Tryptophan	Amino acid	CHP20/C04	5-2	34
L-Tryptophan	L-Amino acid	CRS10W	6-10	53

Compound	Classification	MCI GEL™ column	Figure	Page
Tyrosine	Amino acid	CK10U	2-31	17
Tyrosine	Amino acid	CK10U	2-36	18
D-Tyrosine	D-Amino acid	CRS10W	6-2	53
L-Tyrosine	L-Amino acid	CRS10W	6-2	53
UMP	Nucleotide	CHK45/C05	5-31	46
Uracil	Nucleic base	CHK40/C04	5-25	43
Uracil	Nucleic base	CHK45/C05	5-31	46
Uric acid	2,6,8-Trioxypurine	CHP20/C04	5-6	35
Uridine	Nucleoside	SCK01	3-6	22
Uridine	Nucleoside	CHK40/C04	5-25	43
Uridine	Nucleoside	CHK45/C05	5-31	46
Ursodeoxycholic acid	Bile acid	CHP20/C04	5-7	35
Valine	Amino acid	CK10U	2-31	17
Valine	Amino acid	CK10U	2-32	18
Valine	Amino acid	CK10U	2-35	18
D-Valine	D-Amino acid	CRS10W	6-2	53
L-Valine	L-Amino acid	CRS10W	6-2	53
Valsartan	Sartan	CHK40/C04	5-28	45
Vitamin B3	Water soluble vitamin	CMG20/C04	5-15	38
Vitamin B6	Water soluble vitamin	CMG20/C04	5-15	38
Vitamin B12	Water soluble vitamin	CMG20/C04	5-15	38
Vitamin C	Water soluble vitamin	CMG20/C04	5-15	38
Xanthine	2,6-Dihydroxypurine	CHP20/C04	5-6	35
Xanthine	Nucleic base	CHK40/C04	5-25	43
Xanthine	Nucleic base	CHK45/C05	5-31	46
Xanthine oxidase	Nucleic base	CHK45/C05	5-31	46
Xanthosine	Nucleoside	CHK40/C04	5-25	43
Xylitol	Sugar alcohol	CK08EC	2-1	7
Xylitol	Sugar alcohol	CK08EC	2-10	9
Xylose	Sugar	CA08F	2-37	19
Zinc ion	Cation	SCK01	3-7	23

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Printed in Japan 2024.4