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<http://www.diaion.com>

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MCI GEL™

Mitsubishi Chemical's packed columns and packing materials for HPLC

TECHNICAL INFORMATION 2014-2015



Excellent performance

spherical and sharp particle size distribution

Persistence and highest quality

offers 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

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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	28~29	
			Ion Exchange	CQA Series CQK Series	2 ~12	Proteins,Biopolymers	35~36	
			Hydrophobic Interaction	CQH Series	2 ~12	Proteins,Biopolymers	37~39	
			Reversed-Phase	CMG20/C04 CMG20/C10	2 ~12	Proteins,Biopolymers	40~56	
				CHP20/C04 CHP20/C10	Full range	Proteins,Biopolymers	40~56	
			M.W. <2,000	Size Exclusion	CK02A CK02AS	6 ~ 7	Oligosaccharides	14~16
		CK04S CK04SS			6 ~ 7	Oligosaccharides	14~16	
		CQP06			2 ~12	Peptides	28~29	
		Ion Exchange		CK10U	1 ~14	Amino acids	7~ 8	
				CA08F CDR10	1 ~13	Organic acids Saccharrides	17~20	
				CDR10	1 ~13	Nucleotides	19~20	
			SCA04	3 ~ 7	Anions	21, 24~26		
	SCK01		1.5~12	Cations	21~23			
	Organic Solvent Soluble	M.W. <2,000	Reversed-Phase	CMG20/C04 CMG20/C10	2 ~12	Organic Compounds	46~50	
				CHP20/C04 CHP20/C10	Full range	Organic Compounds	42~49	
			Mix mode	CHK40/C04	Full range	Organic Compounds	38, 50	
			Ion Exclusion	CK08EH	1 ~ 7	Organic adids	9, 11~12	
		Ligand Exchange	CK08E Series	1 ~ 7	Saccharrides	9~10		
			CRS10W CRS15W	5 ~ 7	Optical isomers (α-amino acids* α-hydroxy carboxylic acids)	57~62		
				Reversed-Phase	CHP20/C04 CHP20/C10 CHP07/C04 CHP07/C10	Full range	Organic Compounds	40~56
					CMG20/C04 CMG20/C10 CHPOD/C04	2 ~12	Organic Compounds	40~56
			Mix mode	CHK40/C04	Full range	Organic Compounds	38, 50	

Particle size [μm]	Analytical				Preparative		
	5	10	30	50	150		
Ion exchange	CK ProtEx	CK CA CDR10	CK CA	CK CA		CK CA	
			CQA_S CQK_S		CQA_P CQK_P		
Ion chromatography	SCA		SCK				
Size exclusion			CQP		CQP_P		
Hydrophobic interaction			CQH_S		CQH_P		
Reversed - phase	CHP20/C04 CHP07/C04 CMG20/C04 CHPOD/C04	CHP20/C10 CSP50/P10 CHP50/P20 CHP50/P30	CHP20/P20 CHP20/P30 CHP50/P20 CHP50/P30	CHP20/P50 CHP20/P70	CHP20/P120		CHP07/P120 CMG20/P150 CHP85/P120 CHP87/P120
Mix mode	CKH40/C04						
Ligand exchange	CRS						



○ Cation exchange resins
MCI GEL™ CK series

○ Anion exchange resins
MCI GEL™ CA series

Mitsubishi Chemical Ion Exchange Resins

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

Features

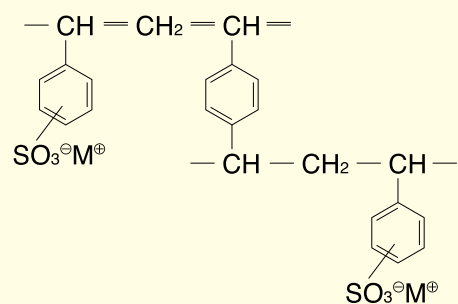
- Variety of products** gel type, porous type, DVB%, particle size, particle size distribution
analytical use, preparative use
- Persistence of high quality, excellent separation performance**
- Accumulation of abundant knowledge and experience of applications**

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

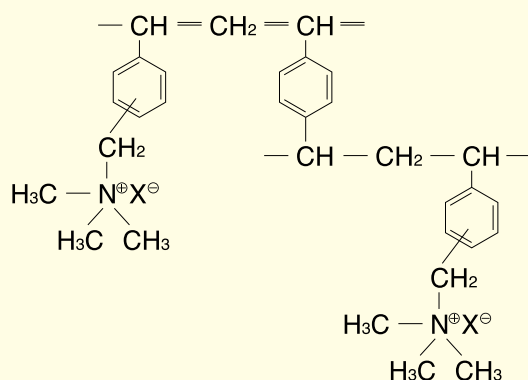
Typical application for each column is shown in this catalog. These data will suggest an appropriate column.

● Chemical structure of ion exchange resin

〈Strongly acidic cation exchange resin〉



〈Strongly basic anion exchange resin〉



● MCI GEL™ columns for HPLC

	Description					Typical usage						
	Product name	Column dimensions I.D×L [mm]	Packing material			USP	Amino acid	Mono saccharide	Oligo-saccharide	Carboxylic acid	Amine	Physiologi fluid
			Cross linkage [%]	Counter ion	Particle size [μm]							
MCI GEL™ Cation exchange columns	MCI GEL™ CK10U	6×120	10	Na ⁺	5		○				○	
	MCI GEL™ CK08S	8×500	8	Na ⁺	11	L58		○				
	MCI GEL™ CK08E	8×300	8	Na ⁺	9	L58		○				
	MCI GEL™ CK08EC	8×300	8	Ca ²⁺	9	L19		○				
	MCI GEL™ CK08ES	8×300	8	Ag ⁺	9			○	○			
	MCI GEL™ CK08EH	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	Cl ⁻	7			○		○		
	MCI GEL™ CDR10	4.6×250	High porous	AcO ⁻	7			○		○		○

● Packing materials

Packing materials are available. Please look at P.67 and P.68.

● Description of a gel type ion exchange column

MCI GEL™ CK08EC

for HPLC use

Cation=K
Anion=A

DVB%

Counter ion
(no letter=Na⁺, C=Ca²⁺
S=Ag⁺, H=H⁺)

Particle size (mode)
(A=20μm, S=11μm
E=9μm, F=7μm,
U=5μm)

● Note ; Pre-column and guard column

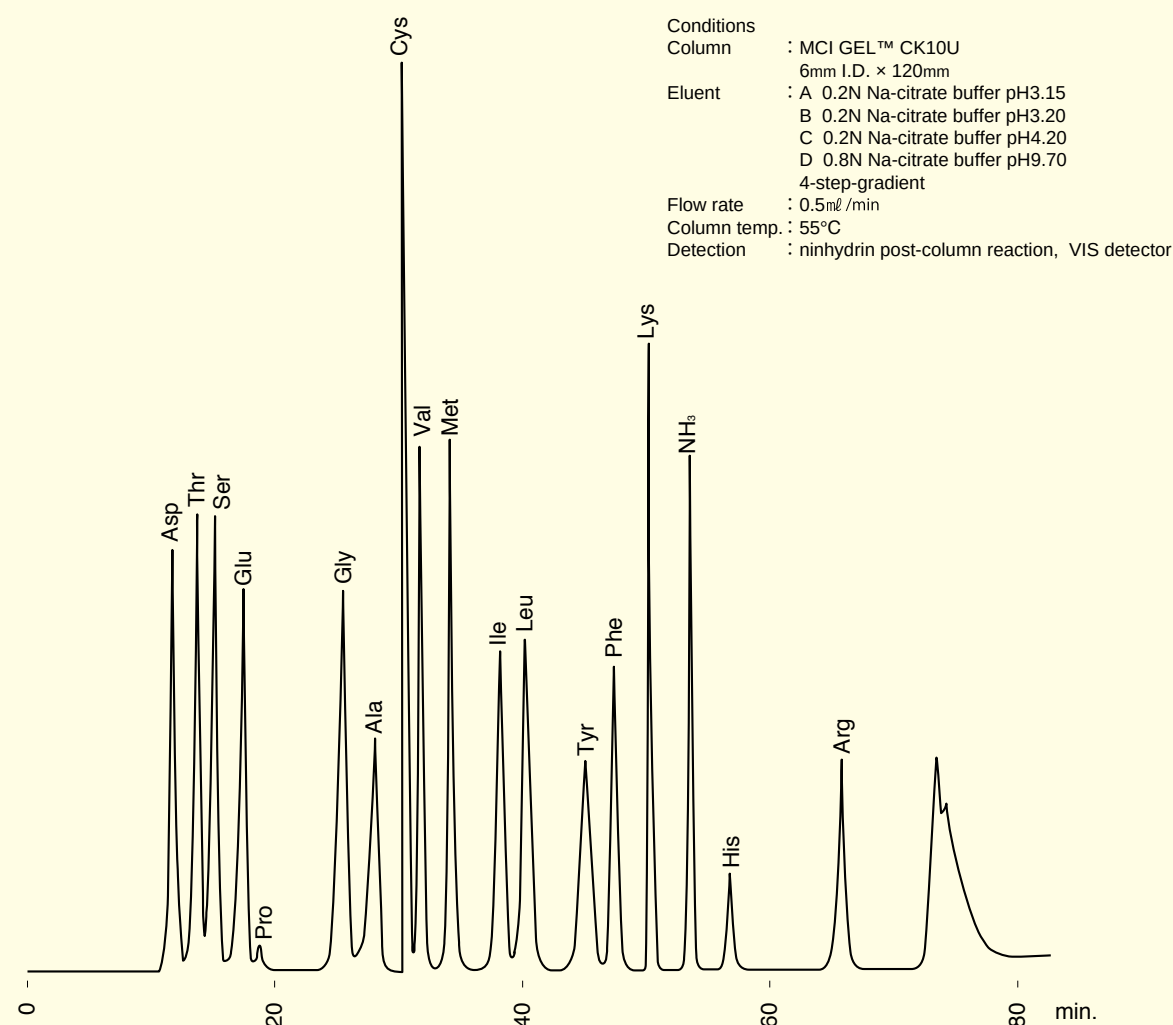
- Please consider using a guard column concerning purity of injection sample. Guard columns, are listed in the end of this catalog, should be selected in accordance with a main column.
- As for analysis of amino acids by MCI GEL™ CK10U, MCI GEL™ AFR2-PC is recommended as a pre-column. The AFR2-PC column 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.



CK10U 6×120

Separation of amino acids

Fig. 2-1 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. 2-2 Valine, β-Alanine

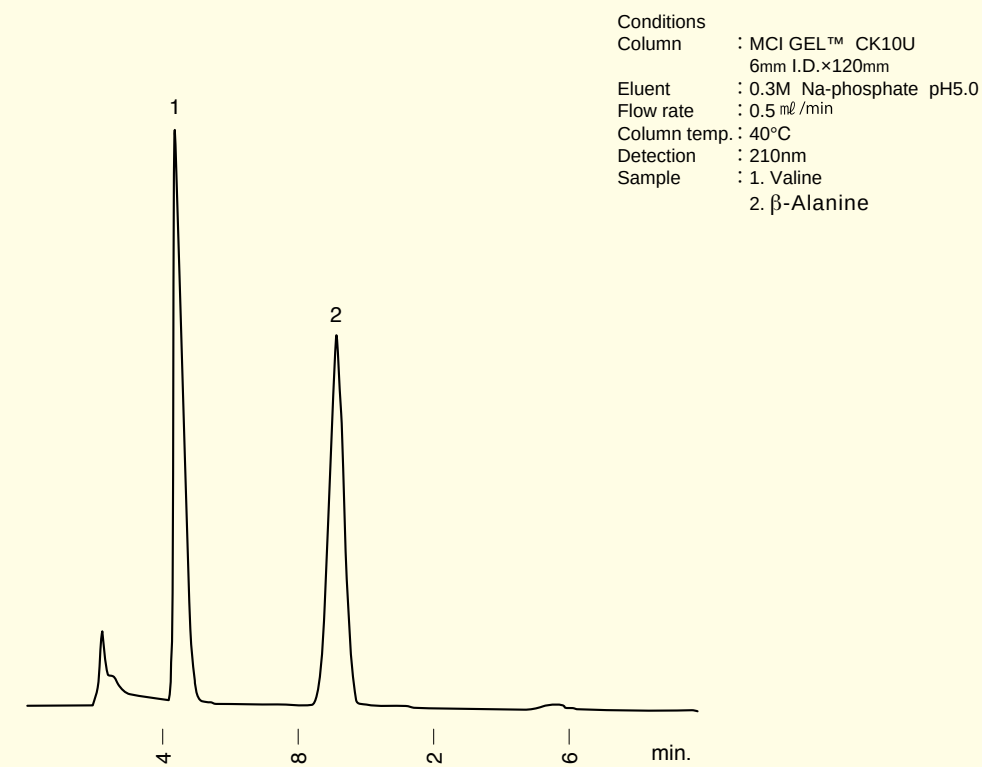
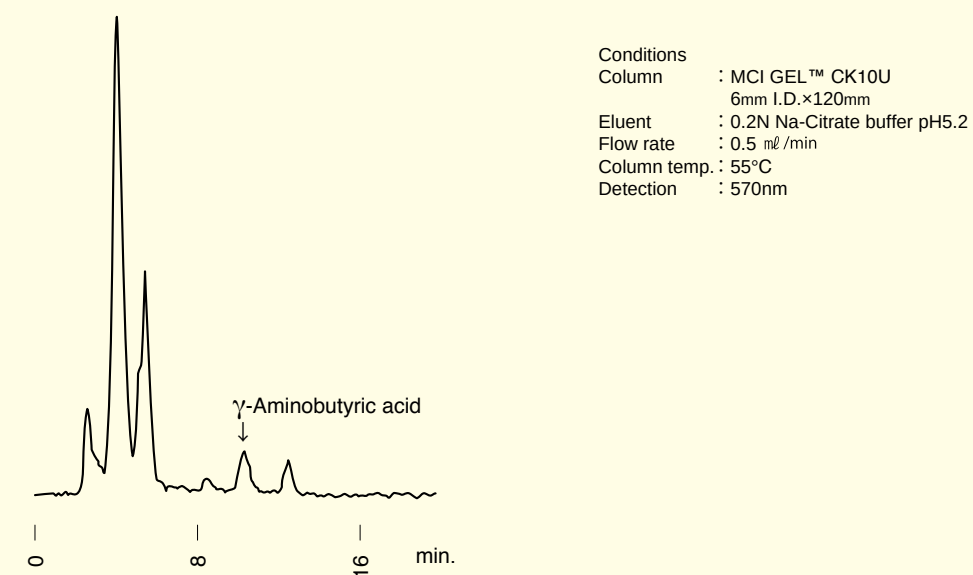


Fig. 2-3 γ-Aminobutyric acid



CK08E series

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



CK08EC 8×300

CK08EH 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	L19
MCI GEL™ CK08ES	Ag ⁺	Gel permeation chromatographic effect	
MCI GEL™ CK08EH	H ⁺	Organic acids with H ₃ PO ₄ eluent; sugars with distilled water eluent	L17

Application data of CK08EC

Fig. 2-4 Sugars

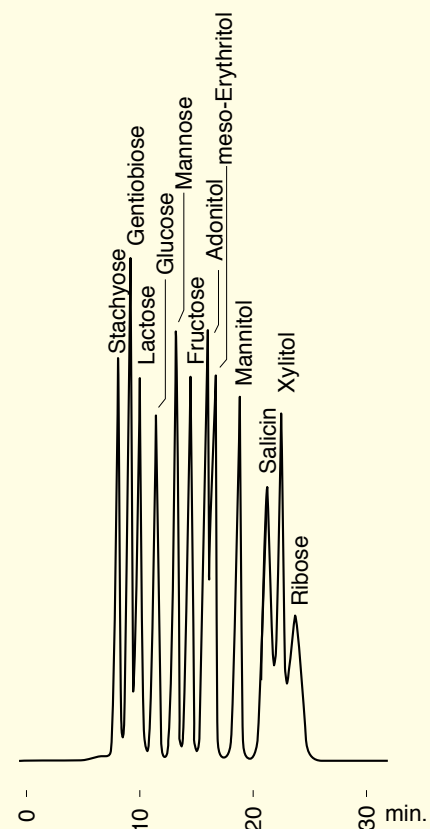
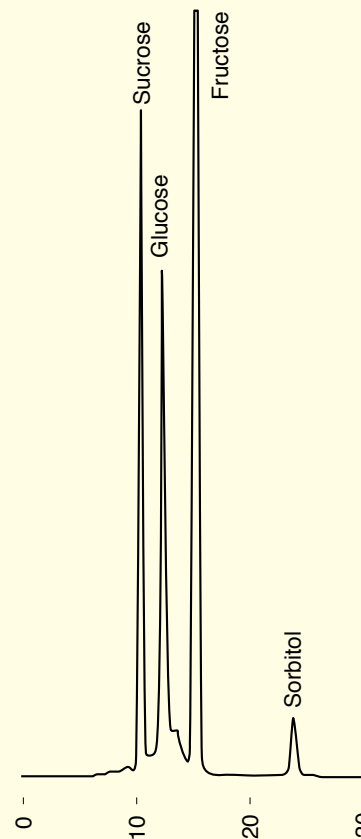
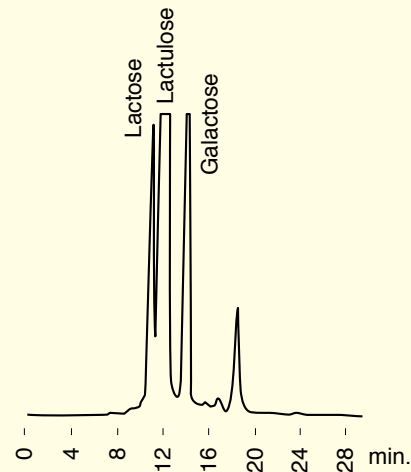


Fig. 2-5 Apple juice



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

Fig. 2-6 Lactulose syrup



Application data of CK08EC

Fig. 2-7 Sports drink A

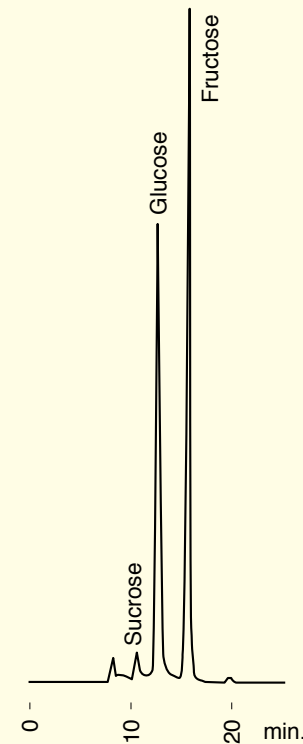


Fig. 2-8 Sports drink B

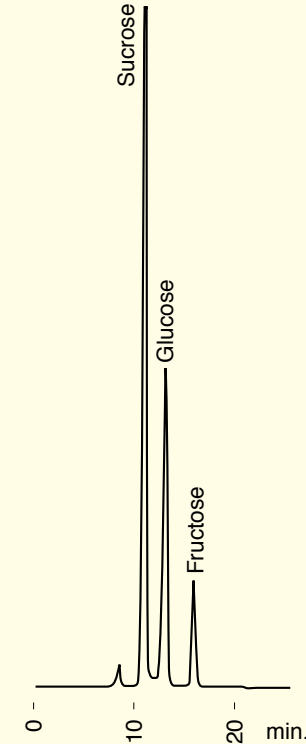


Fig. 2-9 Honey

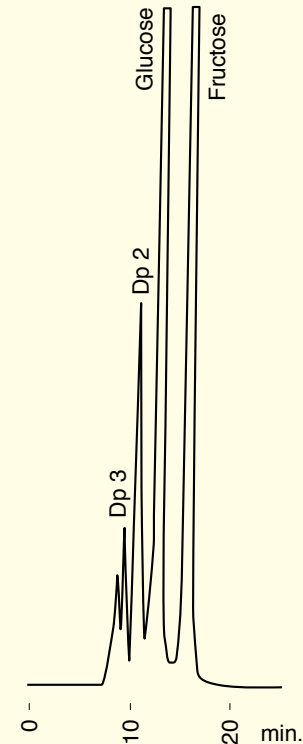


Fig. 2-10 Jam

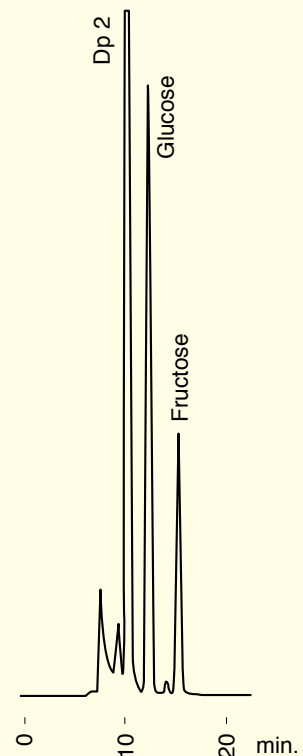
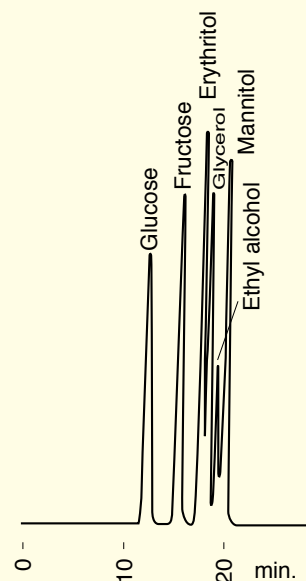


Fig. 2-11 Sugars/Alcohols



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

Application data of CK08EH

Fig. 2-12 Carboxylic acids

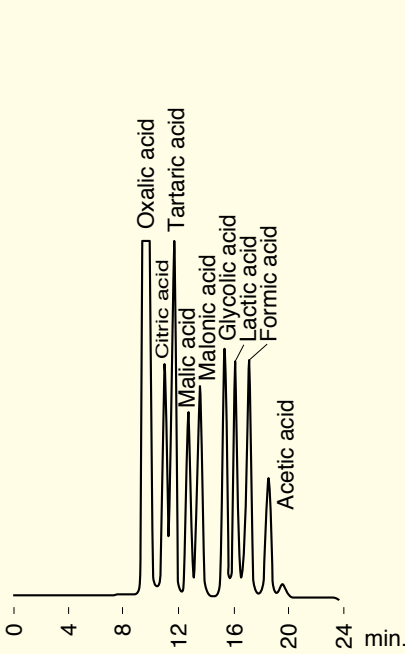


Fig. 2-13 Amino sugars

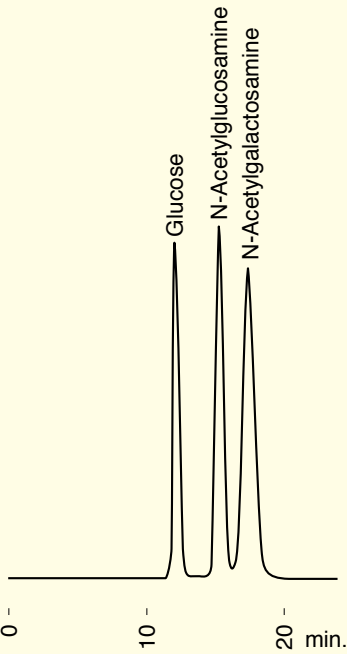
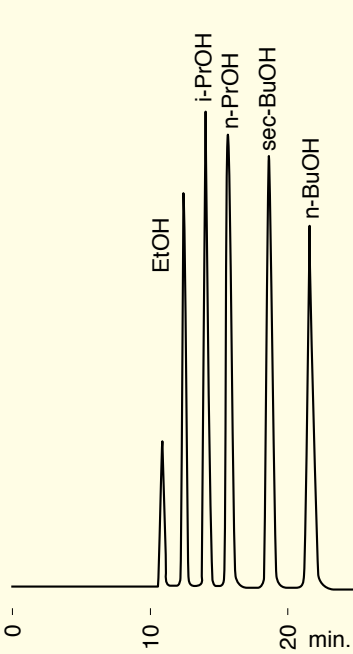


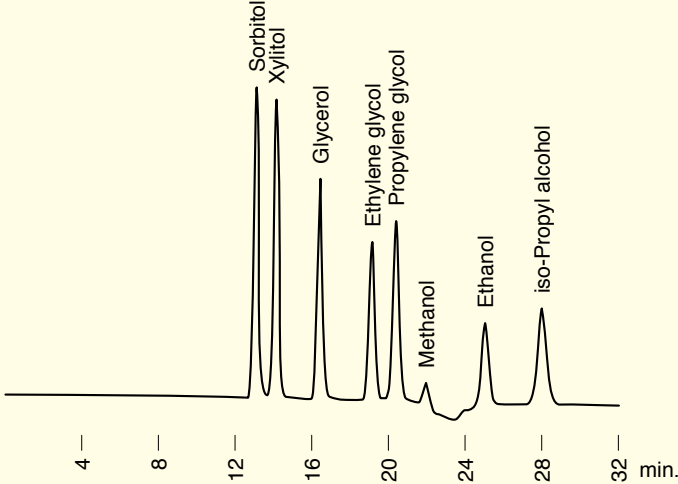
Fig. 2-14 Alcohols



Conditions
Column : MCI GEL™ CK08EH, 8mm I.D.×300mm
Eluent : 1% H₃PO₄ (Fig.2-12,2-13) , H₂O (Fig. 2-14)
Flow rate : 0.6 mL/min
Column temp. : 45°C (Fig. 2-12) , ambient (Fig. 2-13) , 60°C (Fig. 2-14)
Detection : 210nm (Fig. 2-12) , RI (Fig. 2-13, 2-14)

Fig. 2-15 Sugar alcohols/Alcohols

Conditions
Column : MCI GEL™ CK08EH
8mm I.D.×300mm
Eluent : H₂O
Flow rate : 0.6 mL/min
Column temp. : 45°C
Detection : RI



Application data of CK08EH

Fig. 2-16 Poly alcohols

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

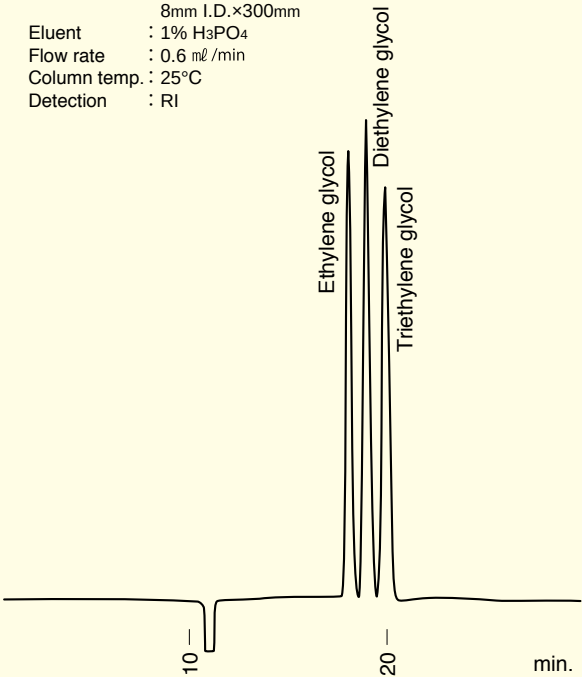


Fig. 2-17 Chloroacetic acids

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

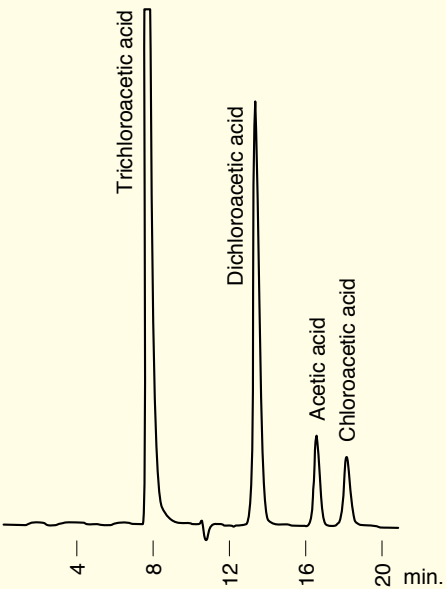
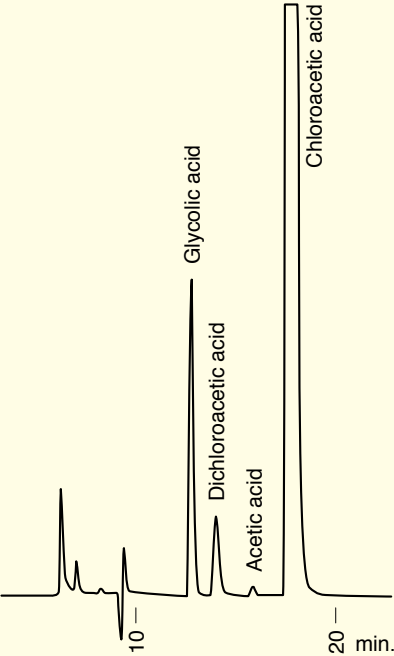


Fig. 2-18 Carboxylic acids

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



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

CK08EC Ca ²⁺	CK08E Na ⁺	CK08ES Ag ⁺
Stachyose 9	Stachyose 8	* Melezitose 12
Melezitose	Melezitose	* Stachyose
Raffinose	Raffinose	* Raffinose 13
Gentiobiose 10	Gentiobiose 9	
Cellobiose	Cellobiose	* Sucrose 14
Trehalose	Trehalose	Trehalose
Isomaltose	Sucrose	Cellobiose
Sucrose	Isomaltose	Gentiobiose
Maltose	Melibiose	Maltose
Melibiose	Maltose	Isomaltose
Lactose	Maltulose	Maltulose 15
Maltulose 11	Lactose 10	
		Lactose 16
Lactulose 12	Lactulose 11	Melibiose 17
Glucose 13		
		Lactulose 18
Xylose 14	Glucose 12	Adonitol
Galactose	Mannitol	Digitoxose
Mannose	Rhamnose	Rhamnose
Rhamnose 15	Adonitol	Glucose
	Sorbitol	Xylose
	Digitoxose	Xylitol
Fructose 16	Mannose	Erythritol
Fucose	Xylose	Mannitol
Inositol	Galactose	Fructose 19
Arabinose	Fructose	
Digitoxose	Inositol	Dulcitol 20
Adonitol 17	Xylitol	Galactose
	Fucose	Sorbitol
Erythritol 18	Dulcitol	Mannose
	Arabinose	Arabinose 20
Mannitol 20	Erythritol 15	
		Fucose 21
Salicin 22	Ribose 17	Ribose 21
	Salicin 27	Inositol 23
Dulcitol 23		Salicin 52
Xylitol 24		
Sorbitol 24		
Ribose 25		

Column temp : CK08EC...75°C, CK08E...45°C, CK08ES...75°C
Column size : 8mm I.D.×300mm
Eluent : H₂O
Flow rate : 0.6 ml/min
Sample : 1% aq. solution
Injection vol. : 20μl

* ; These sugars, containing Fructose component, may partially be decomposed by CK08ES and CK08EH.

2 MCI GEL™

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)
MCI GEL™ CK04S	Na ⁺	8~9
MCI GEL™ CK04SS	Ag ⁺	12~13
MCI GEL™ CK02A	Na ⁺	15~16
MCI GEL™ CK02AS	Ag ⁺	19~20

Calibration curves of malto-oligosaccharides

Fig. 2-19

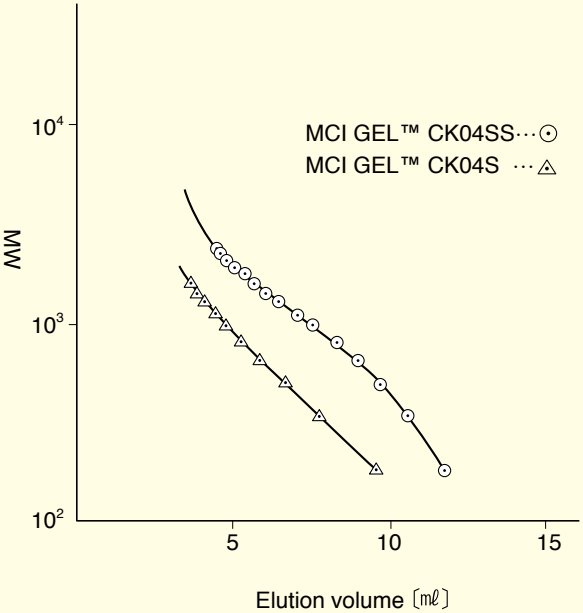
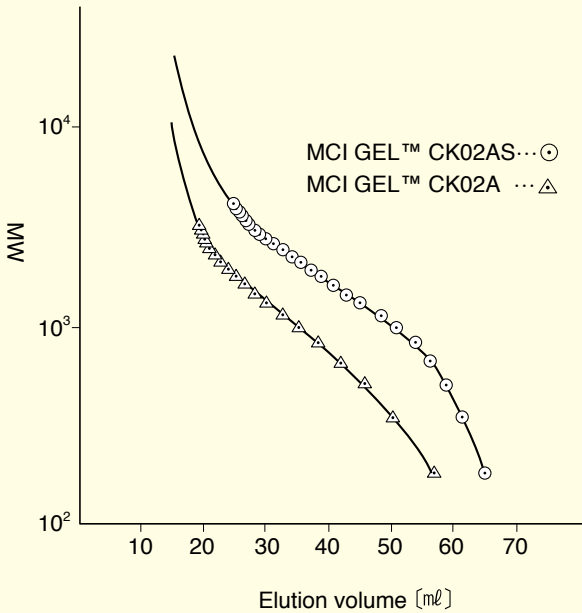


Fig. 2-20



Comparison data of malto-oligosaccharides

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

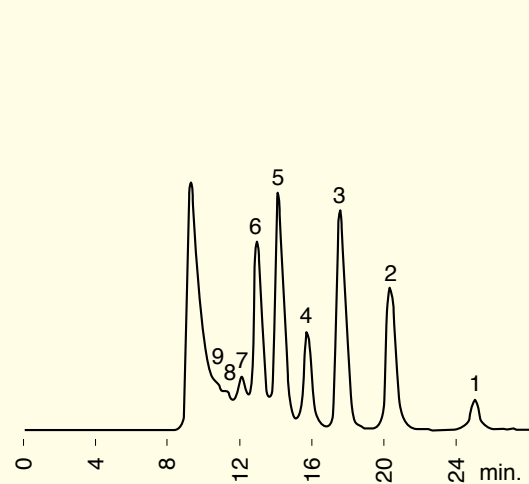


Fig. 2-22 MCI GEL™ CK04SS
10mm I.D.×200mm

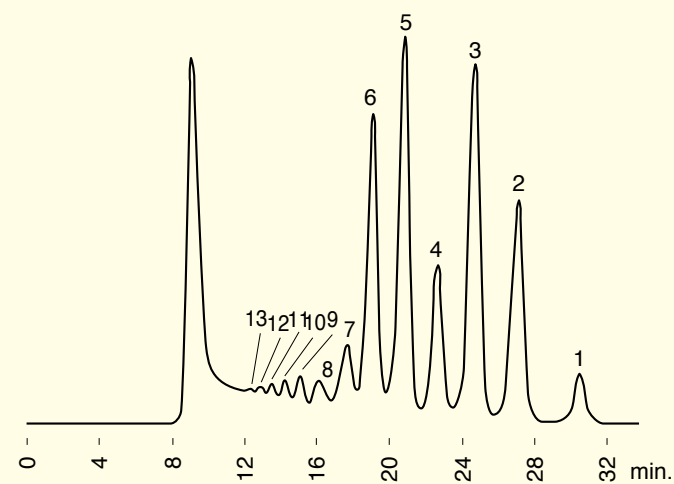


Fig. 2-23 MCI GEL™ CK02A
20mm I.D.×250mm

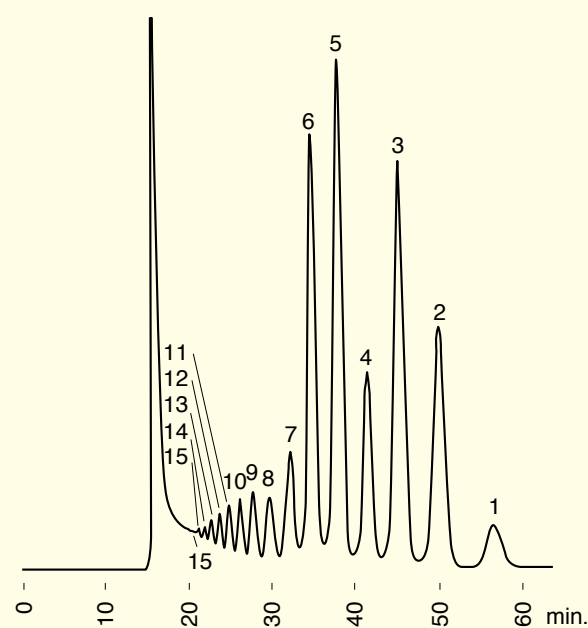
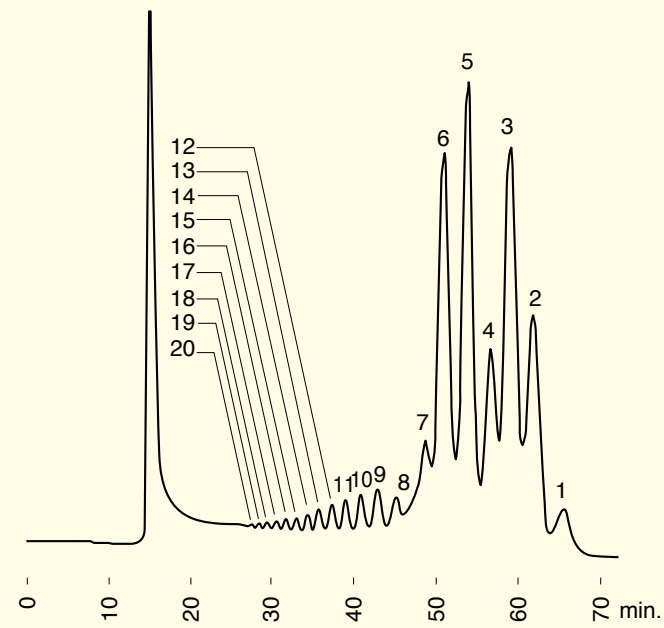


Fig. 2-24 MCI GEL™ CK02AS
20mm I.D.×250mm



Conditions
Eluent : H₂O
Flow rate : 0.4 mL/min (Fig. 2-21, 2-22, 2-25, 2-26)
1.0 mL/min (Fig. 2-23, 2-24, 2-27)
Column temp.: 85°C
Detection : RI

* On Fig. 2-21 to 2-27, the numbers indicate degree of polymerization.

Comparison data of authentic malto-oligosaccharides samples

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

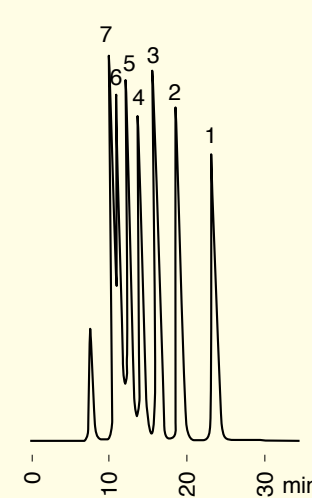


Fig. 2-26 MCI GEL™ CK04SS
10mm I.D.×200mm

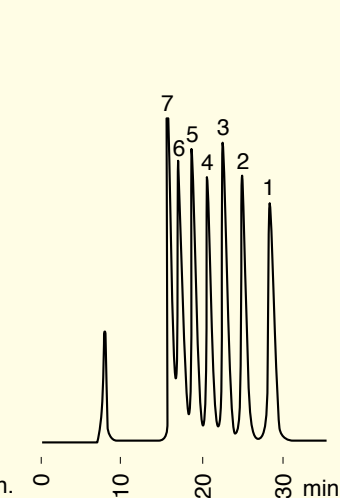
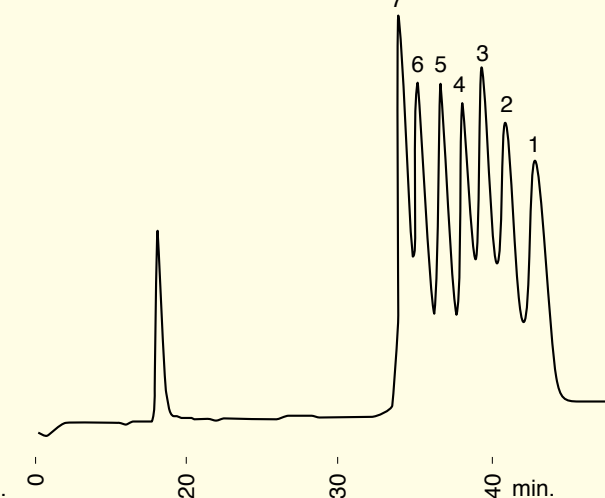


Fig. 2-27 MCI GEL™ CK02AS
20mm I.D.×250mm



Application data of CK04S

Fig. 2-28 Honey

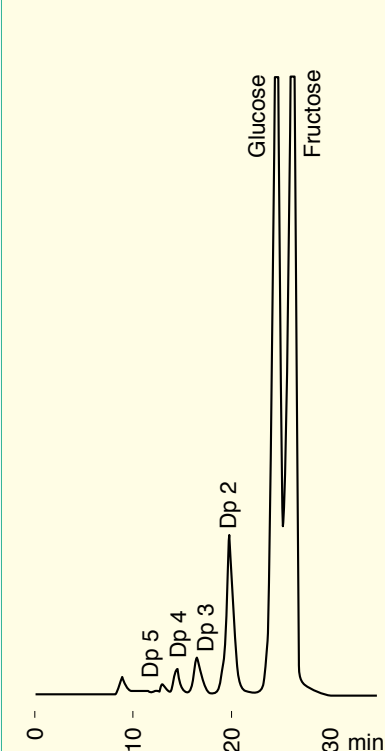


Fig. 2-29 Jam

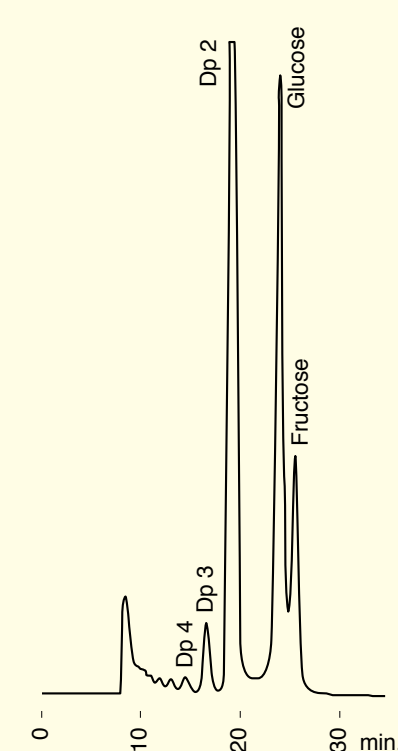
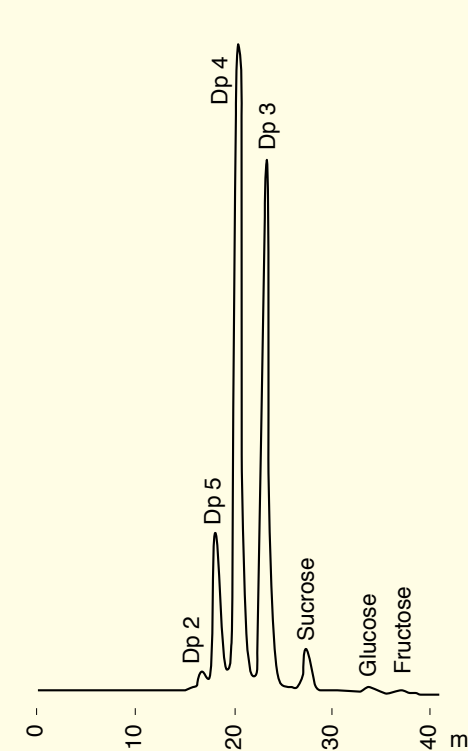


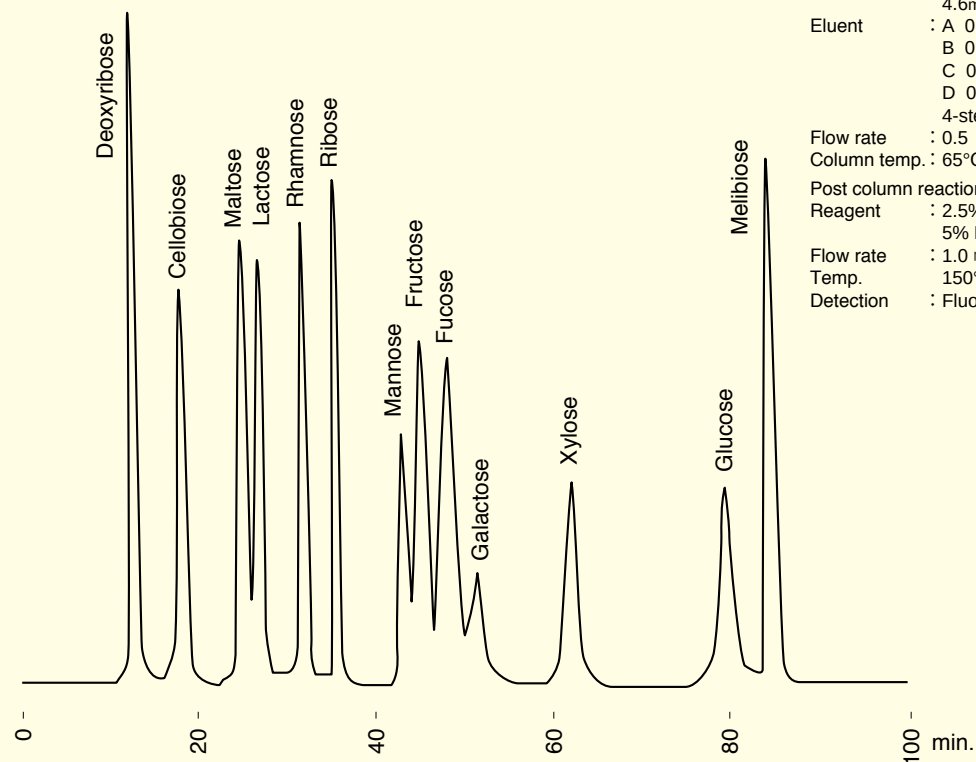
Fig. 2-30 Fructo-oligosaccharides



Conditions
Column : MCI GEL™ CK04S
10mm I.D.×200mm
Eluent : H₂O
Flow rate : 0.4 mL/min (Fig. 2-28, 2-29) 0.3 mL/min (Fig. 2-30)
Column temp.: 85°C (Fig. 2-28, 2-29) 45°C (Fig. 2-30)
Detection : RI

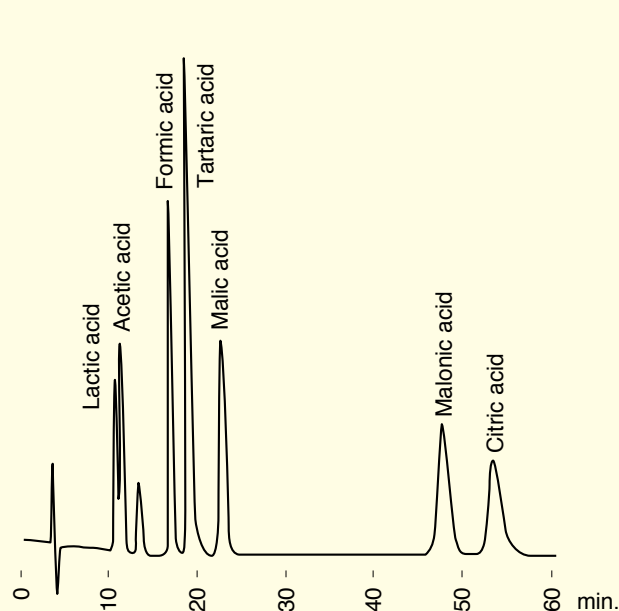
Application data of CA08F

Fig. 2-31 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 : 0.5 ml/min
Column temp.: 65°C
Post column reaction
Reagent : 2.5% Boric acid,
5% Monoethanolamine pH7.9
Flow rate : 1.0 ml/min
Temp. : 150°C
Detection : Fluorescence Ex 360nm, Em 440nm

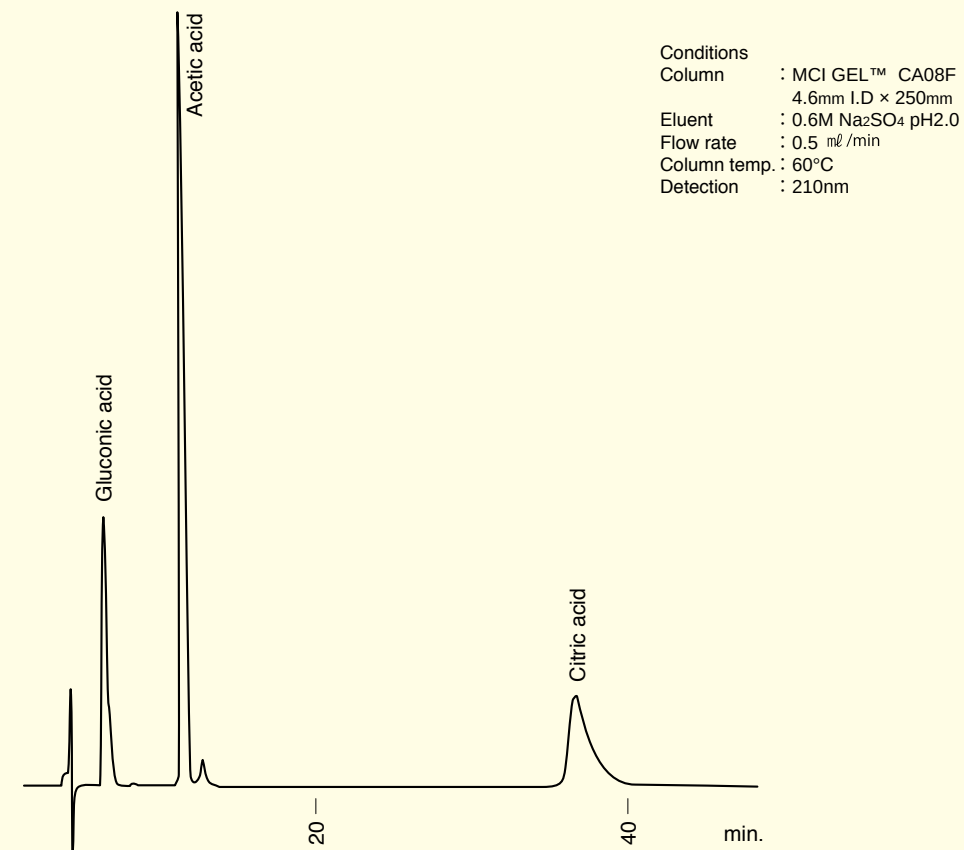
Fig. 2-32 Carboxylic acids



Conditions
Column : MCI GEL™ CA08F
4.6mm I.D.×250mm
Eluent : 0.6M Na₂SO₄ pH3.0
Flow rate : 0.5 ml/min
Column temp.: 60°C
Detection : 210nm

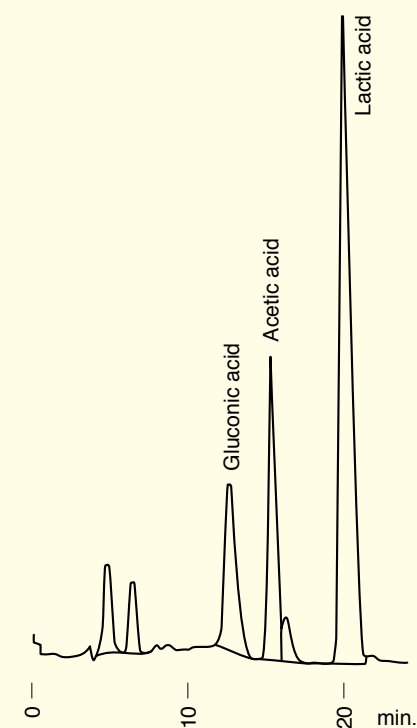
Application data of CA08F

Fig. 2-33 Carboxylic acids



Conditions
Column : MCI GEL™ CA08F
4.6mm I.D. × 250mm
Eluent : 0.6M Na₂SO₄ pH2.0
Flow rate : 0.5 ml/min
Column temp.: 60°C
Detection : 210nm

Fig. 2-34 Carboxylic acids

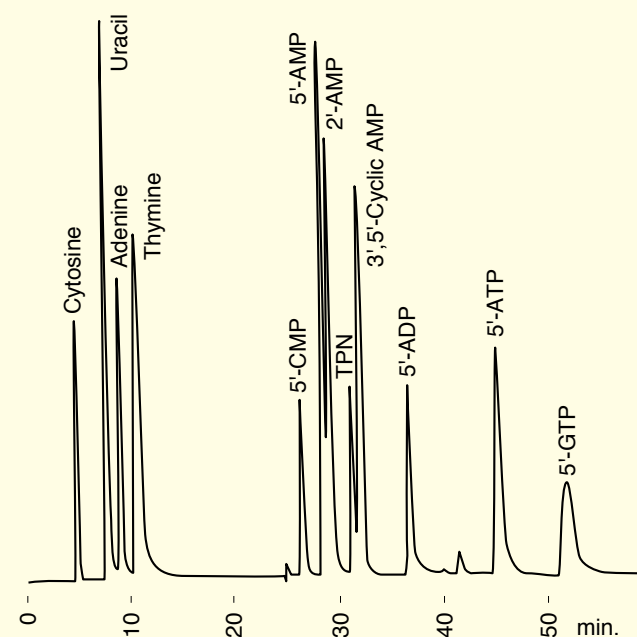


Conditions
Column : MCI GEL™ CA08F
4.6mm I.D. × 250mm
Eluent : 0.1M NaH₂PO₄ pH3.3
Flow rate : 0.4 ml/min
Column temp.: 55°C
Detection : 210nm

Packing material of MCI GEL™ CDR10 column is based on a high porous polystyrene functionalized with a quaternary ammonium anion exchange resin. Since a high porous type ion exchange resin is rigid, CDR10 allows usage of aggressive gradient elution, for example water to 6M of acetate buffer gradient. MCI GEL™ CDR10 is highly recommended for rapid analysis of physiological fluids like urine and blood.

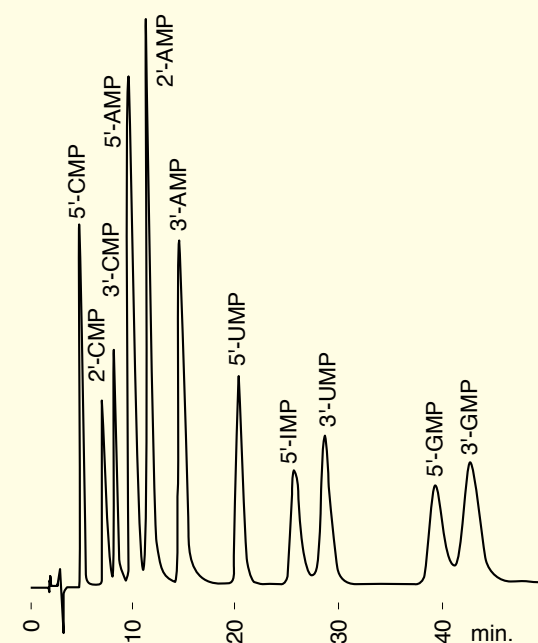
Application data of CDR10

Fig. 2-35 Nucleic acids and related substances



Conditions
Column : MCI GEL™ CDR10
4.6mm I.D.×250mm
Eluent : A H₂O
B 6M Acetate buffer pH4.4
A→B 30min linear gradient
Flow rate : 0.5 mL/min
Column temp. : 60°C
Detection : 254nm

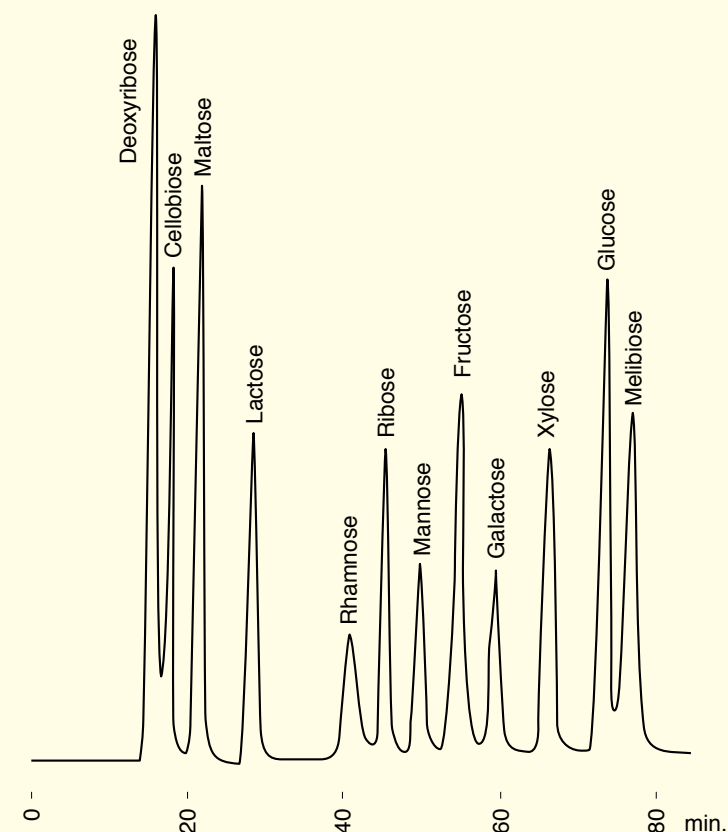
Fig. 2-36 Mono-nucleotides



Conditions
Column : MCI GEL™ CDR10
4.6mm I.D.×250mm
Eluent : 1M Acetate buffer pH3.3
Flow rate : 1.2 mL/min
Column temp. : 60°C
Detection : 254nm

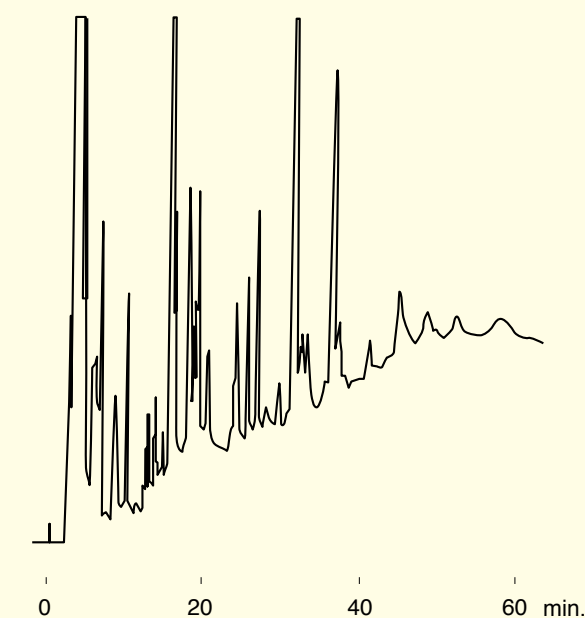
Application data of CDR10

Fig. 2-37 Sugars



Conditions
Column : MCI GEL™ CDR10
4.6mm I.D.×250mm
Eluent : A 0.15M Borate buffer pH7.5
B 0.6M Borate buffer pH9.5
A→B60min linear gradient
Flow rate : 0.5 mL/min
Column temp. : 65°C
Post column reaction
Reagent : 2.5% Boric acid, 5% Monoethanolamine pH7.9
Flow rate : 0.5
Temp. : 150°C
Detection : Fluorescence Ex 360nm, Em 440nm

Fig. 2-38 Human urine



Conditions
Column : MCI GEL™ CDR10
4.6mm I.D.×250mm
Eluent : A 0.006M Acetate buffer pH4.4
B 6M Acetate buffer pH4.4
A→B 60min. linear gradient
Flow rate : 1.0 mL/min
Column temp. : 60°C
Detection : 254nm

- Cation chromatography column
MCI GEL™ SCK01
- 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.

Anion chromatography column MCI GEL™ SCA04

Packing material of MCI GEL™ SCA04 is based on a hydrophilic vinyl 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
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

●Packing materials

Packing materials are available. Please look at P.68.

Application data of SCK01

Fig. 3-1 Monovalent cations

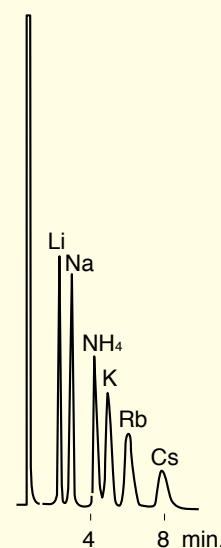


Fig. 3-2 Amines

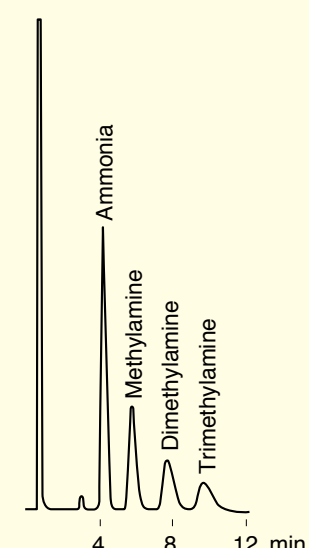


Fig. 3-3 Monovalent cations in rain

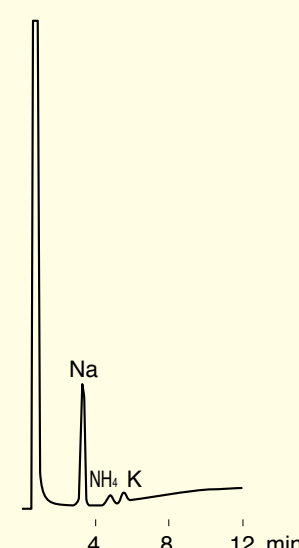


Fig. 3-4 Monovalent cations in tap water

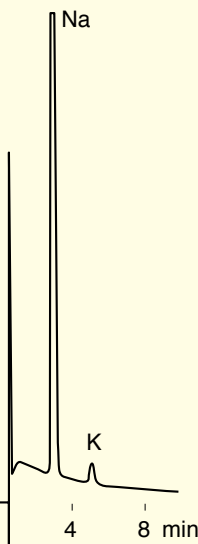


Fig. 3-5 Sports drink

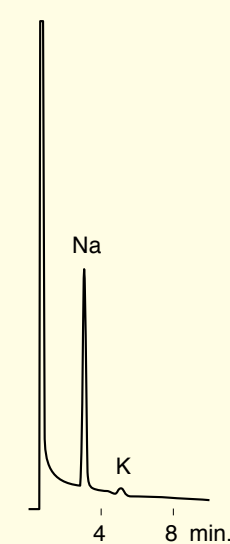
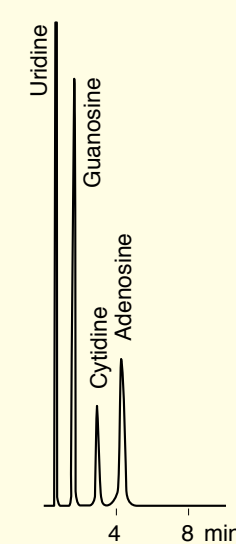


Fig. 3-6 Nucleoside



Conditions
Column : MCI GEL™ SCK01 6mm I.D.×50mm
Eluent : 5mM HNO₃
Flow rate : 1.0 mL/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

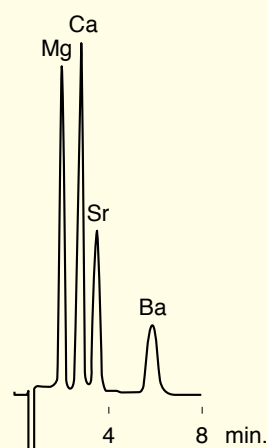


Fig. 3-8 Transition metals

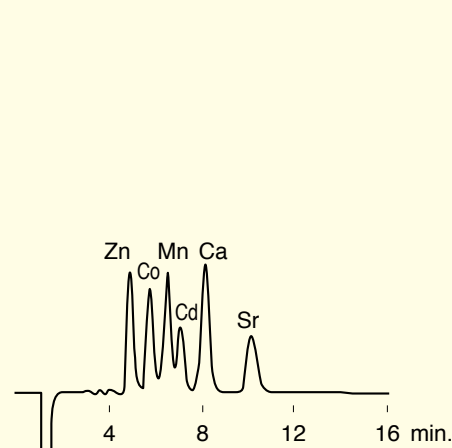


Fig. 3-9 Divalent cations

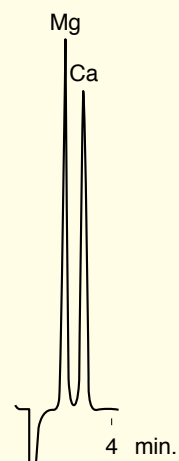


Fig. 3-10 Sports drink A

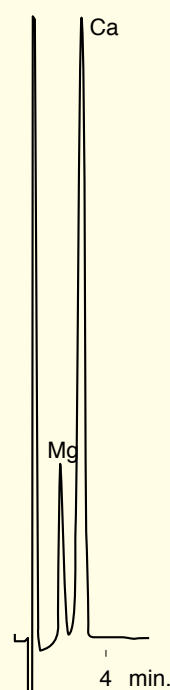
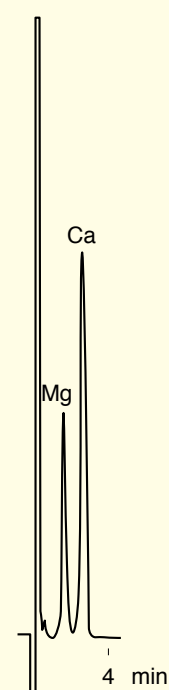


Fig. 3-11 Sports drink B



Conditions
Column : MCI GEL™ SCK01 6mm I.D.×50mm
(On Fig. 3-8, two columns are connected in series)
Eluent : 2mM Tartaric acid, 1.5mM Ethylenediamine (Fig. 3-7, 3-9, 3-10, 3-11)
1.5mM Tartaric acid, 0.8mM Ethylenediamine (Fig. 3-8)
Flow rate : 1.0 mL/min
Column temp. : 40°C
Detection : Conductivity

Application data of SCA04

Fig. 3-12 Standard anions eluent ; VA/MDEA

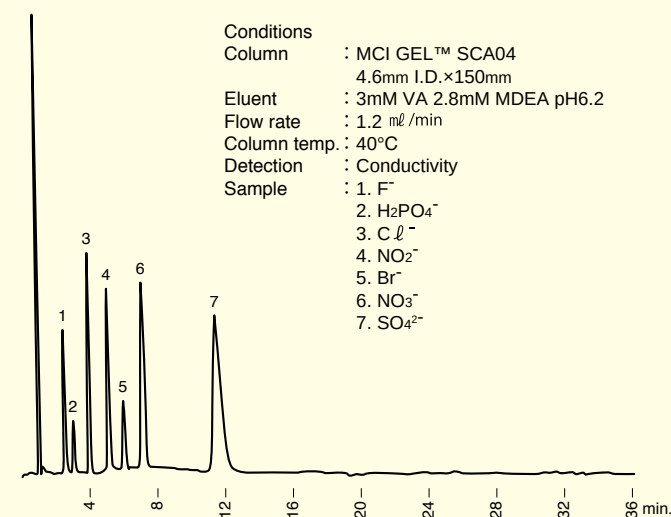


Fig. 3-13 Standard anions eluent ; Potassium hydrogenphthalate

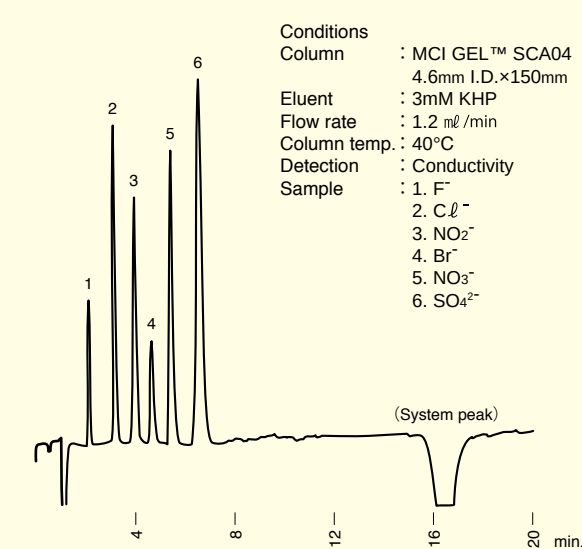
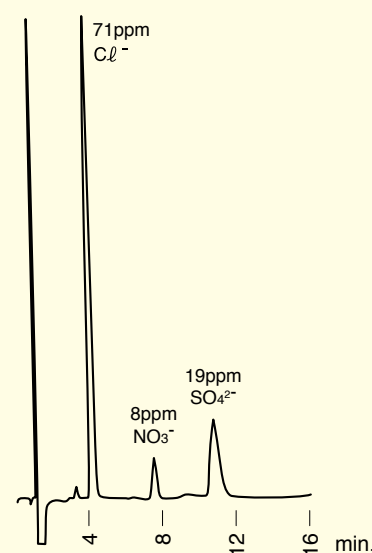
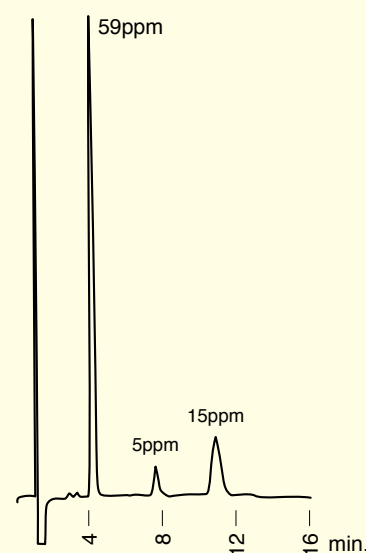


Fig. 3-14 Rain

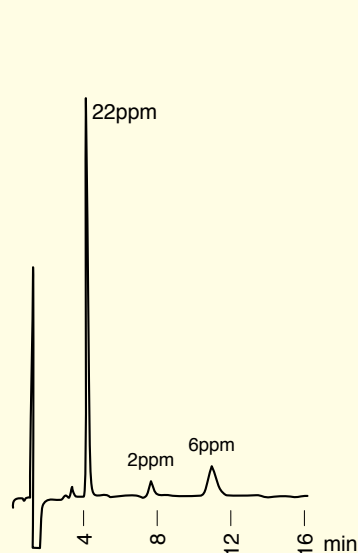
A; Beginning of rain fall



B; After 4 hours



C; After 38 hours



Application data of SCA04

Fig. 3-15 River water

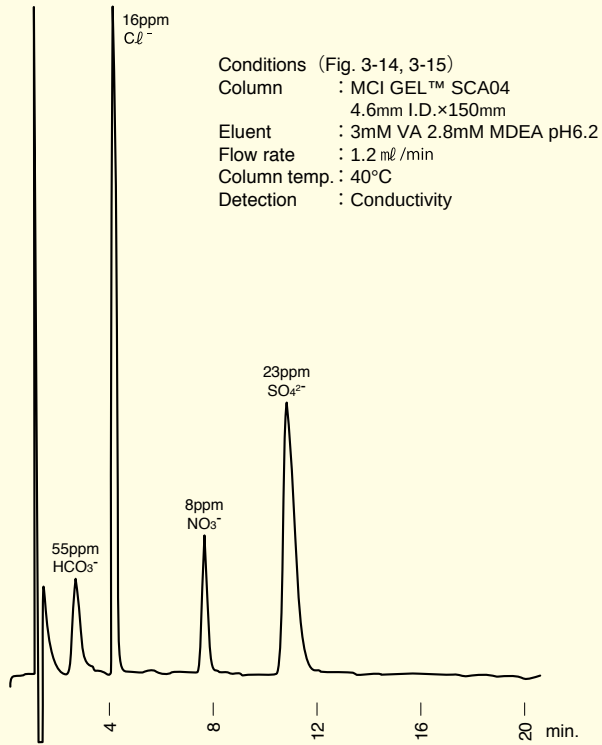


Fig. 3-16 Sulfur compounds

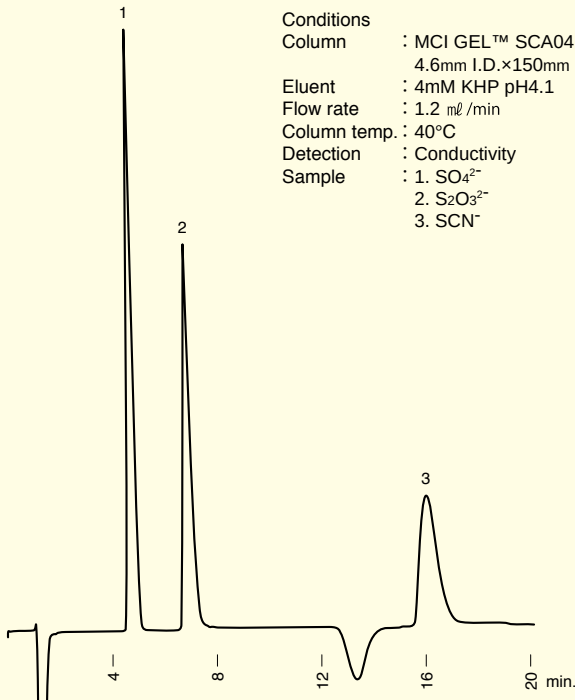
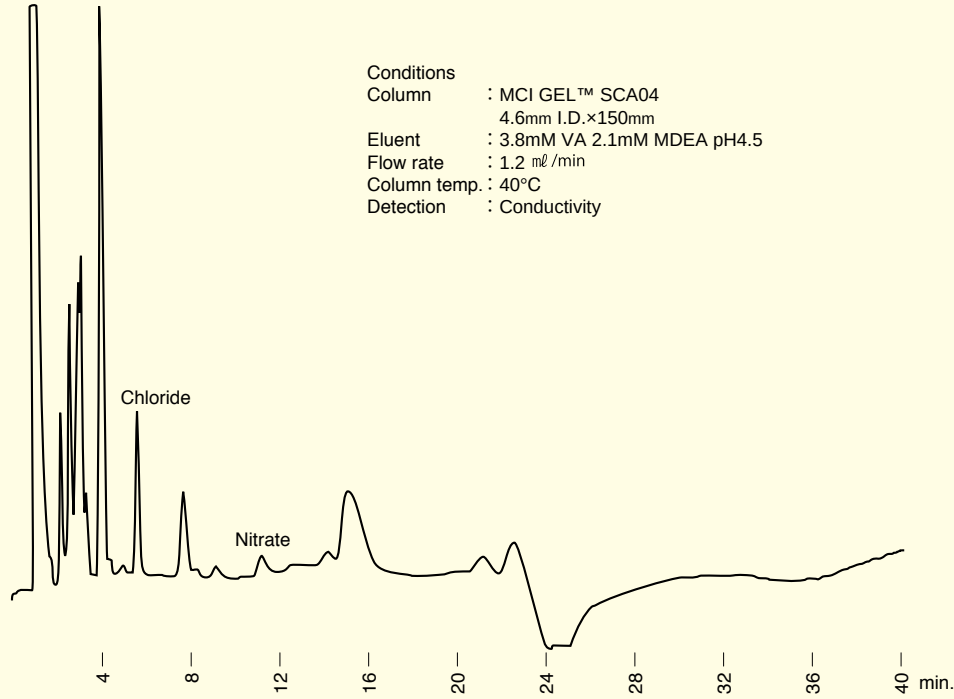


Fig. 3-17 Instant coffee



4 MCI GEL™ Bioseparation columns and materials

- Size exclusion chromatography columns
MCI GEL™ CQP series
- Ion exchange chromatography columns
MCI GEL™ ProtEx series
MCI GEL™ CQA/CQK series
- Hydrophobic interaction chromatography columns
MCI GEL™ CQH 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 for size exclusion chromatography.

For ion exchange chromatography, MCI GEL™ ProtEx series and MCI GEL™ CQA/CQK series are used. MCI GEL™ ProtEx series columns are unique and brilliant packed columns provide excellent separation of proteins, good protein selectivity and high protein recovery. Specifically, proteins of small structural differences (isoforms) can be effectively separated and small amount of proteins (less than several tens μg) can be quantitatively recovered without nonspecific adsorption. From that point of view, the ProtEx columns can be applied in the field of purification of small amount of protein to obtain sample for structural determination and quality control of proteinaceous pharmaceuticals.

MCI GEL™ CQH series are for hydrophobic interaction chromatography.

Column name	USP	Separation mode	Type
MCI GEL™ CQP06	L25	Size exclusion	Exclusion limit MW ~10 ³
MCI GEL™ CQP10	L38	Size exclusion	Exclusion limit MW ~10 ⁴
MCI GEL™ CQP30	L37, L38	Size exclusion	Exclusion limit MW ~10 ⁶
MCI GEL™ ProtEx-DEAE		Anion exchange	DEAE
MCI GEL™ ProtEx-SP		Cation exchange	SP
MCI GEL™ CQA31S	L23	Anion exchange	DEAE
MCI GEL™ CQA35S	L47	Anion exchange	QA
MCI GEL™ CQK30S		Cation exchange	SP
MCI GEL™ CQK31S		Cation exchange	CM
MCI GEL™ CQH3BS		Hydrophobic interaction	Butyl
MCI GEL™ CQH3ES		Hydrophobic interaction	Ether
MCI GEL™ CQH3PS		Hydrophobic interaction	Phenyl

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

●Packing materials

Packing materials are available. Please look at P.68.

Application data of CQP series

Fig. 4-1 Calibration curve

Conditions
Column : MCI GEL™ CQP06
 MCI GEL™ CQP10
 MCI GEL™ CQP30
 7.5mm I.D.×600mm
Eluent : H₂O
Flow rate : 1.0 mL/min
Column temp. : ambient
Detection : RI
Sample : PEG 100μl inj.

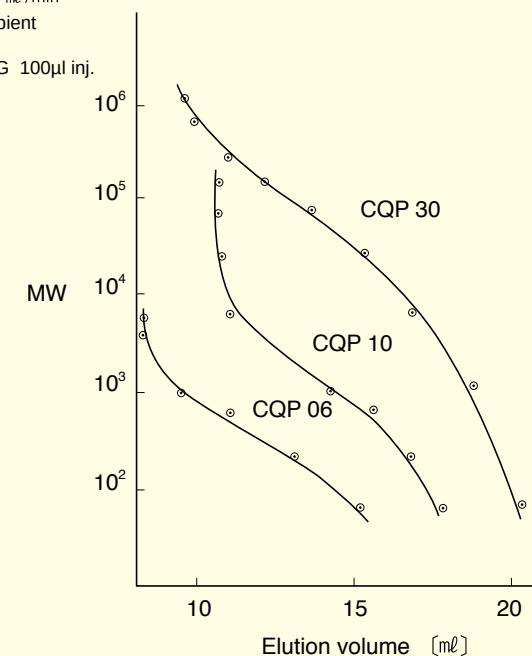


Fig. 4-2 Separation of PEG mixture

Conditions
Column : MCI GEL™ CQP30 7.5mm I.D.×600mm
Eluent : H₂O
Flow rate : 1.0 mL/min
Column temp. : 25°C
Detection : RI
Sample : 1. PEG 145,000
 2. 40,000
 3. 6,000

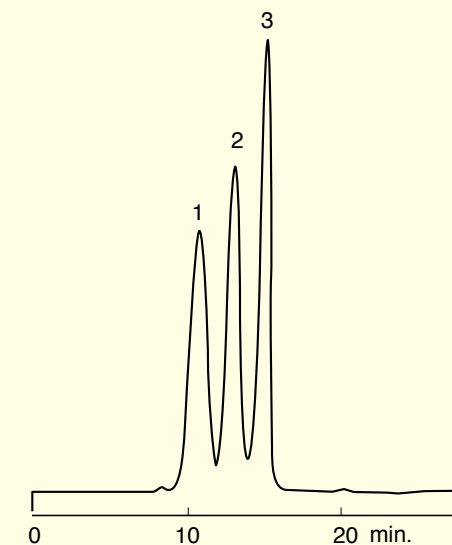


Fig. 4-3 Separation of protein mixture

Conditions
Column : MCI GEL™ CQP30 7.5mm I.D.×600mm
Eluent : 14mM Tris-HClO₄ buffer
Flow rate : 1.0 mL/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Ferritin (MW440,000)
 2. Ovalbumin (MW43,000)
 3. Myoglobin (MW17,500)
 4. Cytochrome c (MW12,400)

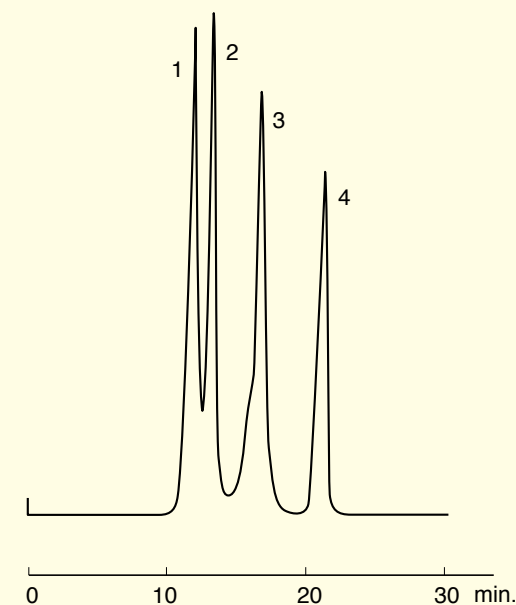
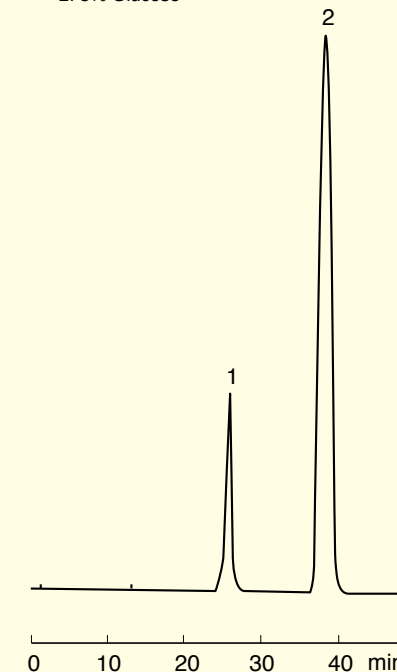


Fig. 4-4 Separation of gluconic acid and glucose

Conditions
Column : MCI GEL™ CQP06 7.5mm I.D.×600mm
Eluent : H₂O
Flow rate : 0.8 mL/min
Column temp. : ambient
Detection : RI
Sample : 1. 5% Gluconic acid
 2. 5% Glucose



ProtEx series

Ion exchange chromatography columns

Separation mechanism and characteristic of ProtEx columns

MCI GEL™ ProtEx series packed columns are for ion exchange chromatography mode which separates sample proteins mainly via ionic interaction between packing material and sample molecules.

The packing materials for ProtEx series columns are based on 5 μm, mono disperse, porous type, methacrylate polymer, are specifically designed for separation of proteins.

On a conventional protein separation column, non-specific adsorption of sample proteins is sometimes occurs resulting in loss of valuable sample. But on the ProtEx columns, non-specific adsorption is eliminated because the surface of the packing material is surrounded by hydrophilic layer is chemically bonded to base material and ion exchange functional group are effectively increased.

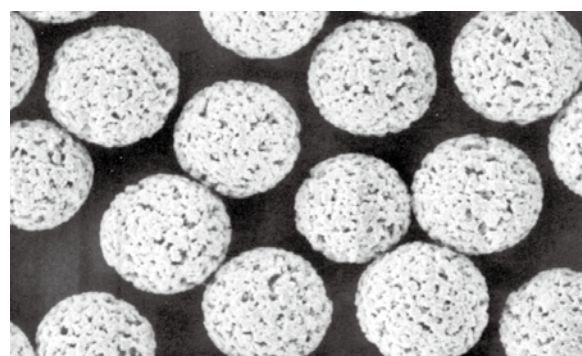
Two types of ion exchange columns, weakly basic diethylaminoethyl (DEAE) type and strongly acidic sulfopropyl (SP) type are available.

Column list

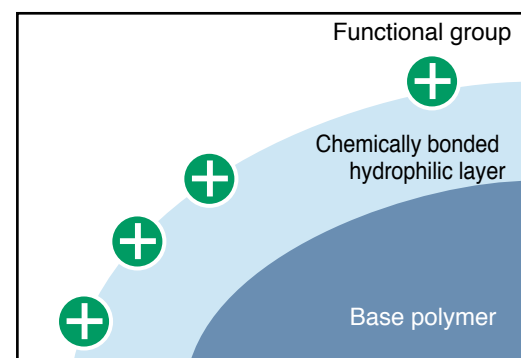
●ProtEx series

Column name	Column dimensions	Column format	Packing material		pH range
			Particle size [μm]	Functional group	
MCI GEL™ ProtEx-DEAE	4.6mm I.D.× 50mm	PEEK	5	Diethylaminoethyl	2~12
MCI GEL™ ProtEx-SP	4.6mm I.D.× 50mm	PEEK	5	Sulfopropyl	1~13

Packing material of ProtEx-DEAE



Scanning electron micrograph



Surface of ProtEx-DEAE

Application data of ProtEx series

Fig. 4-5 Separation of hemoglobin (Hb) isoforms

Conditions
 Column : MCI GEL™ ProtEx-DEAE 4.6mm I.D.×50mm
 Eluent : A 20mM Tris-HCl pH8.0
 B A+0.5M NaCl
 A → 10% B 30min linear gradient
 Flow rate : 0.5 mL/min
 Column temp. : ambient
 Detection : 280nm
 Sample : 1. Hb A₂ 100μg
 2. Hb S 100μg
 3. Hb A₀ 100μg

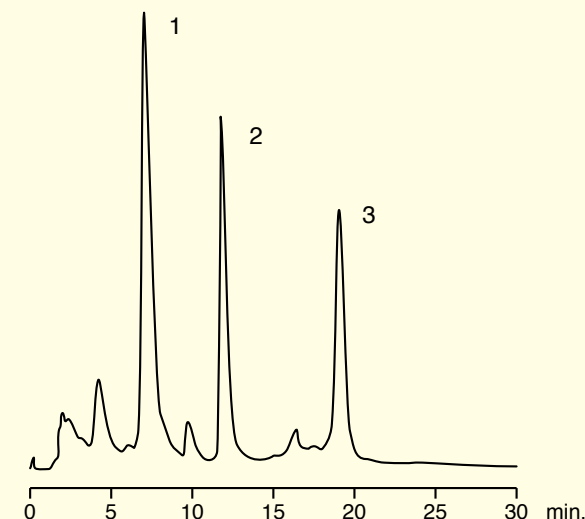


Fig. 4-6 Separation of human growth hormone (hGH)

Conditions
 Column : MCI GEL™ ProtEx-DEAE 4.6mm I.D.×50mm
 Eluent : A 20mM Tris-HCl pH8.0
 B A+0.5M NaCl
 5% B → 70% B 30min linear gradient
 Flow rate : 0.5 mL/min
 Column temp. : ambient
 Detection : 280nm
 Sample : recombinant hGH 10μg

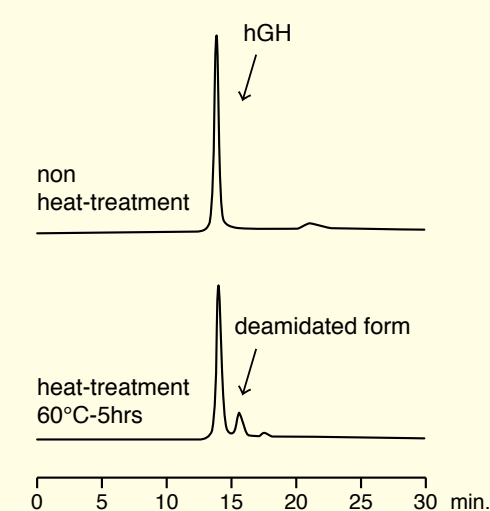


Fig. 4-7 Protein recovery

Conditions
 Column : MCI GEL™ ProtEx-DEAE 4.6mm I.D.×50mm
 Eluent : A 20mM Tris-HCl pH8.15
 B A+0.5M NaCl
 A → 50% B 30min linear gradient
 Flow rate : 0.5 mL/min
 Column temp. : ambient
 Detection : 280nm
 Sample : recombinant epidermal growth factor (EGF)

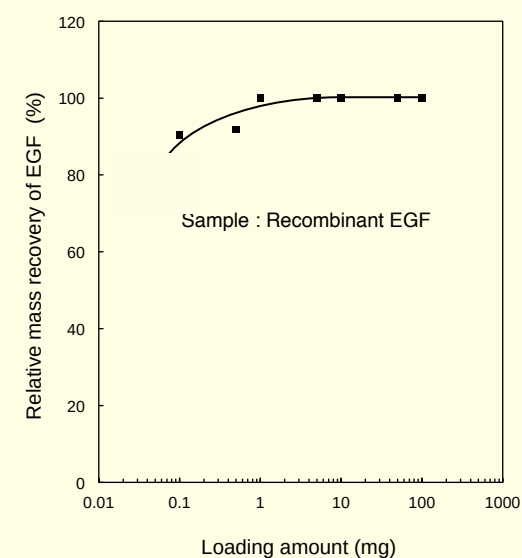
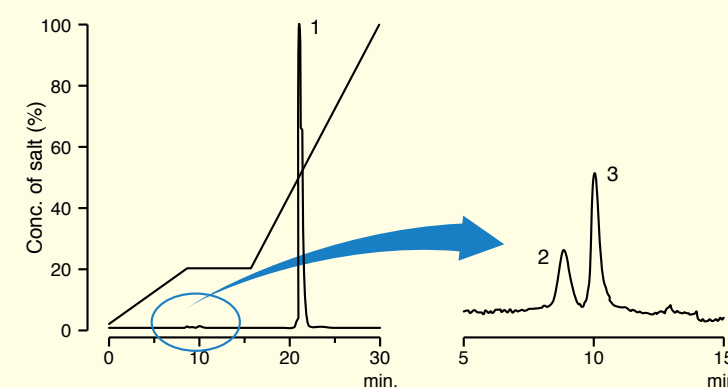


Fig. 4-8 Separation of interleukin 2 (IL-2) coexisting large amount of bovine serum albumin (BSA) as a stabilizer

Conditions
 Column : MCI GEL™ ProtEx-DEAE 4.6mm I.D.×50mm
 Eluent : A 20mM Trimethylenediamine-HCl pH9.75
 B A+0.5M NaCl
 Flow rate : 0.5 mL/min
 Column temp. : ambient
 Detection : 280nm
 Sample : recombinant IL-2 1.5μg
 1. BSA (stabilizer) 400μg
 2. IL-2 (Met-ox)
 3. IL-2



Application data of ProtEx series

Fig. 4-9 Separation of RNA

Conditions
Column : MCI GEL™ ProtEx-DEAE 4.6mm I.D.×50mm
Eluent : A 20mM Phosphate buffer pH7.0
 B A+0.5M NaCl
 A100% → B60% in 5min. B60% → B85% in 45min
Flow rate : 0.5 ml/min
Column temp.: 25°C
Detection : 280nm
Sample : RNA type III from bakers yeast 20μg

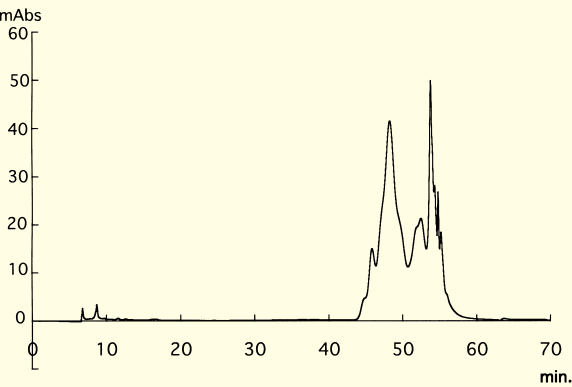


Fig. 4-10 Separation of IgG2b, K(mouse)

Conditions
Column : MCI GEL™ ProtEx-DEAE 4.6mm I.D.×50mm
Eluent : A 20mM HEPES buffer pH7.6
 B A+0.5M NaCl
 A100% → B45% in 30min. B45% for 5min
 B45% → B100% in 5min. B100% for 10min
Flow rate : 0.5 ml/min
Column temp.: 25°C
Detection : 280nm
Sample : IgG2b, K(mouse) 10μg

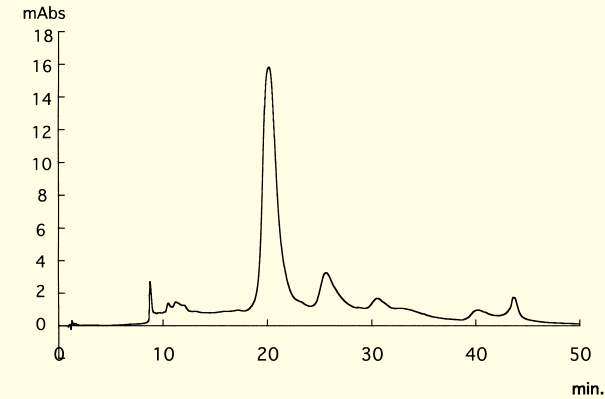


Fig. 4-11 Separation of IgG1 MOPC21 (mouse)

Conditions
Column : MCI GEL™ ProtEx-DEAE 4.6mm I.D.×50mm
Eluent : A 10mM HEPES buffer pH8.0
 B A+0.5M NaCl
 A100% → B100% in 30min. linear gradient
Flow rate : 0.5 ml/min
Column temp.: 25°C
Detection : 280nm
Sample : IgG1 MOPC21 (mouse) 10μg

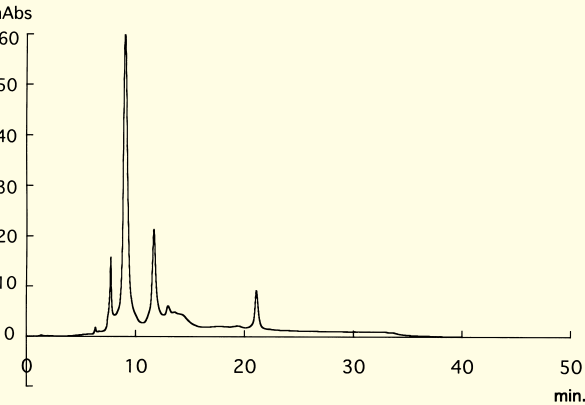
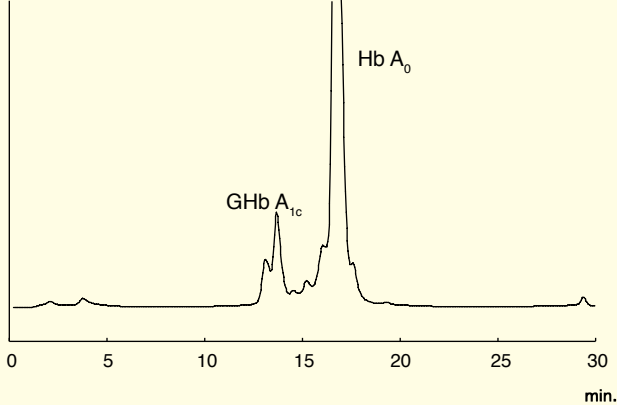


Fig. 4-12 Glycohemoglobin

Conditions
Column : MCI GEL™ ProtEx SP, 7.5mm I.D.×75mmL
Eluent : A:20mM Bis-Tris-HCl pH6.0
 B:0.5M NaCl
Gradient : 7%→40% B over 20min
Flow rate : 0.5 ml/min
Column temp.: ambient
Detection : UV 415nm
Sample : Glycohemoglobin
Injection : 5μg



4 MCI GEL™

CQA series
CQK series

Ion exchange chromatography columns

CQA and CQK series packed columns are for ion exchange chromatography mode which separates sample proteins mainly via ionic interaction between packing material and sample molecules.
Four types of ion exchange columns, strongly basic quaternary ammonium (QA), weakly basic diethylaminoethyl (DEAE), strongly acidic sulfopropyl (SP) and weakly acidic carboxymethyl (CM) are available.

Column list

●CQA series, CQK series

Column name	Column dimensions	Packing material		pH range	USP
		Particle size [μm]	Functional group		
MCI GEL™ CQA31S	7.5mm I.D.×75mm	10	DEAE	2~12	L32
MCI GEL™ CQA35S	7.5mm I.D.×75mm	10	QA	2~12	L47
MCI GEL™ CQK30S	7.5mm I.D.×75mm	10	SP	1~13	
MCI GEL™ CQK31S	7.5mm I.D.×75mm	10	CM	4~13	

●Packing materials

Packing materials are available. Please look at P.69.

Application data of CQA and CQK series

Fig. 4-13 Separation of protein mixture

Conditions
Column : MCI GEL™ CQA31S 7.5mm I.D.×75mm
 MCI GEL™ CQA35S 7.5mm I.D.×75mm
Eluent : A 14mM Tris-HCl buffer pH8.2
 B A+0.5M NaCl
 A → B 30min linear gradient
Flow rate : 1.0 ml/min
Column temp.: ambient
Detection : 280nm
Sample : 1. Myoglobin 60μg
 2. Ovalbumin 200μg
 3. Trypsin Inhibitor 200μg

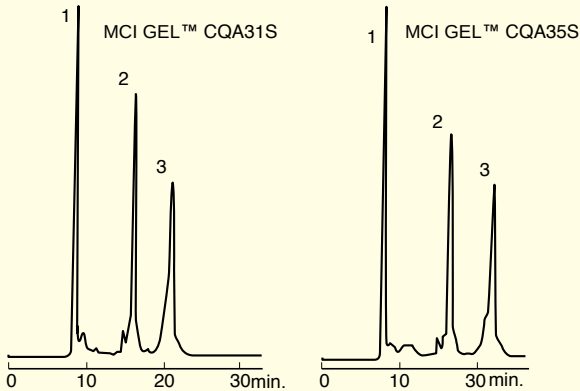
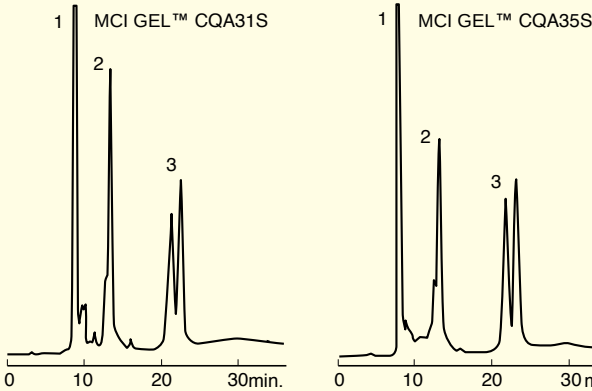


Fig. 4-14 Separation of protein mixture

Conditions
Column : MCI GEL™ CQA31S 7.5mm I.D.×75mm
 MCI GEL™ CQA35S 7.5mm I.D.×75mm
Eluent : A 14mM Tris-HCl buffer pH8.2
 B A+0.5M NaCl
 A → B 30min linear gradient
Flow rate : 1.0 ml/min
Column temp.: ambient
Detection : 280nm
Sample : 1. Myoglobin 120μg
 2. Transferrin 160μg
 3. β-Lactoglobulin 400μg



Application data of CQA and CQK series

Fig. 4-15 Separation of protein mixture

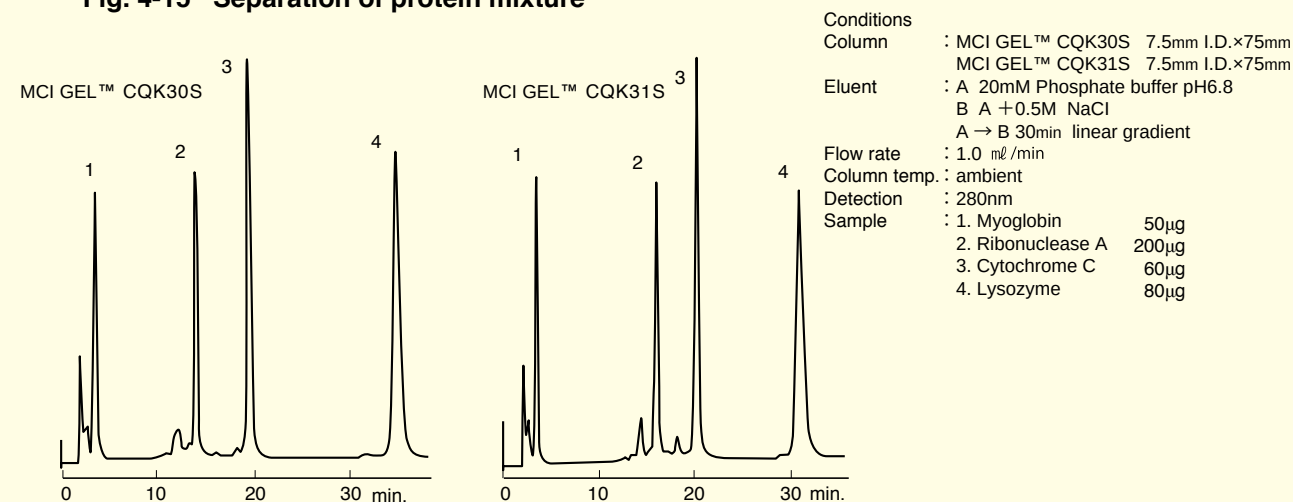


Fig. 4-16 Separation of protein mixture

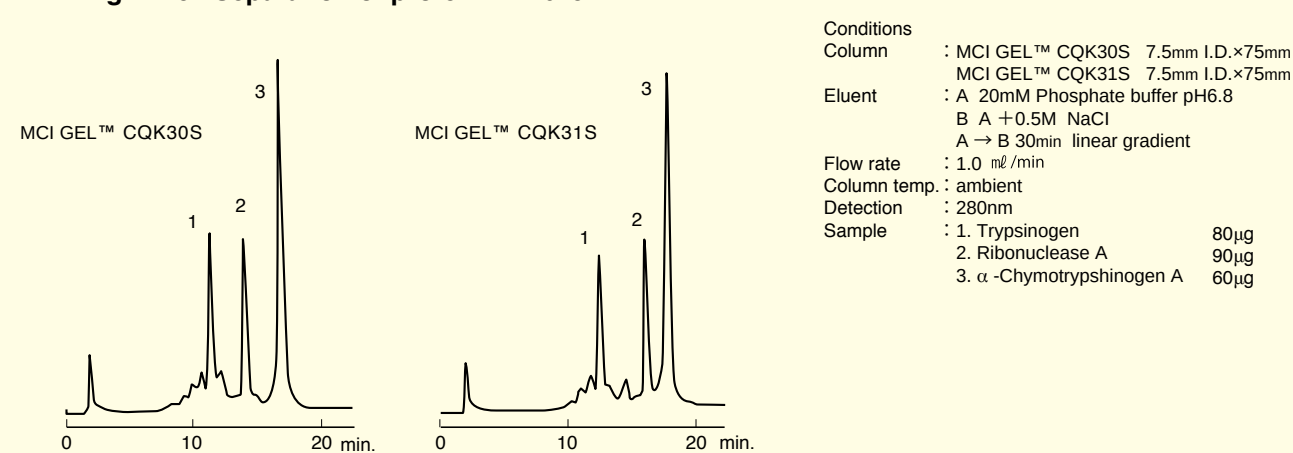
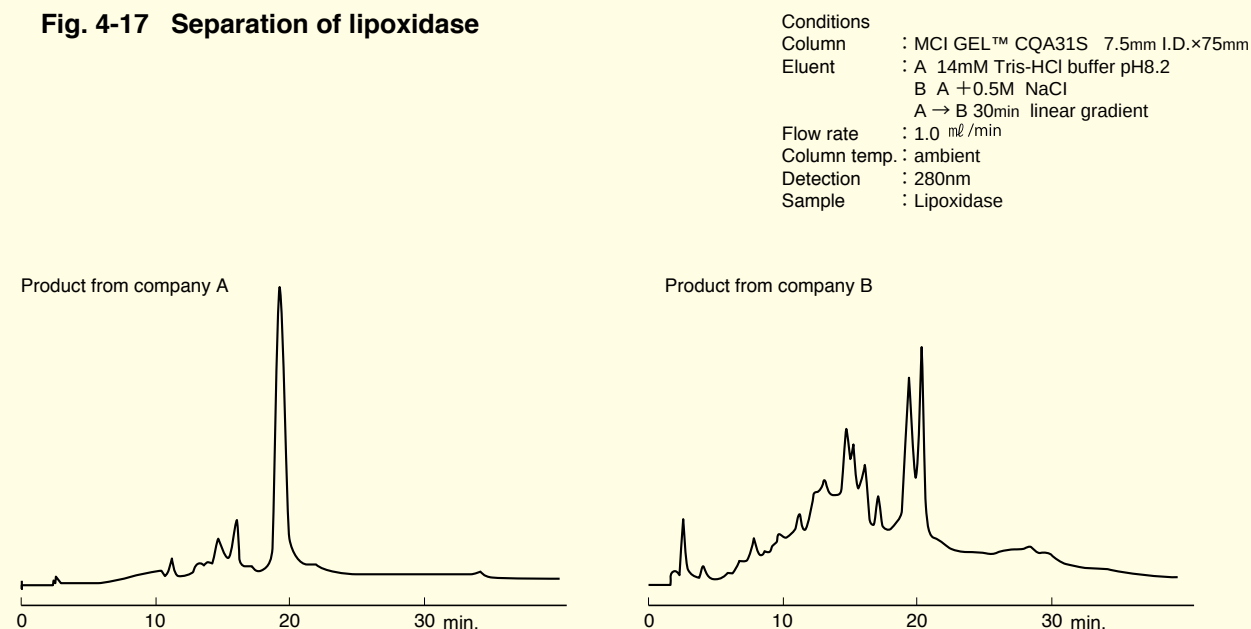


Fig. 4-17 Separation of lipoxidase



4 MCI GEL™

CQH series

Hydrophobic interaction chromatography columns

MCI GEL™ CQH series packed columns are for hydrophobic chromatography mode. Functional groups of the packing materials are butyl, phenyl and ether.

The relative hydrophobicity of the CQH series columns decrease in the following order. CQH3PS > CQH3BS > CQH3ES.

Chromatography column and material list

●CQH_S series

MCI GEL™ CQH_S series are for analytical chromatography columns and materials for separating biomolecules in the basis of difference of their hydrophobic properties. Average particle size is 10 μm.

<Column list>

Column name	Column dimensions	Particle size [μm]	Functional group
MCI GEL™ CQH3BS	7.5mm I.D.×75mm	10	Butyl
MCI GEL™ CQH3ES	7.5mm I.D.×75mm	10	Ether
MCI GEL™ CQH3PS	7.5mm I.D.×75mm	10	Phenyl

<Packing material list>

Material name	Particle size [μm]	Functional group
MCI GEL™ CQH3BS	10	Butyl
MCI GEL™ CQH3ES	10	Ether
MCI GEL™ CQH3PS	10	Phenyl

●CQH_P series

MCI GEL™ CQH3BP and CQH3PP are for preparative chromatography materials for separating biomolecules in the basis of difference of their hydrophobic properties. Average particle size is 30 μm.

The relative hydrophobicity of the CQH_P series columns decrease in the following order.

CQH3PP > CQH3BP.

The chromatographic characteristics of CQH_S series and CQH_P series are same, so experimental results of separating conditions of CQH_S series can be applied to CQH_P series.

<Packing material list>

Material name	Particle size [μm]	Functional group
MCI GEL™ CQH3BP	30	Butyl
MCI GEL™ CQH3PP	30	Phenyl

Application data of CQH series

Fig. 4-18 Separation of human serum

Conditions
 Column : MCI GEL™ CQH3ES 7.5mm I.D.×75mm
 MCI GEL™ CQH3PS 7.5mm I.D.×75mm
 Eluent : A B+1.7M(NH₄)₂SO₄
 B 0.1M Phosphate buffer pH6.8
 A → B 60min linear gradient
 Flow rate : 1 ml/min
 Column temp.: ambient
 Detection : 280nm
 Sample : Human serum

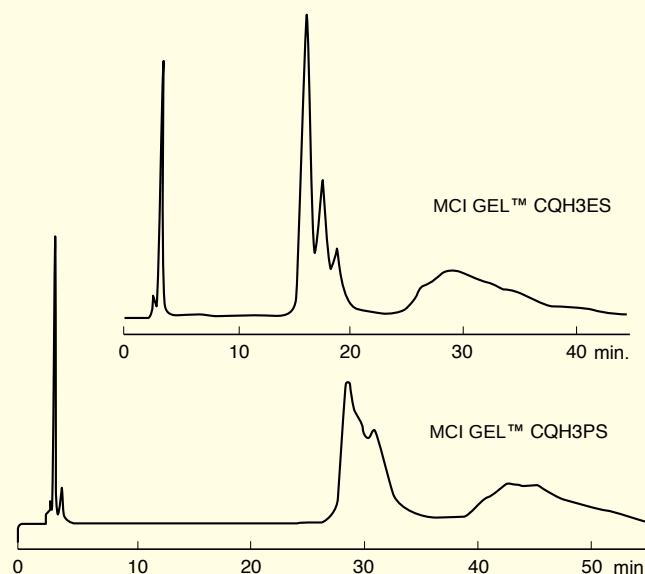


Fig. 4-19 Separation of colibacillus extract

Conditions
 Column : MCI GEL™ CQH3ES 7.5mm I.D.×75mm
 Eluent : A B+1.7M(NH₄)₂SO₄
 B 0.1M Phosphate buffer pH6.8
 A → B 30min linear gradient
 Flow rate : 1.0 ml/min
 Column temp.: ambient
 Detection : 280nm
 Sample : Colibacillus extract

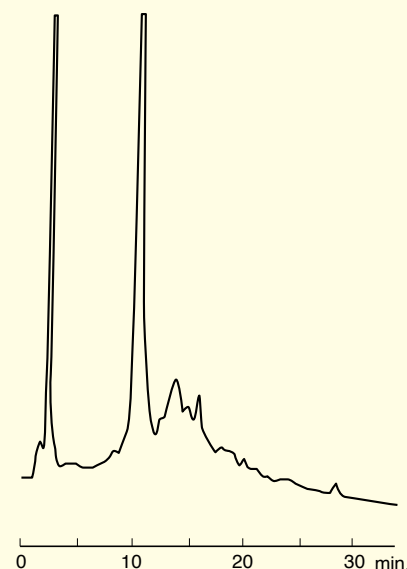


Fig. 4-20 Separation of colibacillus extract

Conditions
 Column : MCI GEL™ CQH3PS 7.5mm I.D.×75mm
 Eluent : A B+1.7M(NH₄)₂SO₄
 B 0.1M Phosphate buffer pH6.8
 A → B 30min linear gradient
 Flow rate : 1.0 ml/min
 Column temp.: ambient
 Detection : 280nm
 Sample : Colibacillus extract

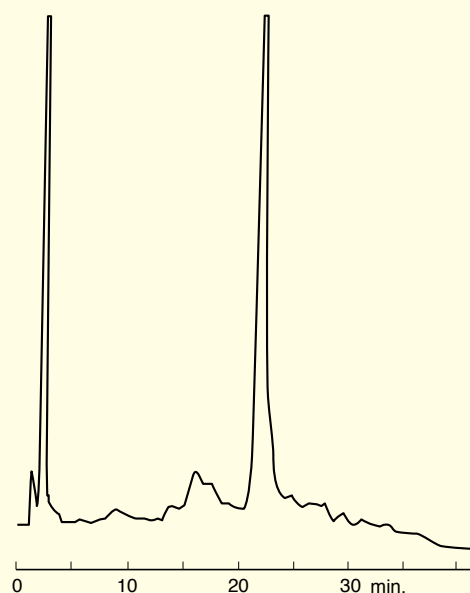
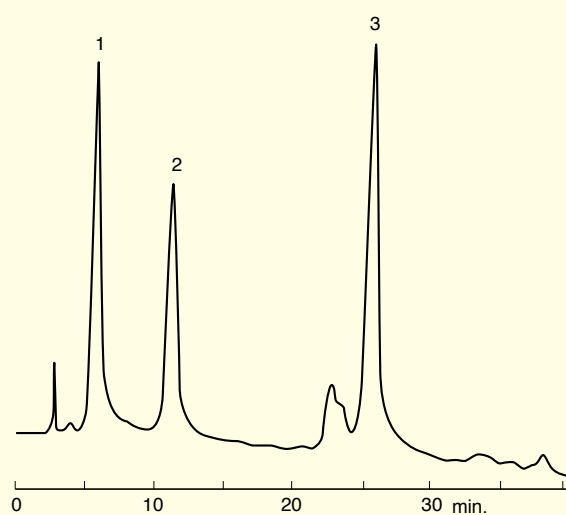


Fig. 4-21 Separation of mixture of peptides

Conditions
 Column : MCI GEL™ CQH3PS 7.5mm I.D.×75mm
 Eluent : A B+1.7M(NH₄)₂SO₄
 B 0.1M Phosphate buffer pH6.8
 A → B 30min linear gradient
 Flow rate : 1.0 ml/min
 Column temp.: ambient
 Detection : 220nm
 Sample : 1. Met-Leu-Tyr
 2. Leu-Enkephalin
 3. Bacitracin



Application data of CQH series

Fig. 4-22 Proteins

Conditions
 Column : MCI GEL™ CQH3BS, 7.5mm I.D.×75mmL
 MCI GEL™ CQH3BP, 7.5mm I.D.×75mmL
 Eluent : A : B+1.7M (NH₄)₂SO₄
 B : 0.1M Phosphate buffer (pH6.8)
 Gradient : A → B, 30min, linear
 Flow rate : 1.0 ml/min
 Column temp.: 25°C
 Detection : 280nm,
 Sample : 1. Ribonuclease A 112μg
 2. Transferrin 154μg
 3. α-Chymotrypsinogen A 60μg

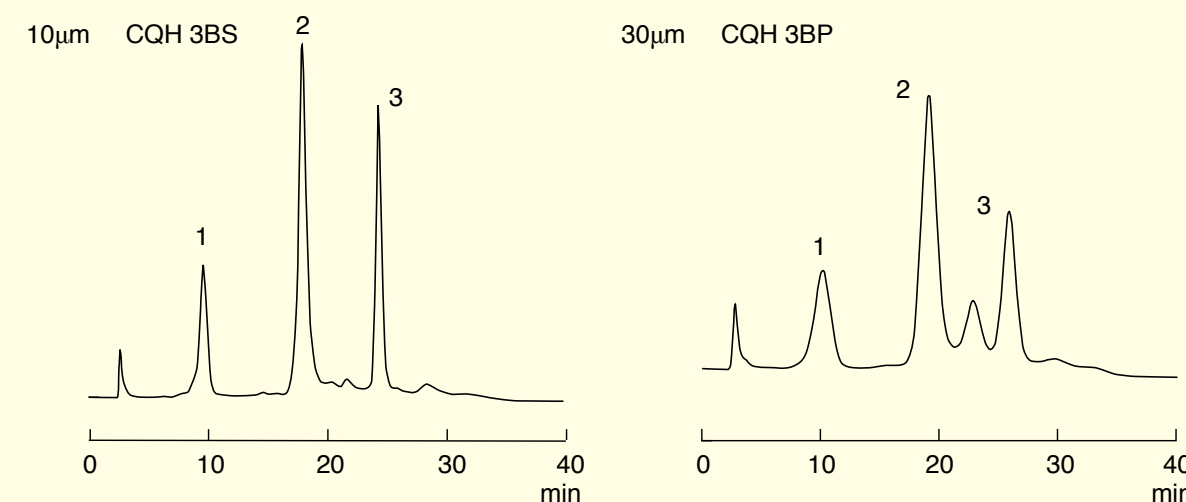
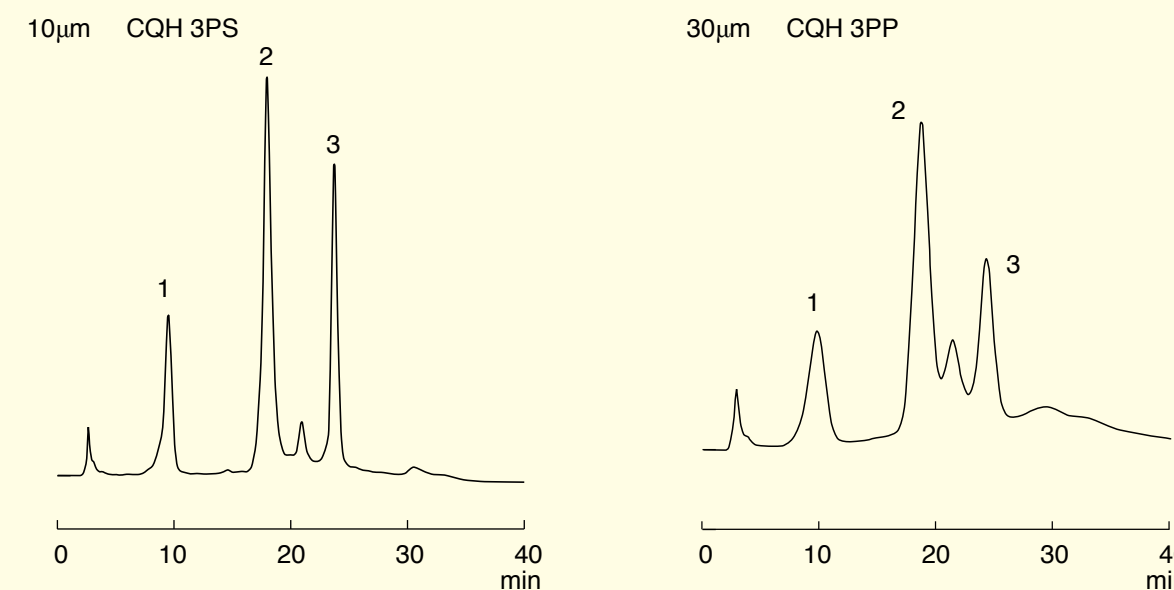


Fig. 4-23 Proteins

Conditions
 Column : MCI GEL™ CQH3PS, 7.5mm I.D.×75mmL
 MCI GEL™ CQH3PP, 7.5mm I.D.×75mmL
 Eluent : A : B+1.7M (NH₄)₂SO₄
 B : 0.1M Phosphate buffer (pH6.8)
 Gradient : A → B, 30min, linear
 Flow rate : 1.0 ml/min
 Column temp.: 25°C
 Detection : 280nm,
 Sample : 1. Ribonuclease A 112μg
 2. Transferrin 154μg
 3. α-Chymotrypsinogen A 60μg



Analytical and preparative chromatography columns and materials for pharmaceutical applications

○Polymeric reversed-phase chromatography columns and materials MCI GEL™ CHP series

Polymeric reversed-phase separation mechanism of CHP series

A partition chromatography, an adsorption chromatography, an ion exchange chromatography and a size exclusion chromatography are typical separation mechanisms of high performance liquid chromatography. The partition chromatography is most commonly used, separates solute samples in accordance with the difference of partition of the samples between a stationary phase and a mobile phase, can be applied to broad range of applications of organic compounds such as pharmaceuticals, agricultural chemicals and those intermediate substances. There are two separation mechanisms in the partition chromatography, one is a normal phase and the other is a reversed phase are discriminated by comparison of polarity of stationary phase and mobile phase. On the normal phase chromatography, a polarity of the stationary phase is stronger than that of the mobile phase. As for the reversed-phase (RP) mode, the relationship of the polarities of the two phases reverses. The RP chromatography is the most popular separation mode is said that RP occupies 60-70 % of HPLC applications.

MCI GEL™ specializes in polymer based packing materials. The use of polymeric based RP columns has become more widespread thanks to unique selectivity of the polymer matrix, no specific adsorption common with silica based packings and can be operated with a wide pH range, basic eluents and acidic eluents due to the chemical stability of the inert polymeric materials. The MCI GEL™ reversed-phase columns are based on a polystyrenic and polymethacrylate porous polymers are normally applied to the separation of aromatic and aliphatic based compounds in the isocratic and gradient elution modes. The applications include pharmaceuticals, steroids, small peptides, amphoteric molecules such as sulfonamides and cephalosporin antibiotics, plus basic drugs, simple amines, antihistamines and carbamate pesticides.

The MCI GEL™ reversed-phase packing materials are based on the same chemistries offered in the Diaion™ and Sepabeads™ synthetic adsorbents 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 industrial reversed phase separations. The MCI GEL™ reversed-phase packing materials are available as packed columns for analytical applications and as bulk packings for analytical, preparative and production chromatography applications.

●Description of reversed-phase chromatography columns and materials

MCI GEL™ CHP20/C04

Matrix type _____ Particle size _____

{ C=Column
P=Material

CHP column series Polymeric reversed-phase chromatography columns

MCI GEL™ CHP series are suitable for reversed-phase chromatography and there are four kind of columns of various hydrophobicity; Porous polystyrene, Modified porous polystyrene, Polymethacrylates and Modified porous polymethacrylates. Thus proper kind of columns can be selected in accordance with 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
Polymethacrylates packing : MCI GEL™ CMG20/C10
Modified polymethacrylate packing : MCI GEL™ CHPOD/C04

The hydrophobicities of the columns are in the following orders:

MCI GEL™ CHP07/C04=CHP07/C10 > CHP20/C04=CHP20/C10 > CHPOD/C04 ≥ ODS columns ≥ CMG20/C04=CMG20/C10
Polymer columns for HPLC, with superior chemical resistance, can be applied with various mobile phases of broad pH range, acidic through alkaline. They have the following advantages due to their high hydrophobicity:

- 1) In the reversed phase distribution chromatography to separate acidic or alkaline compounds, the eluents suppressing the ionic properties of such compounds are generally used. Polymer columns can be applied for the unsuitable compounds to ODS columns.
- 2) Some of high hydrophilic compounds, e.g. amino acids, can be separated with strong hydrophobic CHP07/C04 and CHP07/C10 column.
- 3) Polymer columns can be washed with acidic and/or basic solutions when deteriorated by contamination.

Polymethacrylates, CMG20/C04 and CMG20/C10, can be applied not only for reversed phase distribution chromatography but also for normal phase one.

Modified polystyrene packing CHK40/C04 is mix-mode type; both hydrophobic and hydrophilic interaction occur between packing material surface and analytes. It is useful for the compounds that is difficult to separate existing ODS column or polymeric column. This column is also used in normal phase mode and show unique separation profile. All polymeric column have superior stability and yield comparing ODS column which have remaining silanol group.

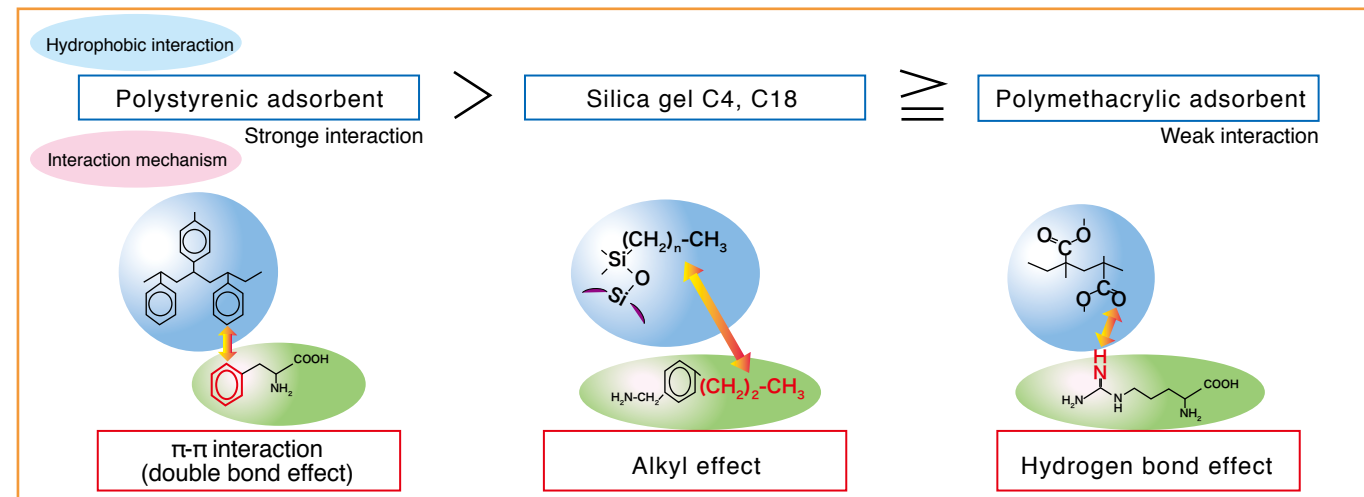
Column list

●CHP column series

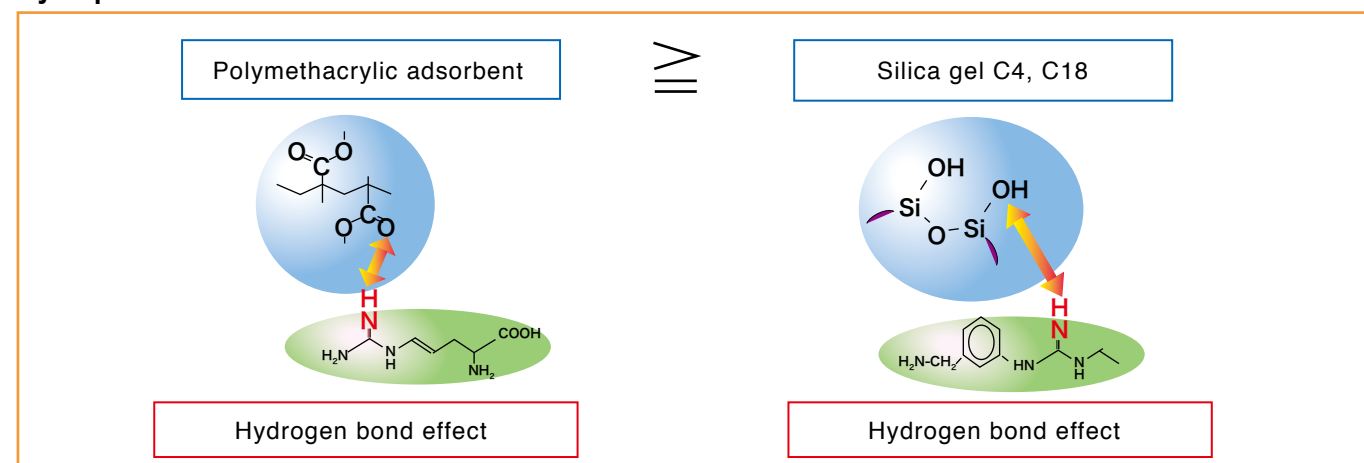
Matrix Type	Functional group	Product name	Particle size [μm]	Column size [mm I.D.×mm]	pH range	USP
Styrene Divinylbenzene	None	CHP20/C04	4	4.6×150 20×150	Full range	L21
		CHP20/C10	10	4.6×250 10×250 20×150 20×250		
	Br	CHP07/C04	4	4.6×150 20×200		
		CHP07/C10	10	4.6×250 10×150 20×150 20×250		
	Cation exchange group	CHK40/C04	4	4.6×150		
Methacrylates	None	CMG20/C04	4	4.6×150 20×150	2~12	
		CMG20/C10	10	4.6×250 10×250 20×150 20×250		
	C18	CHPOD/C04	4	4.6×150 20×200		

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

Retentiveness in reverse phase mode



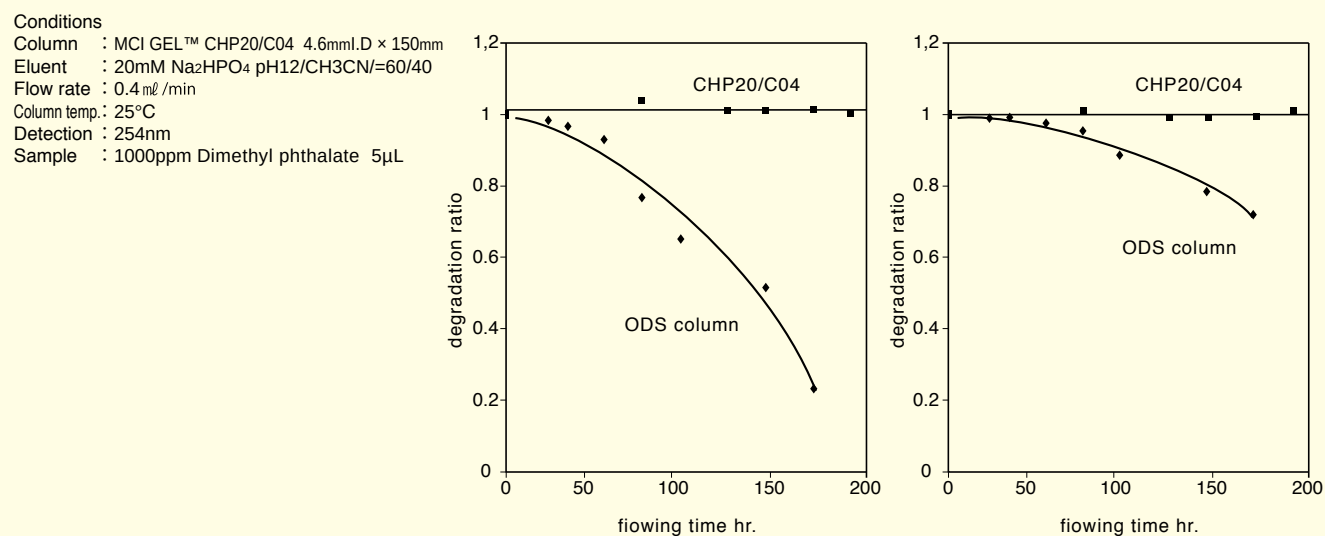
Hydrophobic interaction Interaction mechanism



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



Application data of CHP series

Fig. 5-2 Separation of catecholamines

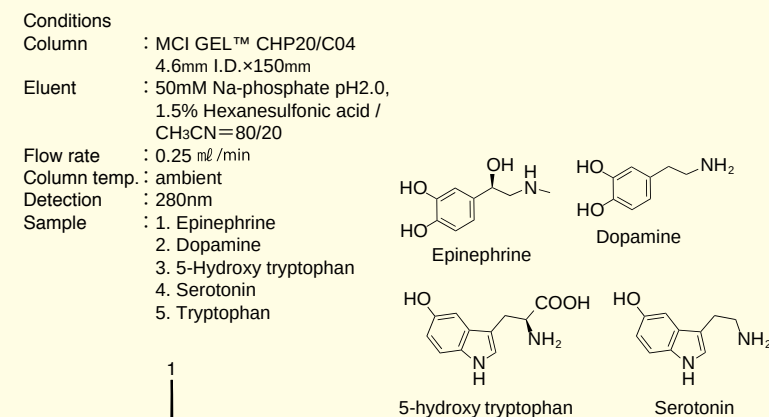


Fig. 5-3 Separation of phthalic acid esters

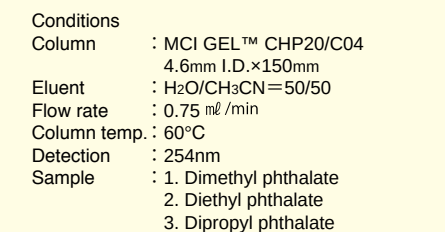


Fig. 5-4 Purine alkaloids

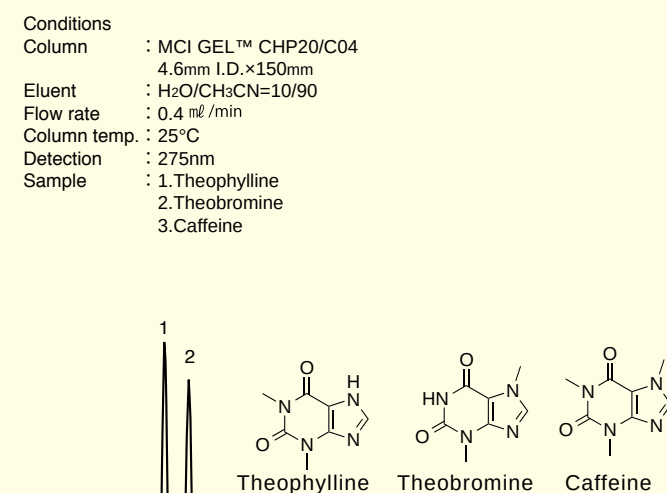
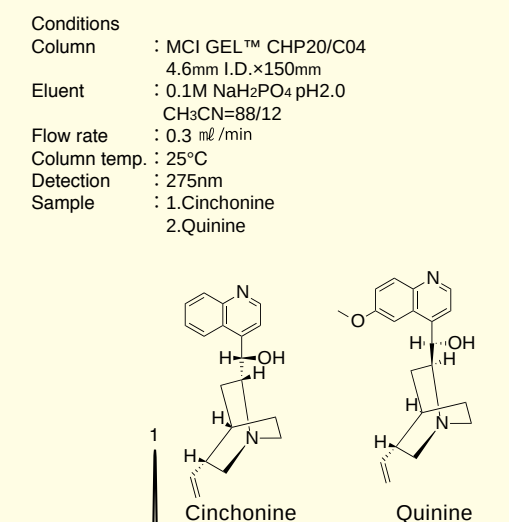
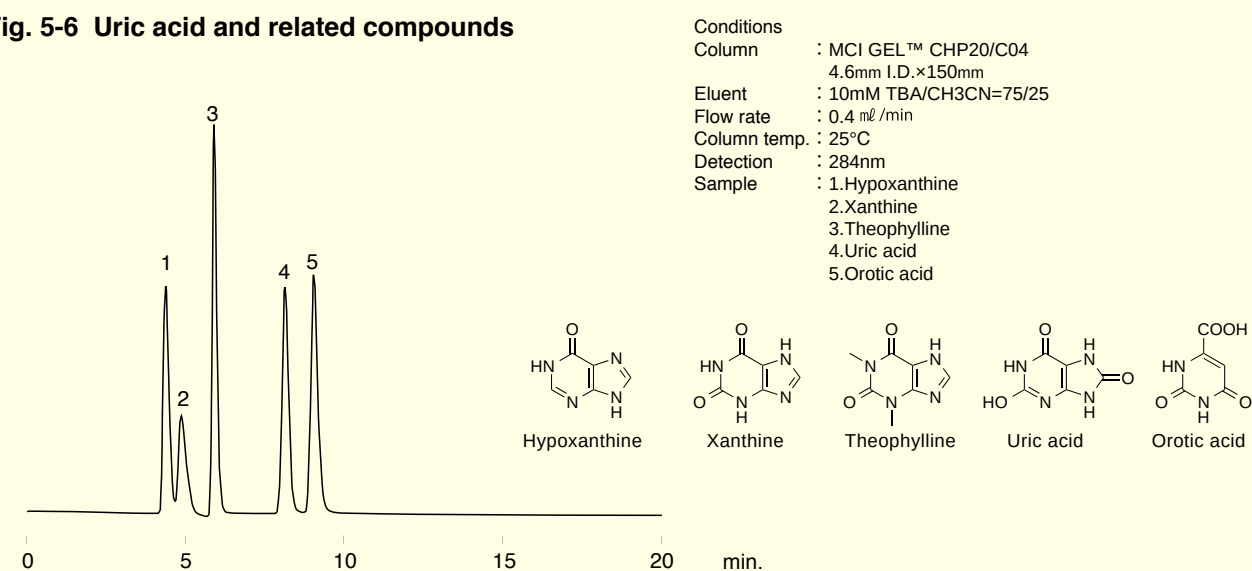


Fig. 5-5 Cinchona alkaloids



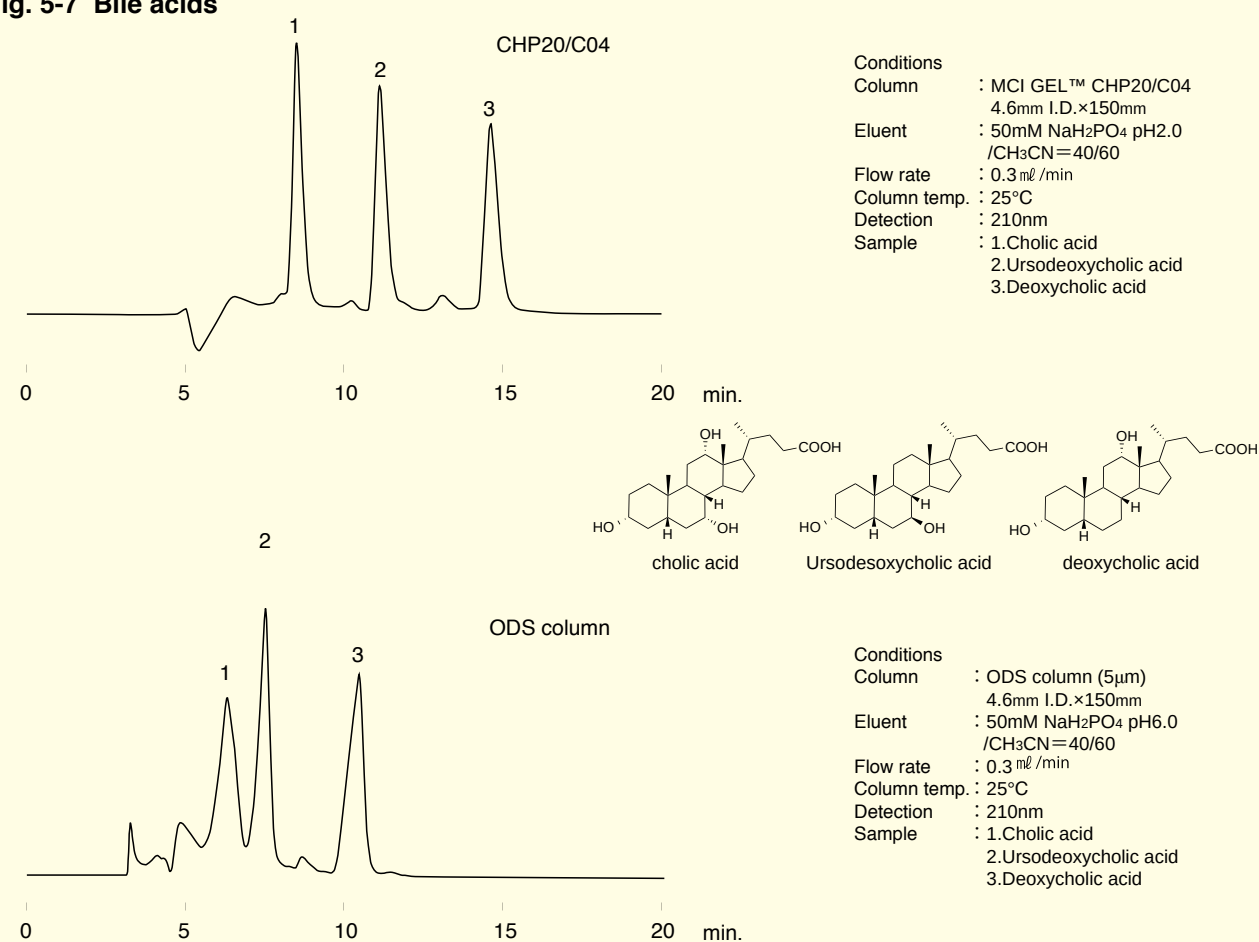
Application data of CHP series

Fig. 5-6 Uric acid and related compounds



Comparison with an ODS column

Fig. 5-7 Bile acids



Application data of CHP series

Fig. 5-8 Glycyrrhizae radix

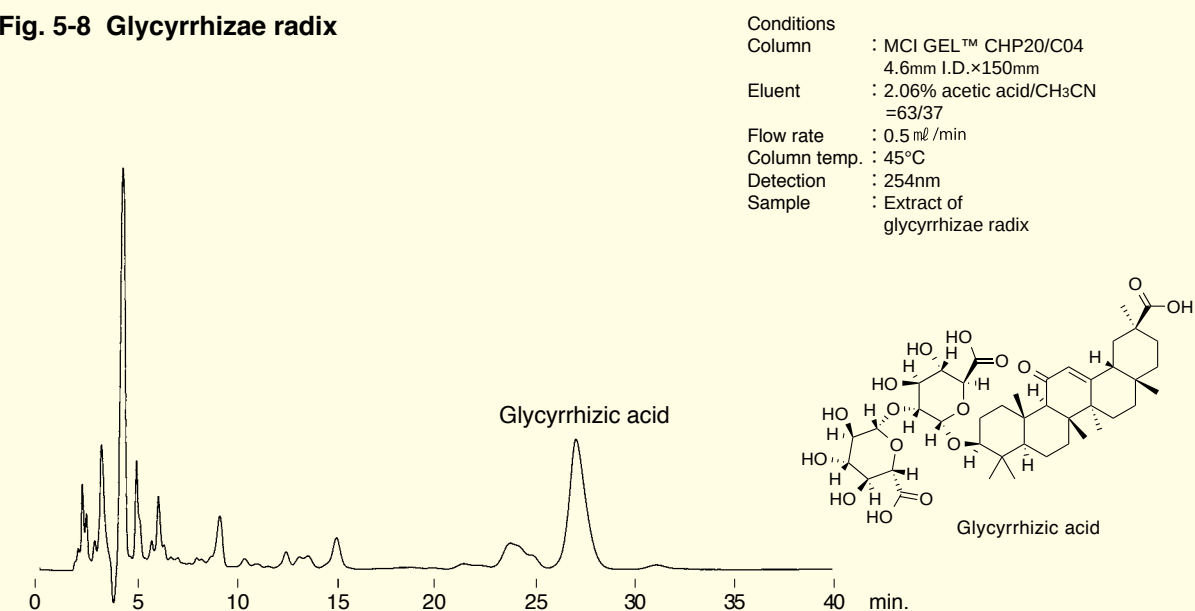
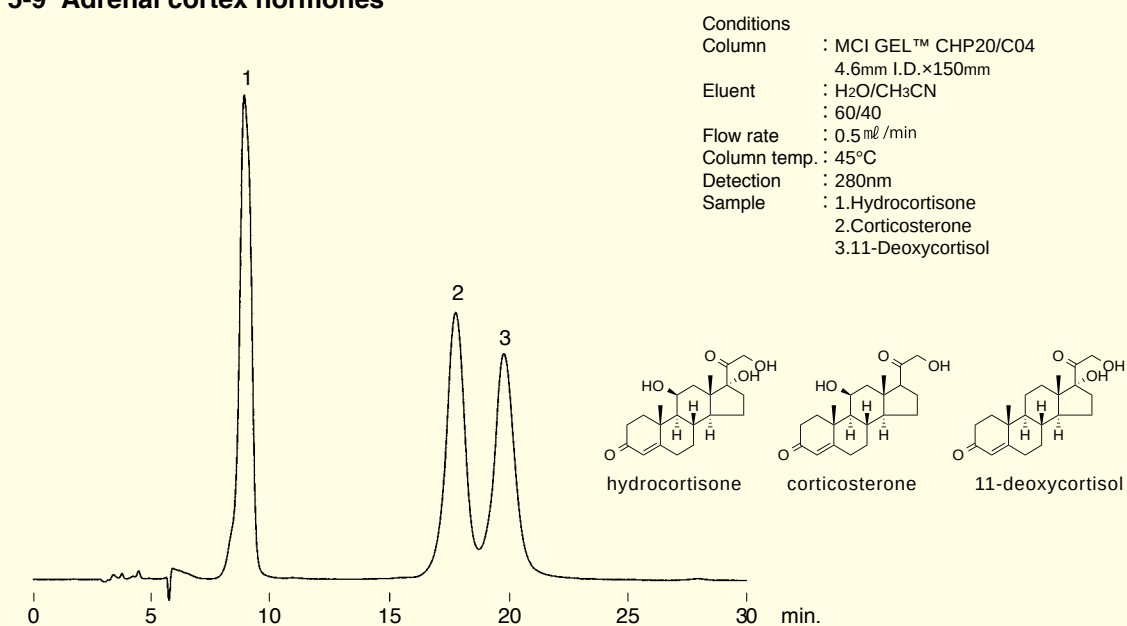
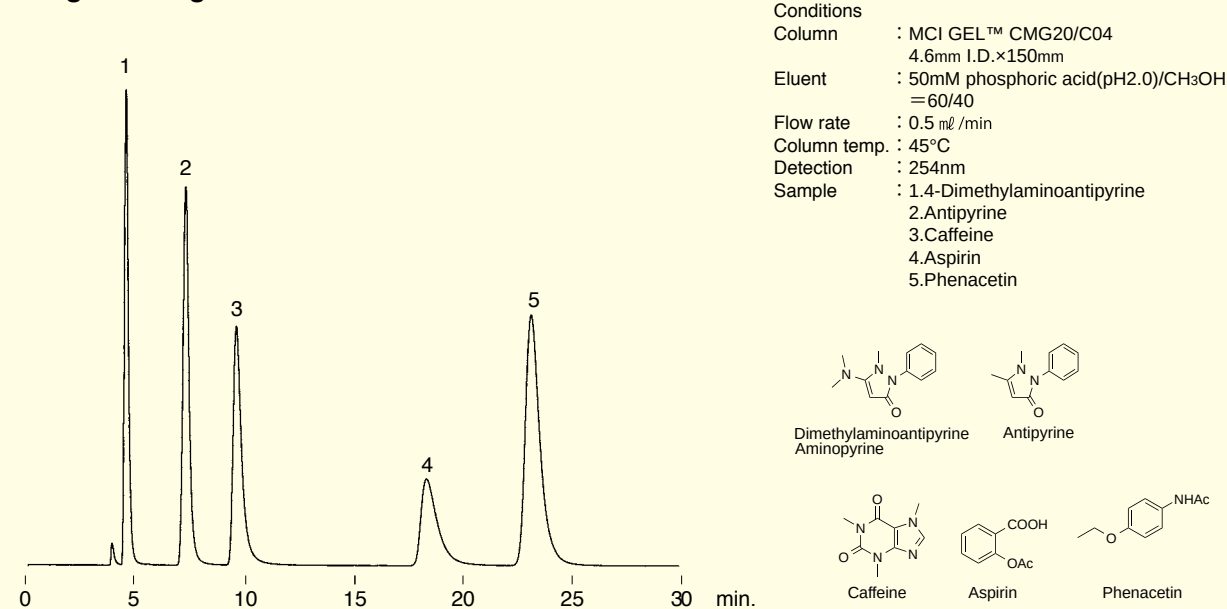


Fig. 5-9 Adrenal cortex hormones



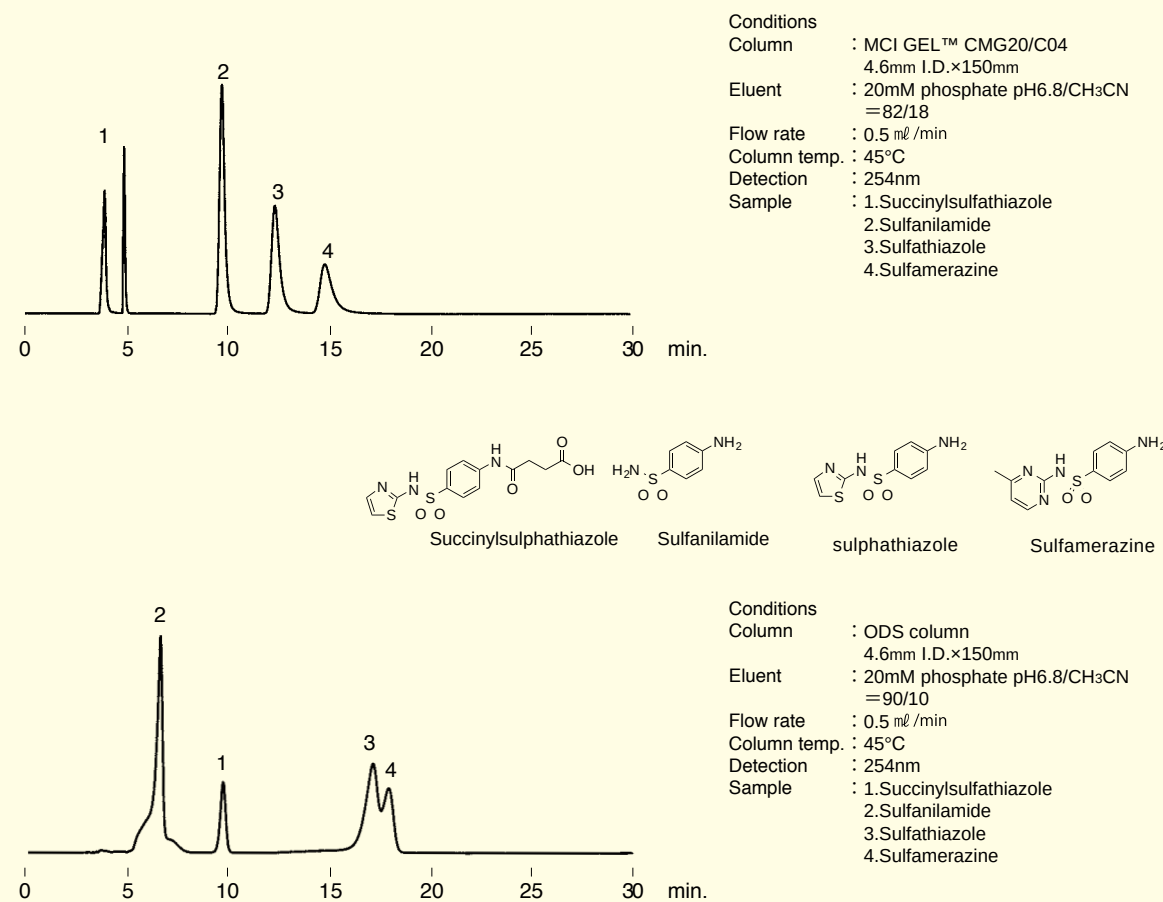
Application data of CHP series

Fig. 5-10 Ingredients of medicine



Comparison with an ODS column

Fig. 5-11 Sulfa drugs



Application data of CHP series

Fig. 5-12 Peptides

Conditions
Column : MCI GEL™ CMG20/C04
4.6mm I.D.×150mm
Eluent : 0.1%TFA/CH₃CN
=70/30
Flow rate : 0.5 mL/min
Column temp. : 25°C
Detection : 220nm
Sample : 1.Gly-Tyr
2.Met Enkephalin
3.Leu Enkephalin
4.Angiotensin II

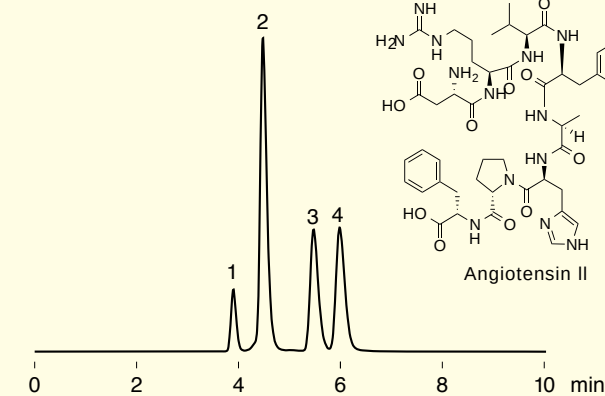
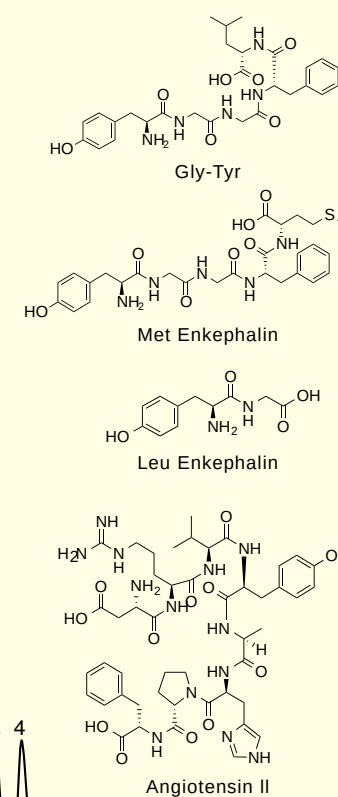


Fig. 5-13 Proteins

Conditions
Column : MCI GEL™ CMG20/C04
4.6mm I.D.×150mm
Eluent : A;0.05%TFA/CH₃CN
=80/20
B;0.05%TFA/CH₃CN
=20/80
A→B 30min.linear
Flow rate : 0.5 mL/min
Column temp. : 25°C
Detection : 280nm
Sample : 1.Ribonuclease A
2.Cytochrome c
3.α-Chymotrypsinogen A

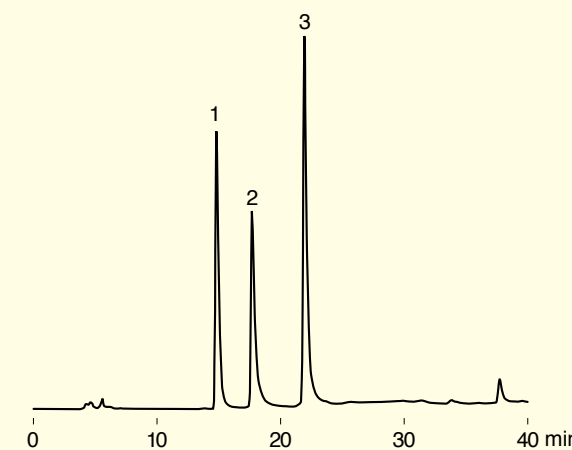


Fig. 5-14 Procainamide, Procaine

Conditions
Column : MCI GEL™ CMG20/C04
4.6mm I.D.×150mm
Eluent : 20mM phosphate pH7.2/CH₃CN
=65/35
Flow rate : 0.5 mL/min
Column temp. : 45°C
Detection : 254nm
Sample : 1.Procainamide
2.Procaine

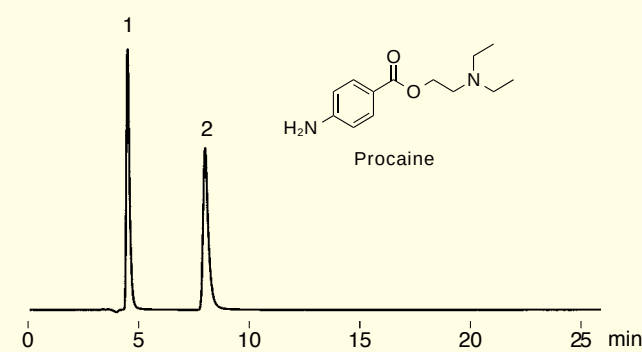
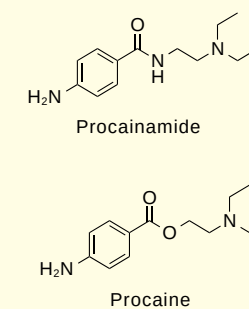
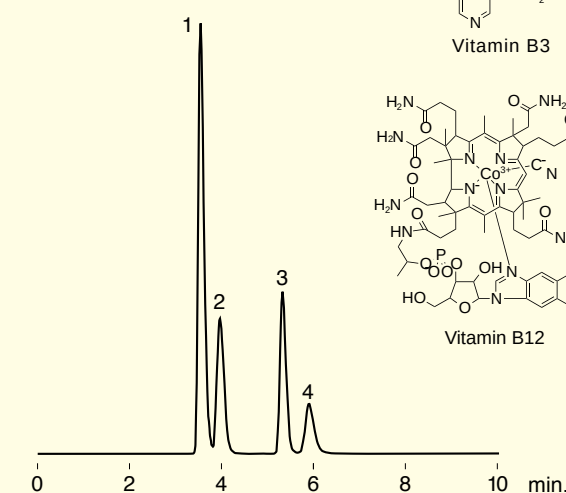
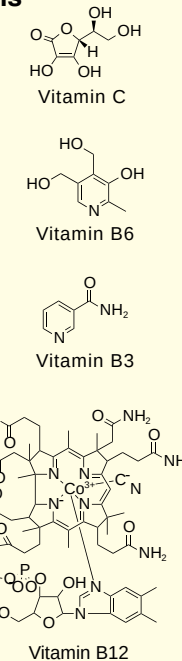


Fig. 5-15 Water-soluble vitamins

Conditions
Column : MCI GEL™ CMG20/C04
4.6mm I.D.×150mm
Eluent : 8mM Na₂HPO₄ pH7.0/CH₃CN
=85/15
Flow rate : 0.5 mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1.Vitamin C
2.Vitamin B6
3.Vitamin B3
4.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 : 1.00 mL/min
Column temp.: 25°C
Detection : UV238nm
Sample : Pravastatin sodium, Mevastatin and Simvastatin, 1mg/ml each;
Injection : 5μl

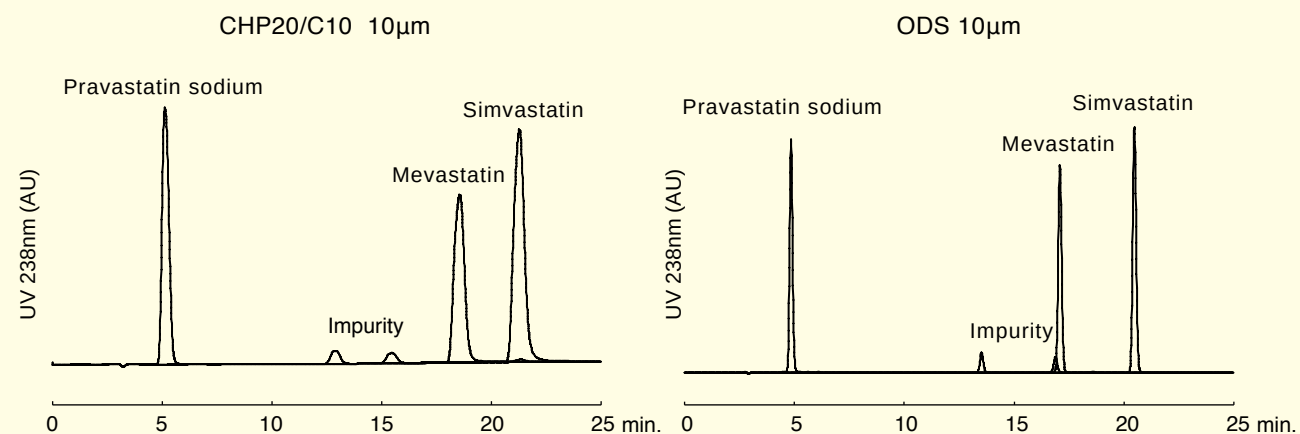
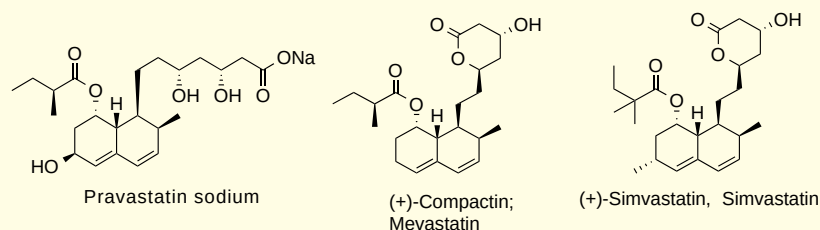
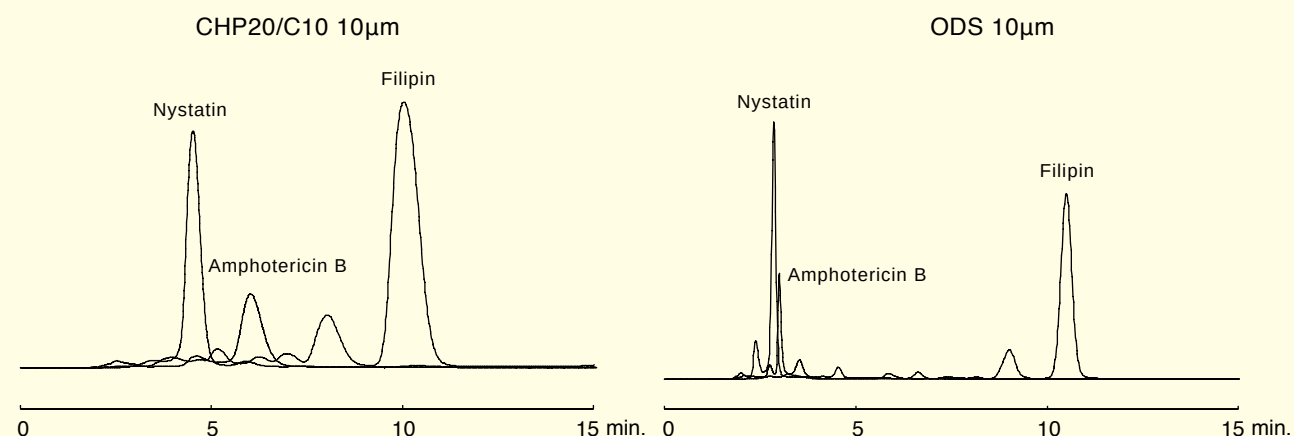
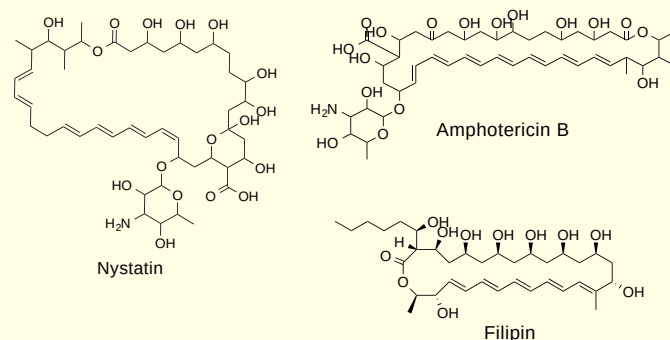


Fig. 5-17 Polyene antibiotics

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 : 1.00 mL/min
Column temp.: 25°C
Detection : UV305nm for Nystatin, VIS405nm for Amphotericin B and UV340nm for Filipin;
Sample : Pravastatin sodium, Mevastatin and Simvastatin, 1mg/ml each;
Injection : 10μl



Application data of CHP series

Fig. 5-18 Proteins

Conditions
Column : MCI GEL™ CMG20/C10 4.6mm I.D.×250mm
Eluent : A :0.05% TFA/CH₃CN=80/20
B :0.05% TFA/CH₃CN=30/70
A → B 45min linear gradient
Flow rate : 0.5 mL/min
Column temp.: 25°C
Detection : 280nm
Sample : 1. Ribonuclease A
2. Cytochrome C
3. Transferrin
4. α-Chymotrypsinogen A
5. β-Lactoglobulin

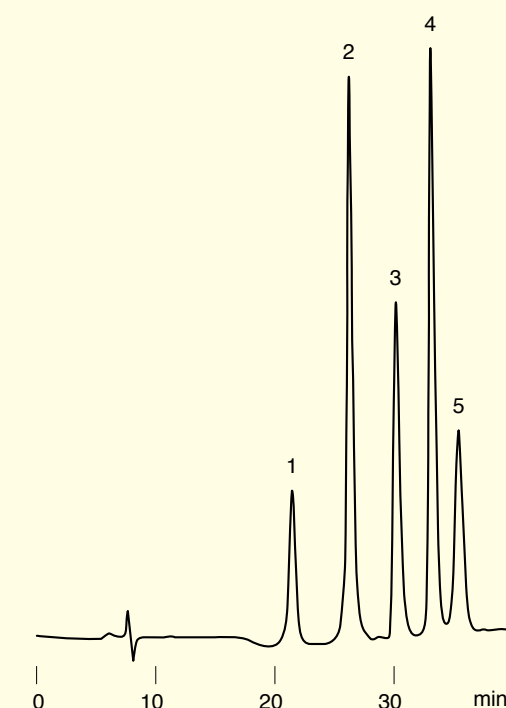
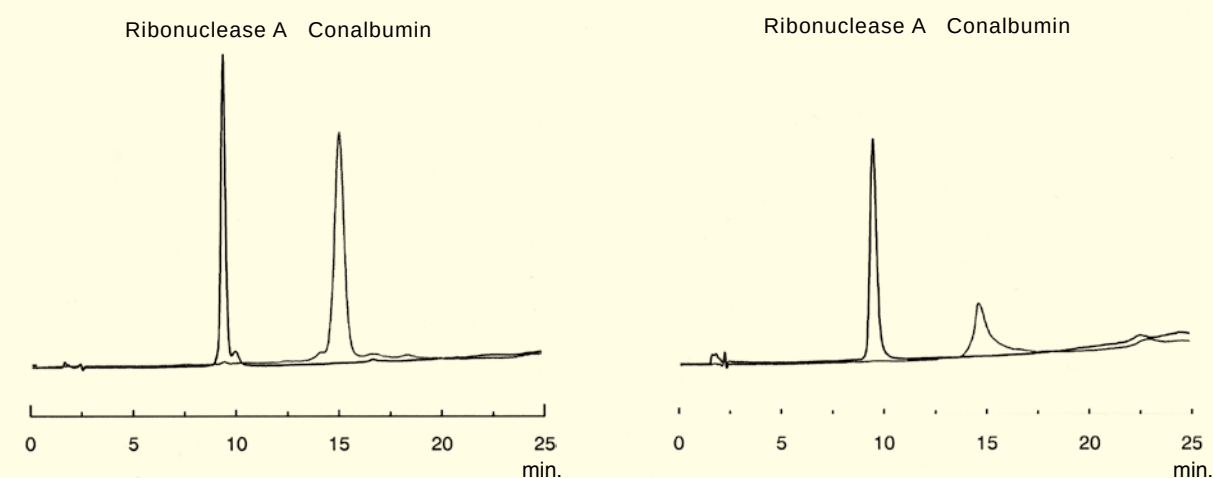


Fig. 5-19 Proteins

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 : 1.00 mL/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

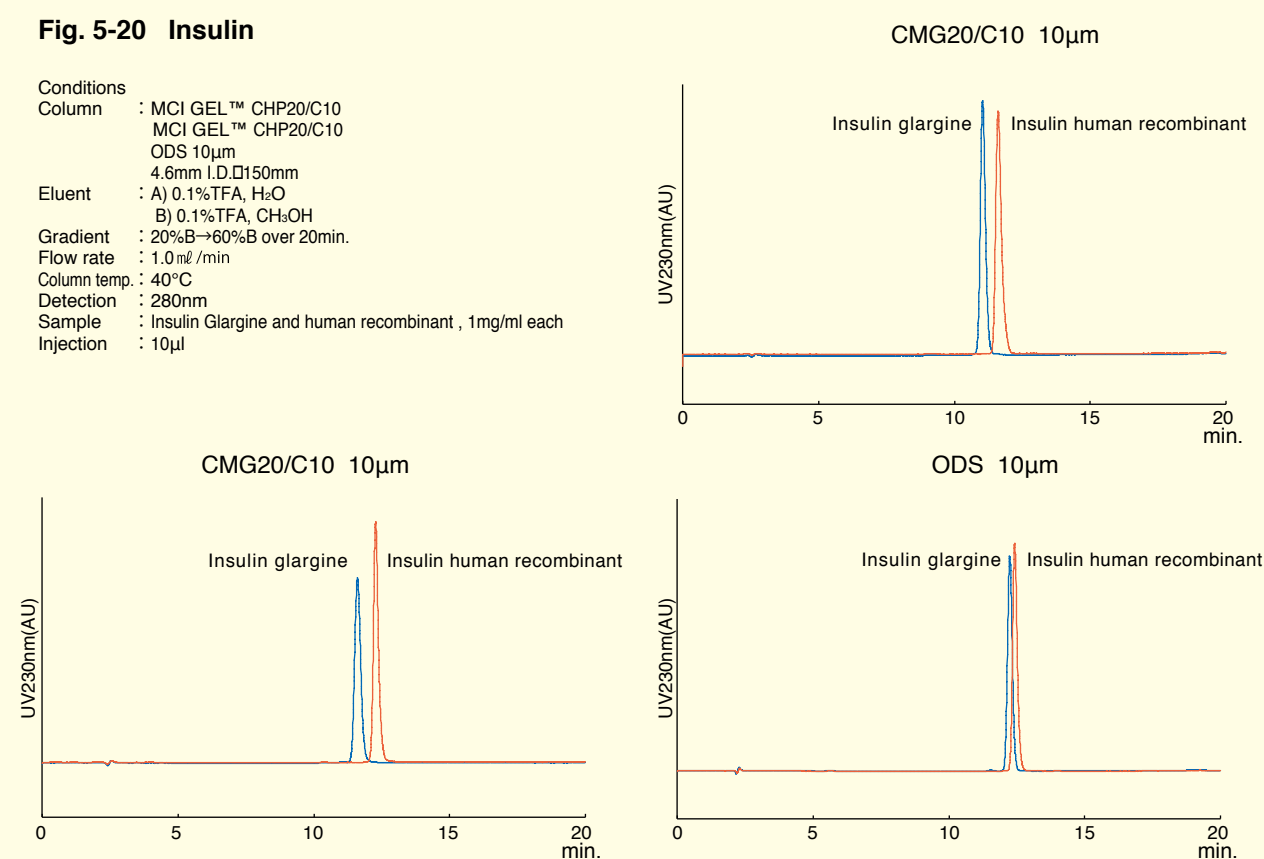
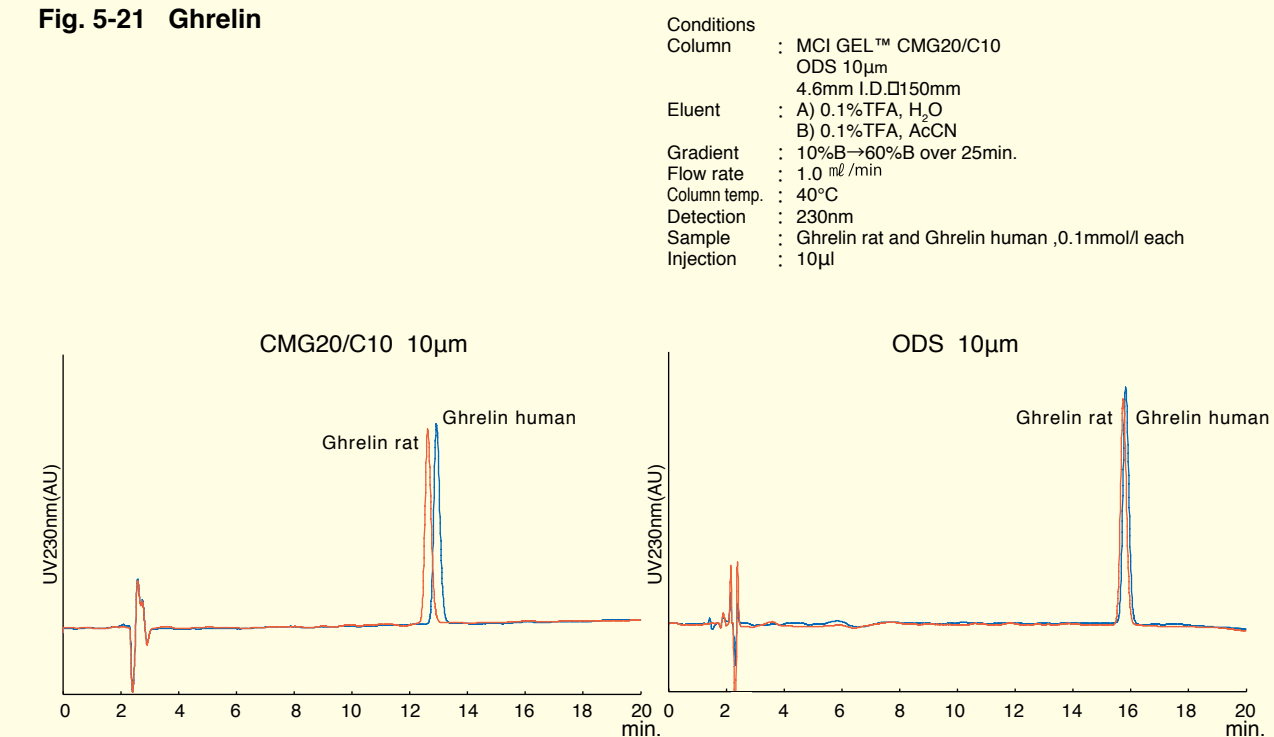


Fig. 5-21 Ghrelin



Application data of CHP series

Fig. 5-22 Leuprorelin

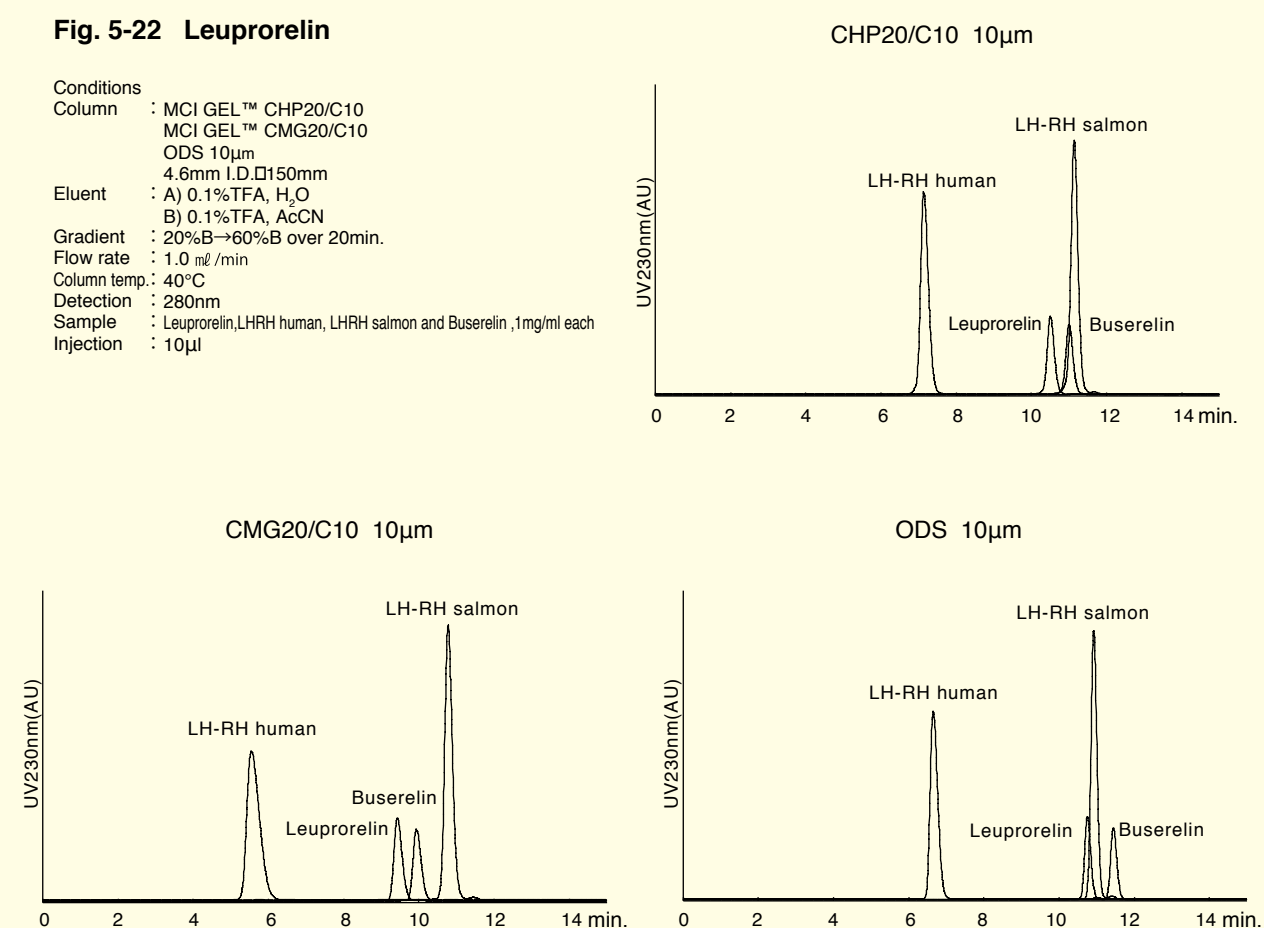
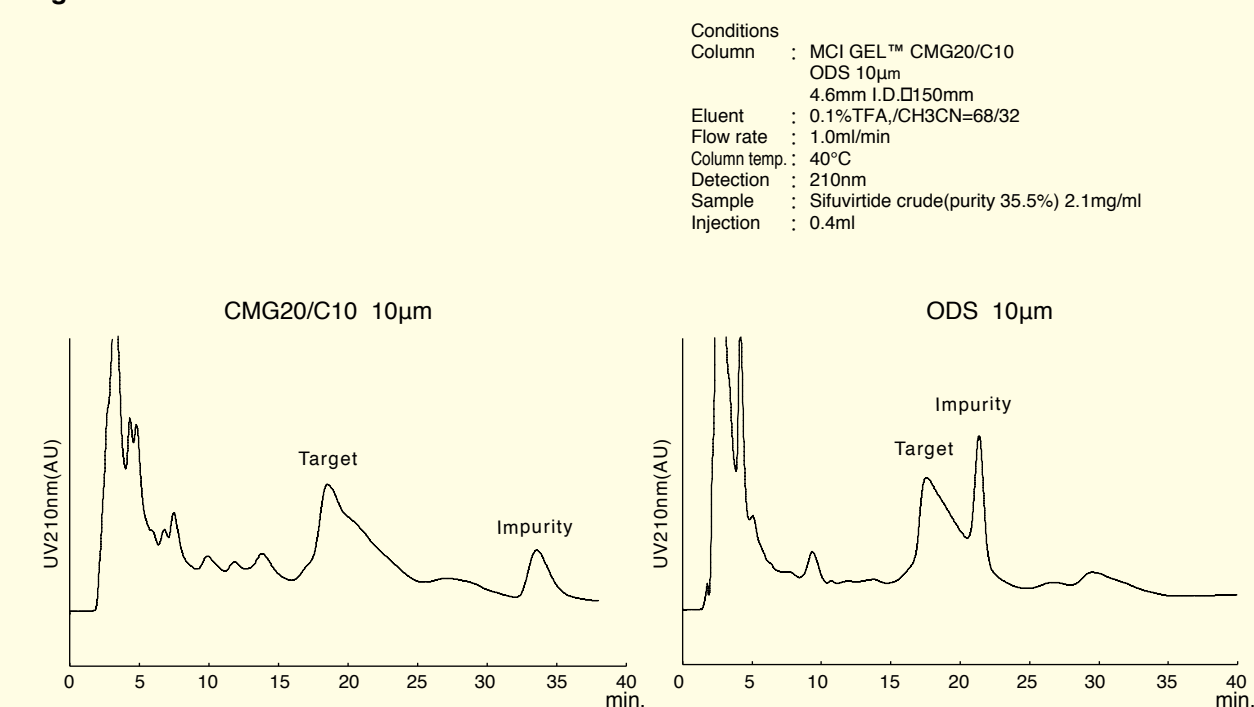


Fig. 5-23 Sifuvirtide



Application data of CHP series

Fig. 5-24 ssRNA Ladder Marker

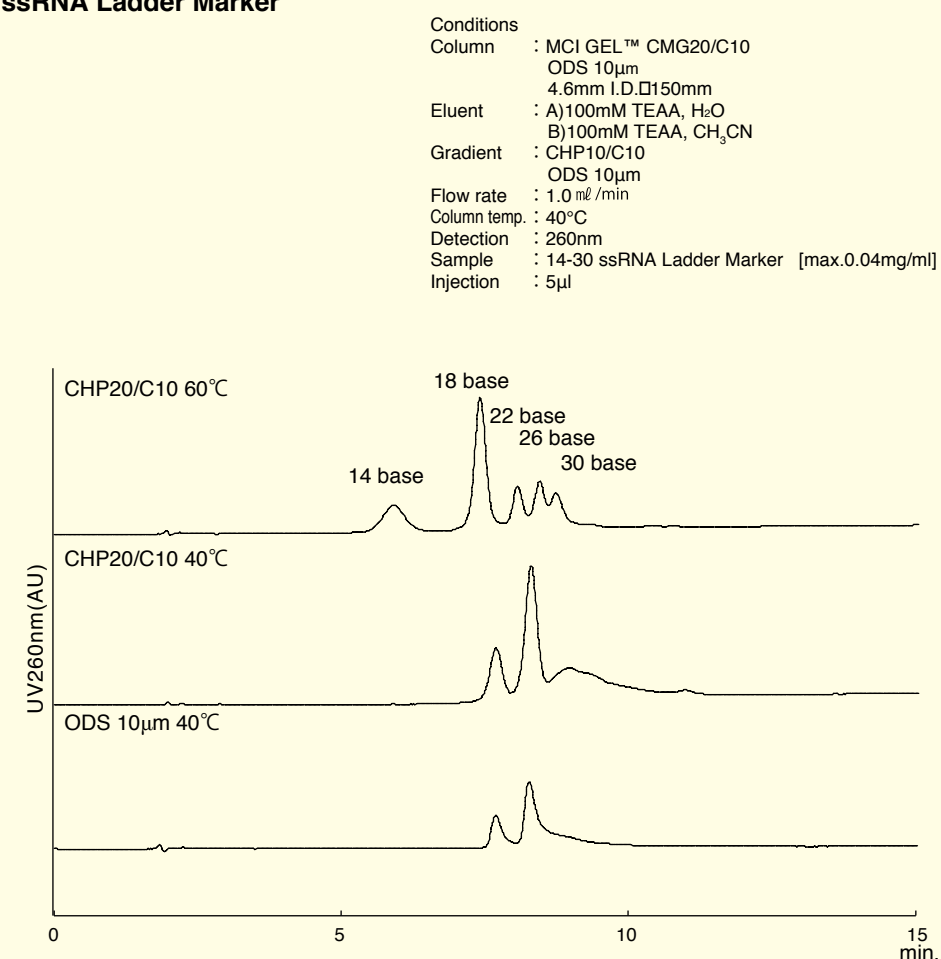
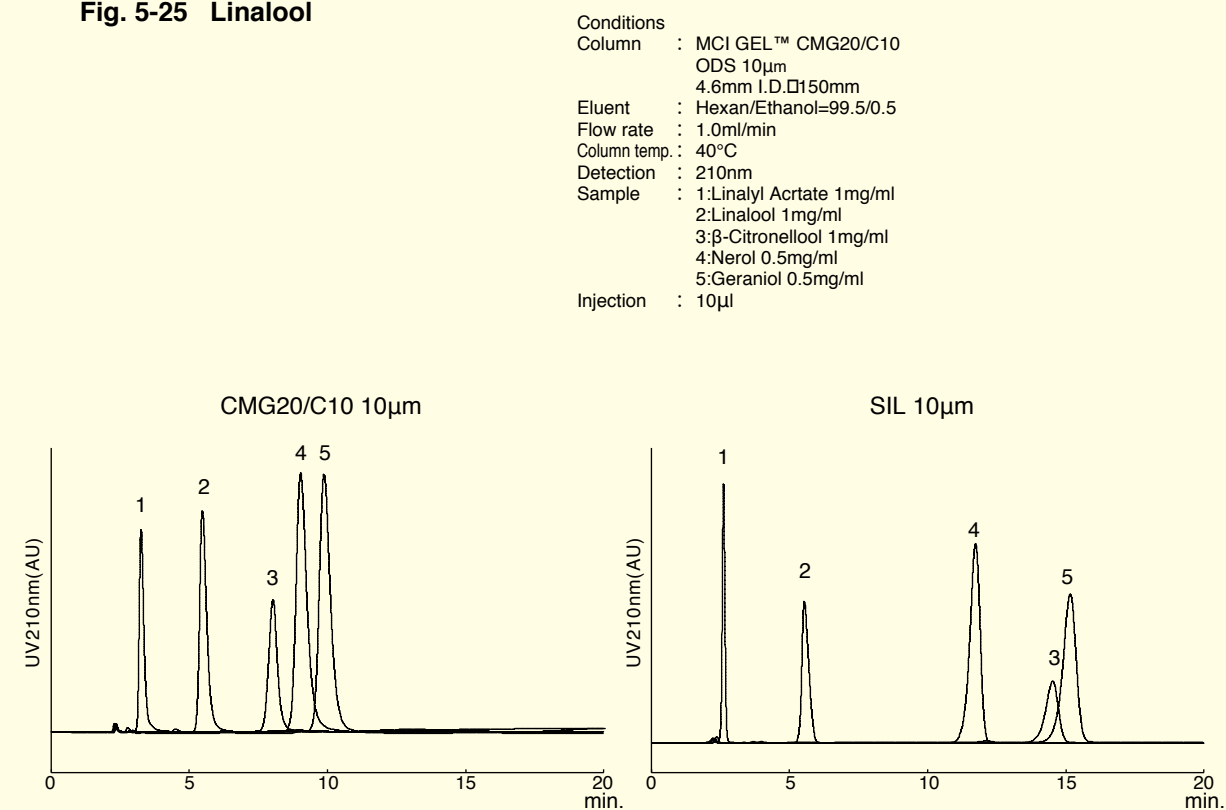


Fig. 5-25 Linalool



Application data of CHP series

Fig. 5-26 Coriander

Conditions

Column : MCI GEL™ CMG20/C10
4.6mm I.D. □150mm

Eluent : Hexan/Ethanol=99.5/0.5

Flow rate : 1.0 mL/min

Column temp. : 40°C

Detection : 210nm

Sample : Coriander

Injection : 10μl

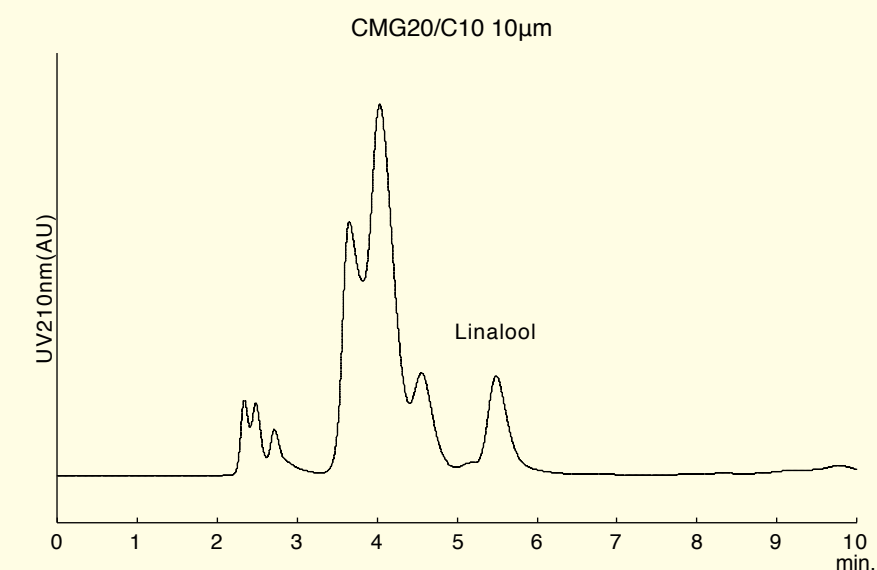


Fig. 5-27 Application data of CHK40/C04: Separation of Sartans

Conditions

Column : MCI GEL™ CHK40/P20
4.6mm I.D. □150mm

Eluent : A)10mM(pH4.7)/CH₃CN=60/40
B)10mM phosphate buffer (pH5.8)/CH₃CN=60/40

Gradient : 0%B→30%B over 3min.

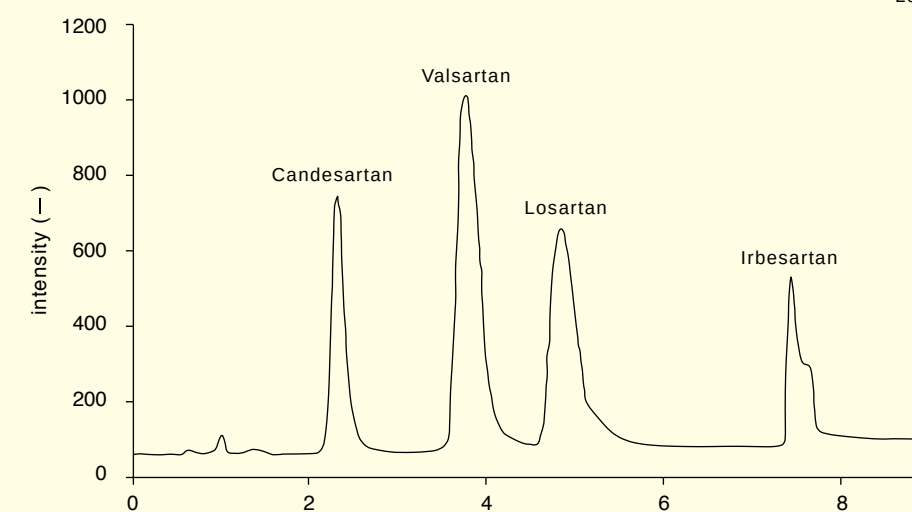
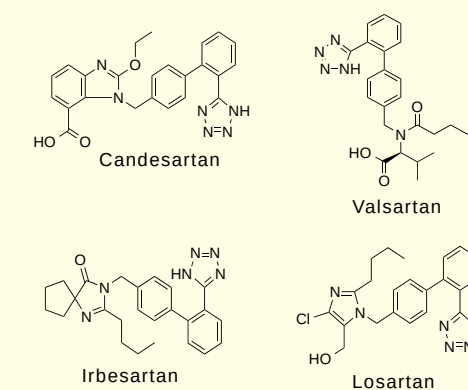
Flow rate : 1.0mL/min

Column temp. : 40°C

Detection : UV

Sample : Losartan, Valsartan, Irbesartan,
Candesartan, 0.02mol/l each

Injection : 20μl



Application data of CHP series

(Polyphenon 60)

Fig. 5-28 Modified Styrene Divinylbenzene CHP07/C04

Conditions
Column : MCI GEL™ CHP07/C04
4.6mm I.D.×150mm
Eluent : CH₃OH/10mM-Acetic acid=60/40
Flow rate : 0.46 mL/min
Column temp.: 60°C
Detection : 280nm
Sample : Polyphenon 60(10mg/mL) each 10μL

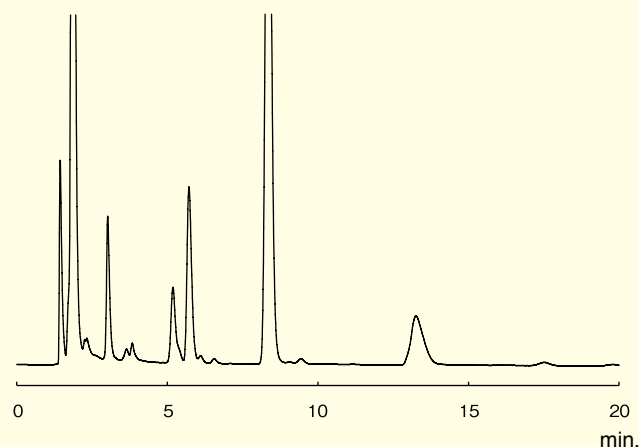
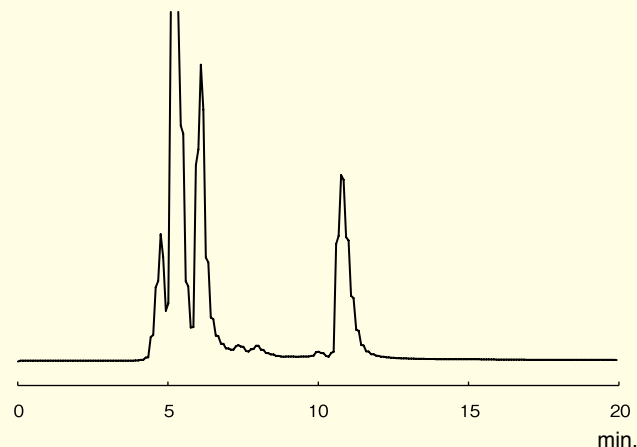


Fig. 5-29 Styrene Divinylbenzene CHP20/C04

Conditions
Column : MCI GEL™ CHP20/C04
4.6mm I.D.×150mm
Eluent : CH₃OH/10mM-Acetic acid=60/40
Flow rate : 0.46 mL/min
Column temp.: 60°C
Detection : 280nm
Sample : Polyphenon 60(10mg/mL) each 10μL



Application data of CHP series

(TritonX-100)

Fig. 5-30 C18-alkylated aliphatics CHPOD/C04

Conditions
Column : MCI GEL™ CHPOD/C04
4.6mm I.D.×150mm
Eluent : 50vol%CH₃CN
Flow rate : 0.50 mL/min
Column temp.: 40°C
Detection : 254nm
Sample : Triton X-100
(Polyoxyethylene octyl phenyl ether)
1% each 10μL

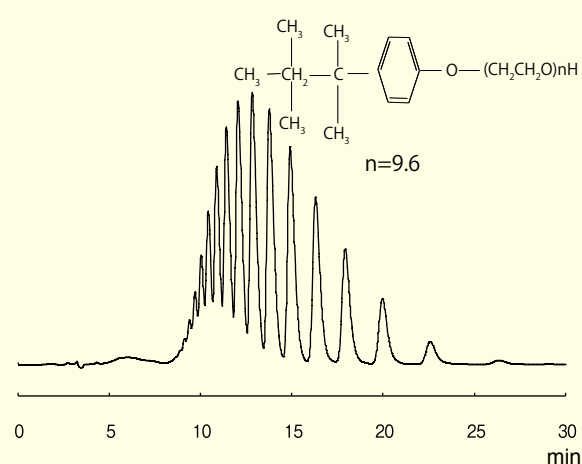
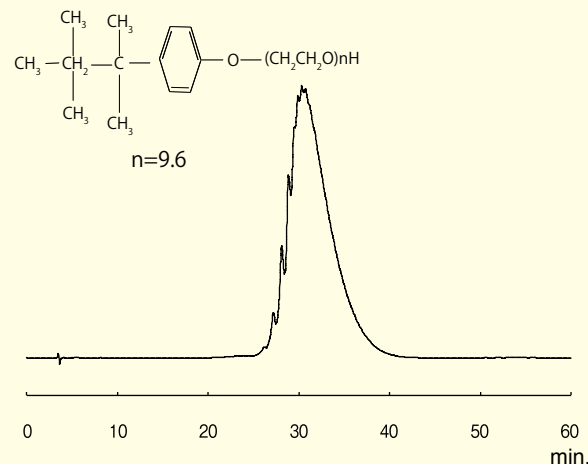


Fig. 5-31 ODS-1HU (ODS)

Conditions
Column : MCI GEL™ ODS-1HU
4.6mm I.D.×250mm
Eluent : 50vol%CH₃CN
Flow rate : 1.00 mL/min
Column temp.: 40°C
Detection : 254nm
Sample : Triton X-100
(Polyoxyethylene octyl phenyl ether)
1% each 10μL



5 MCI GEL™

CHP material series

Polymeric reversed-phase chromatography materials

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			
	CSP50/P10	10	25	CHP20/C10		
	Br	CHP07/P120	120	25		CHP07/C04 CHP07/C10
Polymethacrylate	None	CMG20/P10	10	25	CMG20/C04 CMG20/C10	
		CMG20/P30	30			
		CMG20/P150	150			

Application data of CHP series

Fig. 5-32 Phthalic acid esters

Conditions
 Column : MCI GEL™ CHP50/P20, 10mm I.D.×250mmL
 Eluent : H₂O/CH₃CN=20/80
 Flow rate : 0.75 mL/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

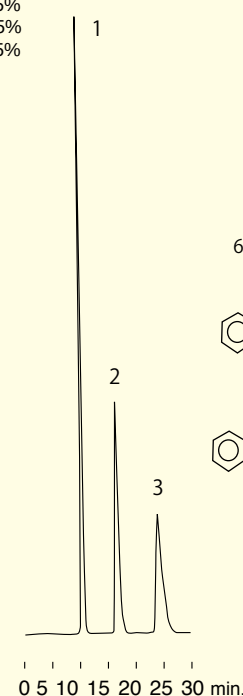
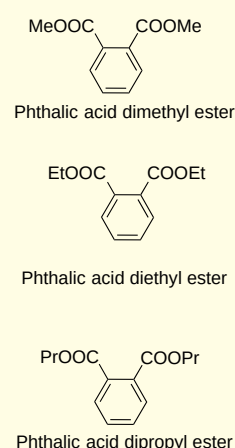


Fig. 5-33 Penicillin antibiotics

Conditions
 Column : MCI GEL™ CHP50/P20, 10mm I.D.×250mmL
 Eluent : CH₃OH/0.05M Phosphate buffer (pH8.0)=60/40
 Flow rate : 2.18 mL/min
 Column temp. : 25°C
 Detection : 254nm,
 Sample : 1. 6-Aminopenicillanic acid 1000ppm
 2. Penicillin G 1000ppm
 3. Penicillin V 1000ppm
 Injection : 100μl

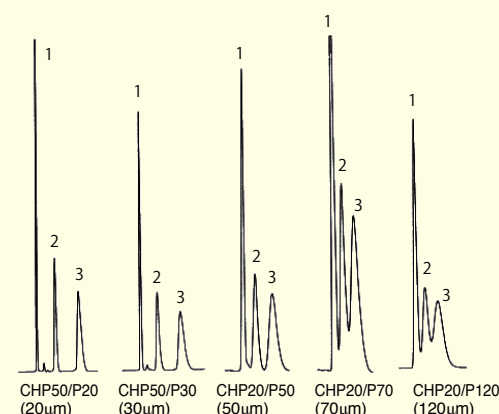
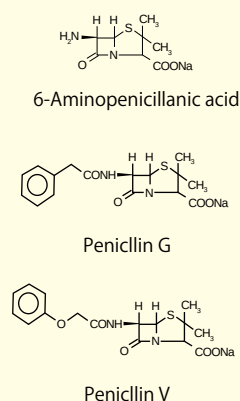


Fig. 5-34 Extract of green tea leaves

Conditions
 Column : MCI GEL™ CHP50/P20, 32mm I.D.×465mm
 Eluent : 0-185min, CH₃OH:0.01M Acetic acid(35:65)
 185-350min, CH₃OH:0.01M Acetic acid(50:50)
 Flow rate : 7.48 mL/min
 Detection : 280nm
 Sample : extract of green tea leaves, injection volume 18.7 μl
 1. Epigallocatechin
 2. Catechin
 3. Epicatechin
 4. Epigallocatechin gallate
 5. Galocatechin
 6. Epicatechin gallate
 7. Caffeine

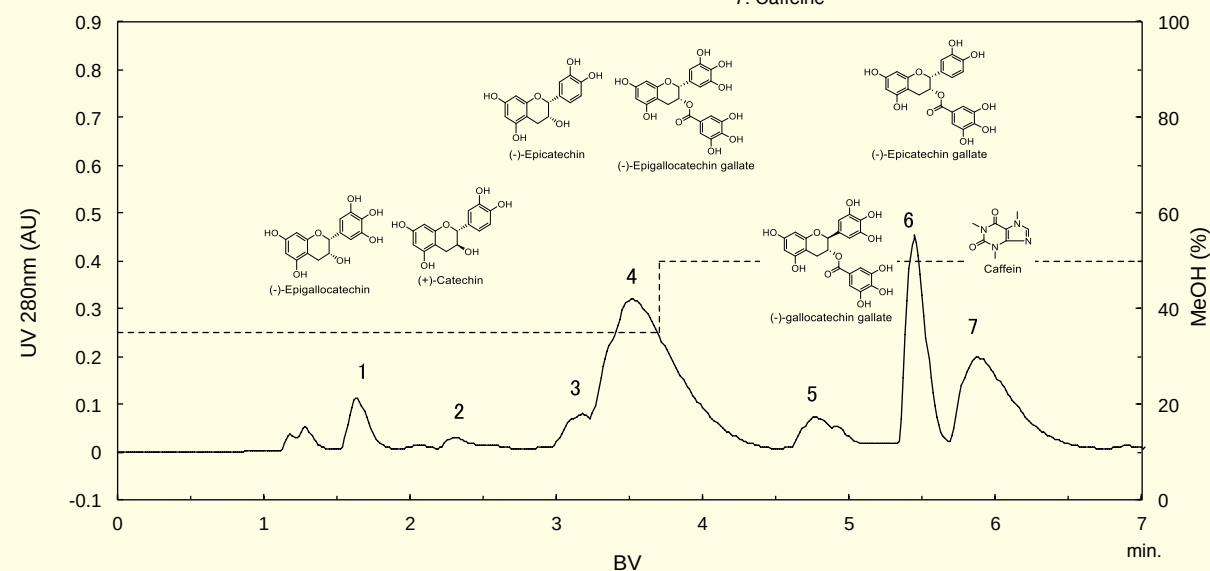


Fig.5-35 Senna pulv. extract

Conditions

Chromatogram A
 Column : MCI GEL™ CHP20/C10
 4.6mm I.D.×250mm
 Eluent : CH₃OH/1% Acetic acid = 60/40 (vol.)
 Flow rate : 0.5 mL/min
 Detection : 270nm
 Sample : Extract of senna pulv. 10μL

Chromatogram B
 Column : MCI GEL™ CHP20/P20
 10.0mm I.D.×250mm
 Eluent : CH₃OH/1% Acetic acid = 60/40 (vol.)
 Flow rate : 2.4 mL/min
 Detection : 270nm
 Sample : Extract of senna pulv. 80μL

Chromatogram C
 Column : MCI GEL™ CHP20/P30
 10.0mm I.D.×250mm
 Eluent : CH₃OH/1% Acetic acid = 60/40 (vol.)
 Flow rate : 2.4 mL/min
 Detection : 270 nm
 Sample : Extract of senna pulv. 80μL

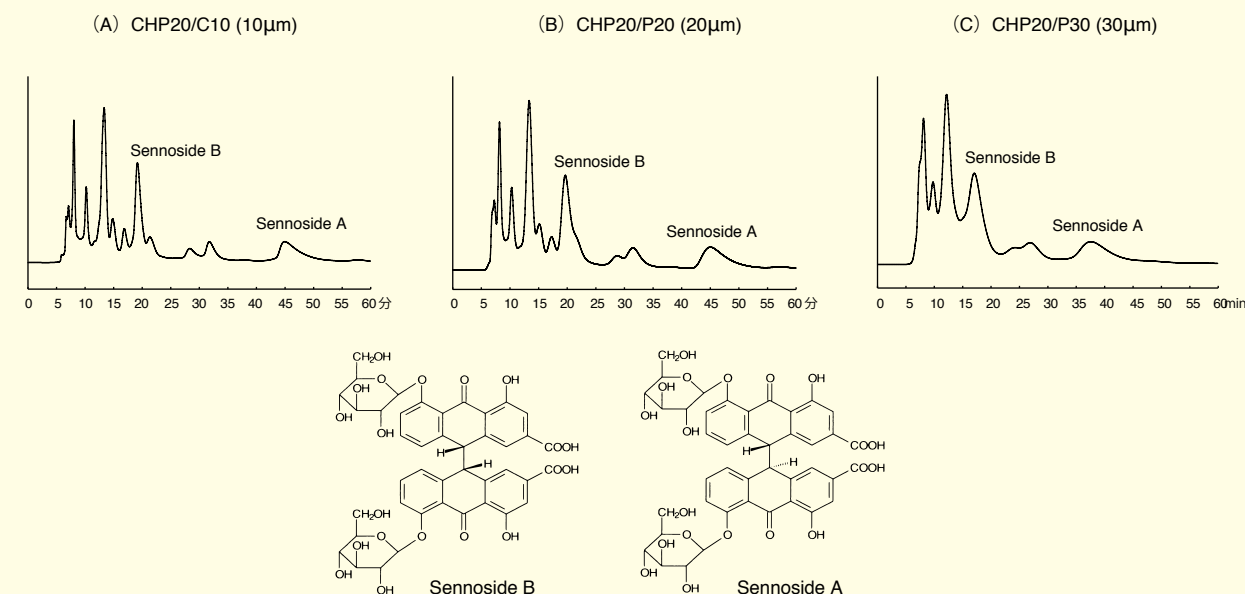
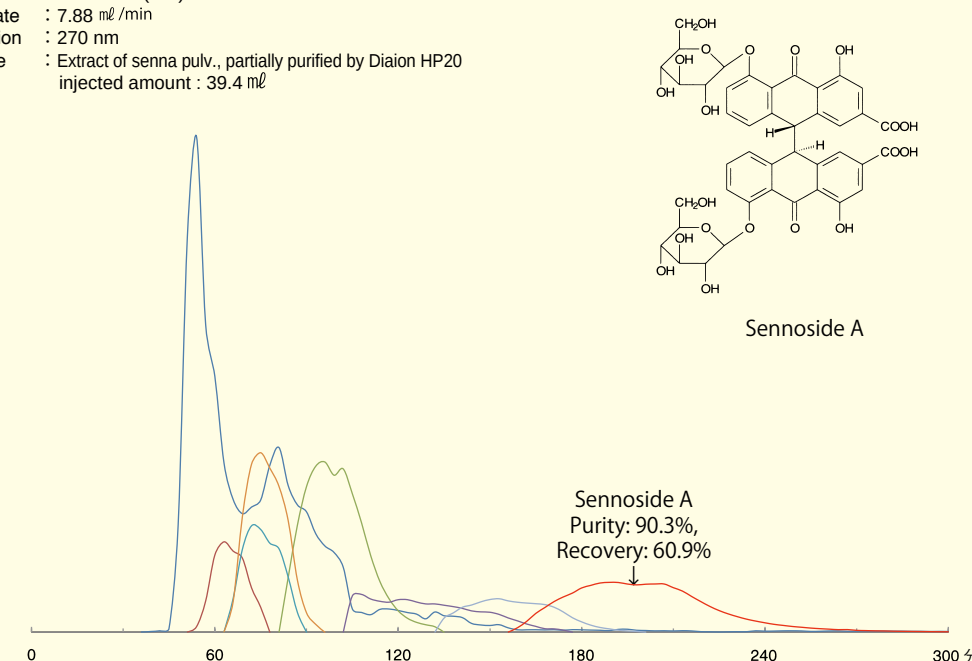


Fig. 5-36 Elution profile of senna pulv. extract separated on MCI GEL™ CHP20/P30

Conditions
 Column : MCI GEL™ CHP20/P30
 32mm I.D.×490mm
 Eluent : CH₃OH + 1% Acetic acid
 = 60 + 40 (vol.)
 Flow rate : 7.88 mL/min
 Detection : 270 nm
 Sample : Extract of senna pulv., partially purified by Diaion HP20
 injected amount : 39.4 mL



Application data of CHP series

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

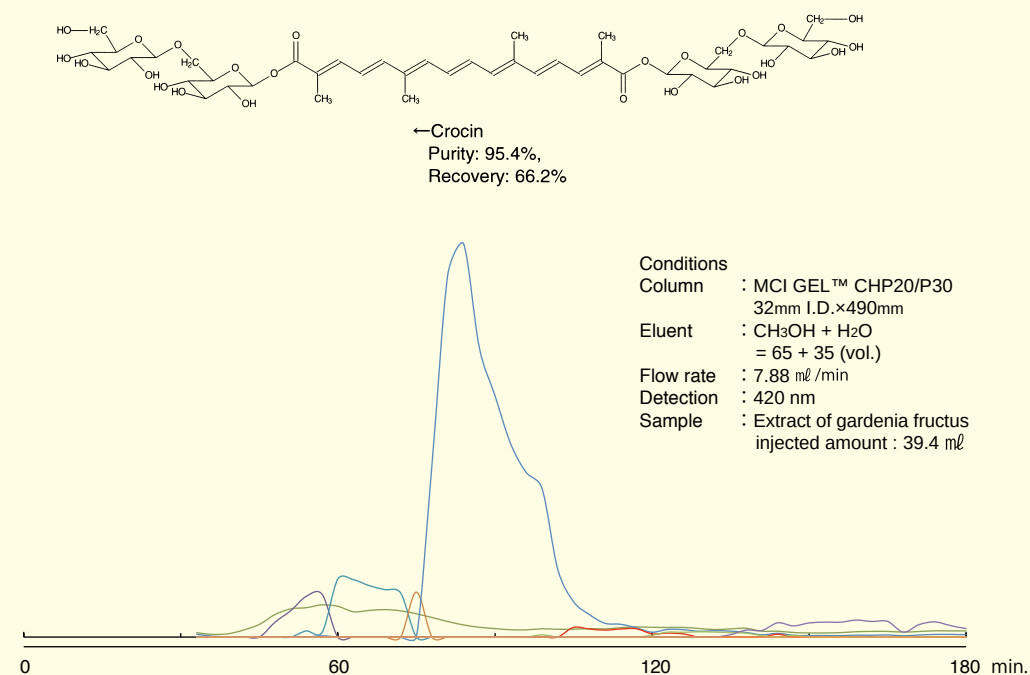
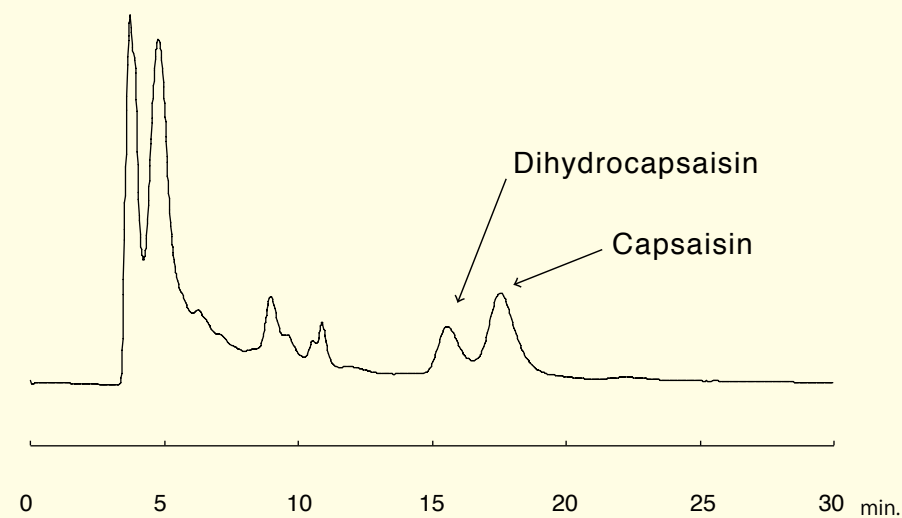


Fig. 5-38 Capsaicin

Conditions
Column : MCI GEL™ CMG20/C10, 4.6mm I.D. x 250mm
Eluent : Hexane/EtOH = 87.5/12.5 (isocratic)
Flow rate : 1.0 mL/min
Column temp. : 25°C
Detection : UV 280nm
Sample : 1. capsaicin
2. Dihydrocapsaicin
3. extract from Capsaicin
Injection : 20μL



Application data of CHP series

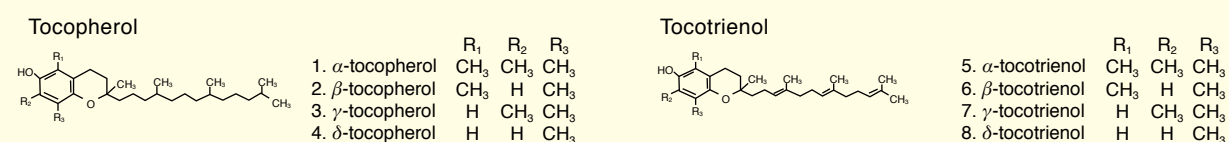


Fig. 5-39 Vitamin E in Rice Bran Oil

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

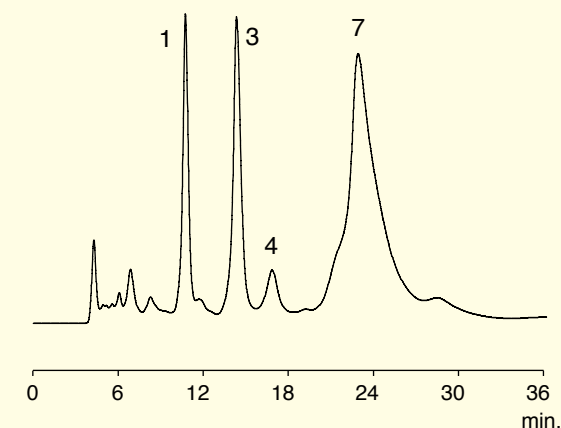


Fig. 5-40 Elution profile of Rice Bran Oil in preparative scale

Conditions
Column : MCI GEL™ CMG20/P30
20mm I.D. x 500mm
Eluent : Hexane/C₂H₅OH = 98/2 (vol.)
Flow rate : 4.7 mL/min
Detection : 295 nm
Sample : Rice Bran Oil, 50 mg/mL
Injection : 1260μL

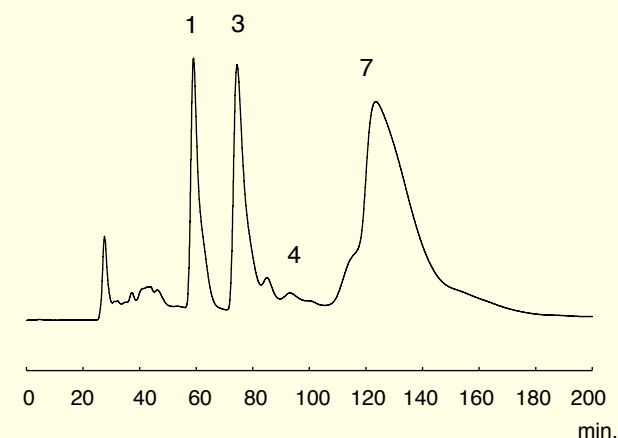


Fig. 5-41 Mixture of tocopherol and tocotrienol : Comparison with silica gel column

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

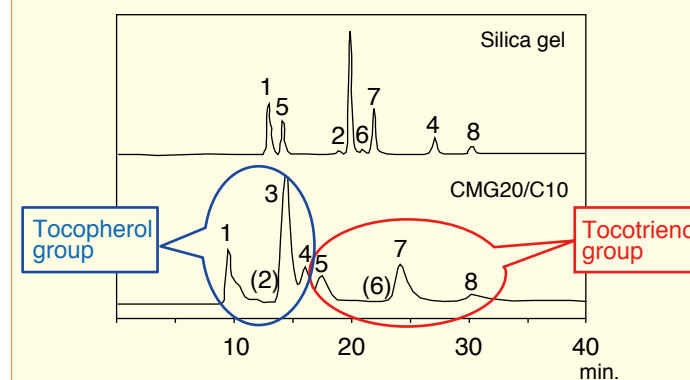
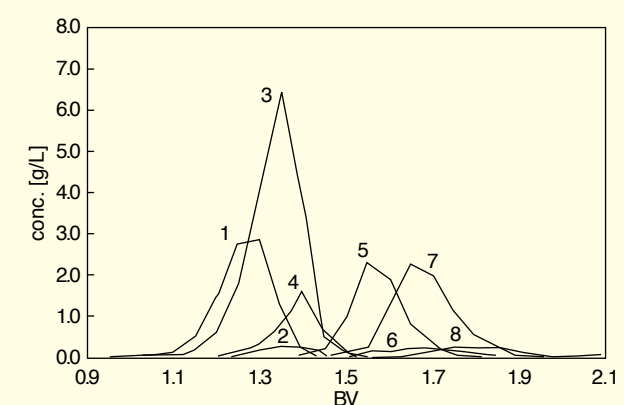


Fig. 5-42 Elution profile of tocopherol and tocotrienol in preparative scale

Conditions
Column : MCI GEL™ CMG20/P150, 41.2mm I.D. x 550mm, D4
Eluent : Hexane/EtOH = 90/10
Flow rate : 49.0 mL/min (SV=1.0)
Column temp. : 25°C
Detection : UV 292n
Sample : Mixture of tocopherol and tocotrienol
Injection : 150 mL (50g/L)



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



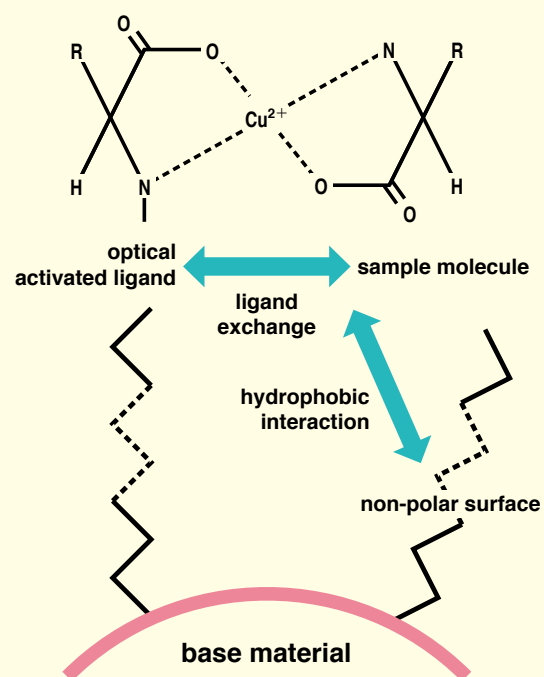
CRS10W 4.6×50



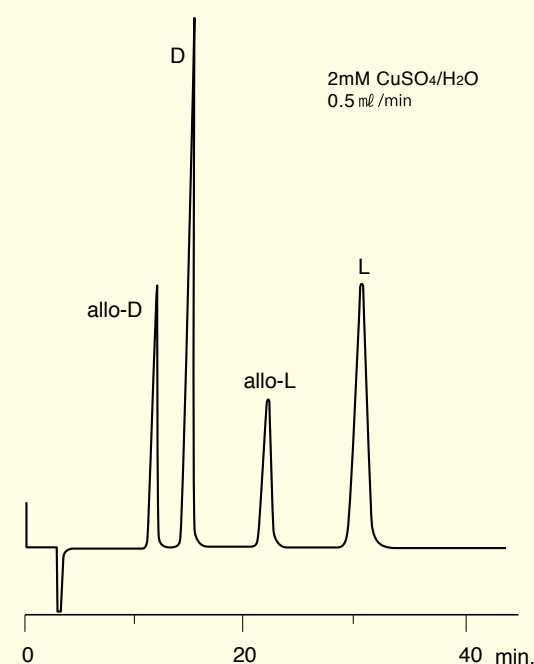
CRS15W 4.6×50

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 (CH₃CN or CH₃OH, 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 CuSO₄ aqueous solution except for Fig. 6-9 and Fig. 6-10.

Fig. 6-2 Separation of amino acids mixture

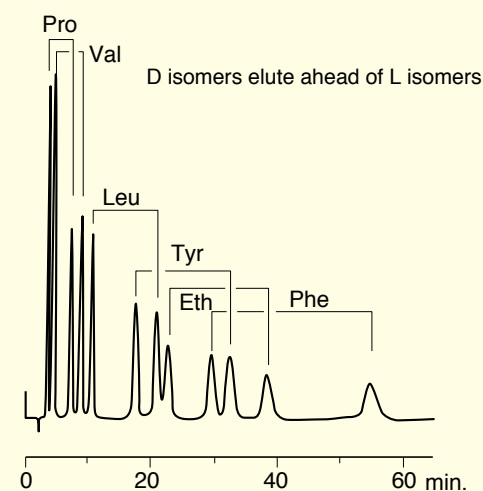


Fig. 6-3 Separation of amino acids mixture

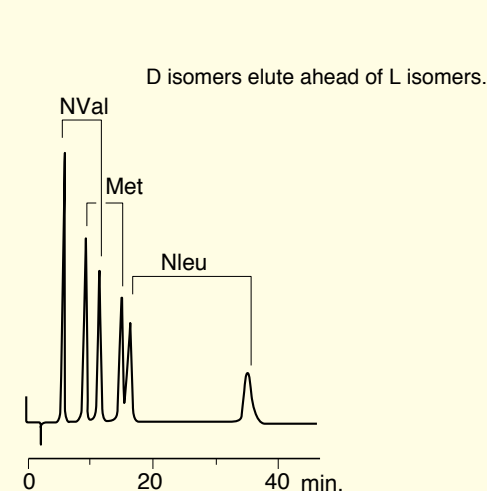


Fig. 6-4 Separation of DL-Ser.

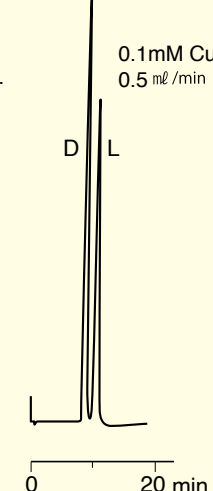


Fig. 6-5 Separation of DL-aspartic acid

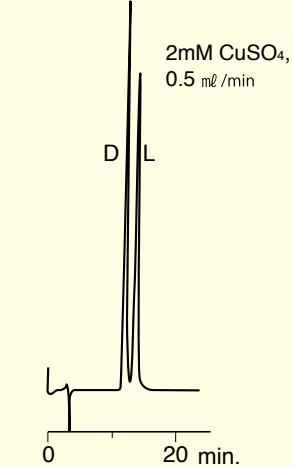


Fig. 6-6 Separation of DL-glutamic acid

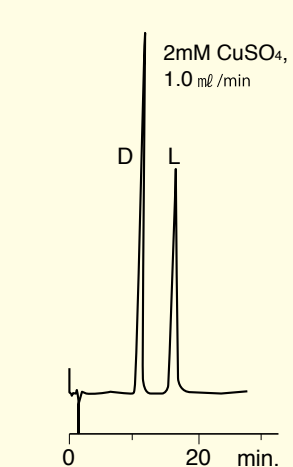


Fig. 6-7 Separation of DL-histidine

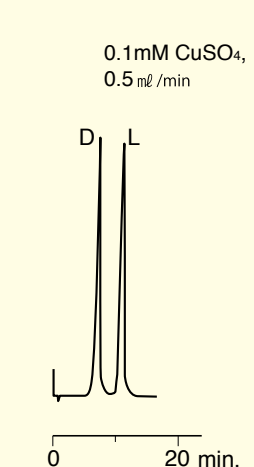


Fig. 6-8 Separation of DL-lysine

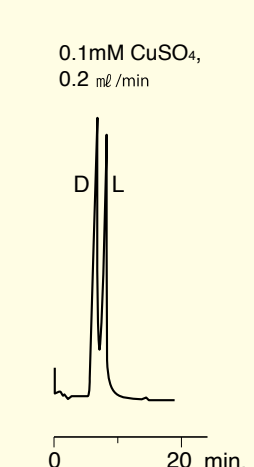


Fig. 6-9 Separation of DL-phenylalanine



Fig. 6-10 Separation of DL-tryptophan

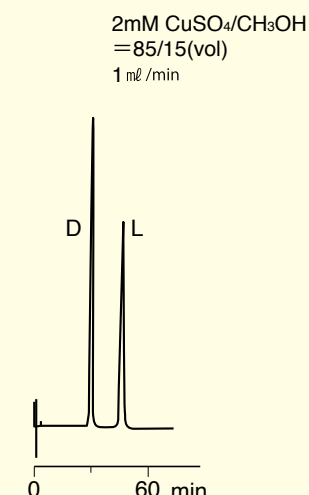


Fig. 6-11 Separation of DL-lactic acid

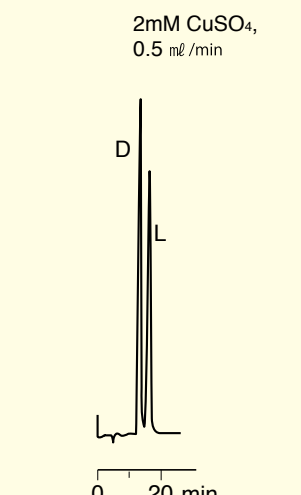
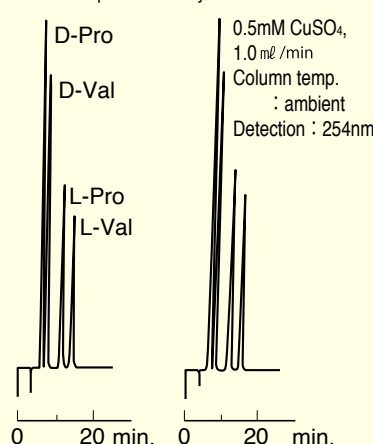


Fig. 6-12 Durability test

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 CuSO₄/CH₃OH=85/15
Flow rate : 1.0 mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1. D- α -Phenylglycine
2. L- α -Phenylglycine

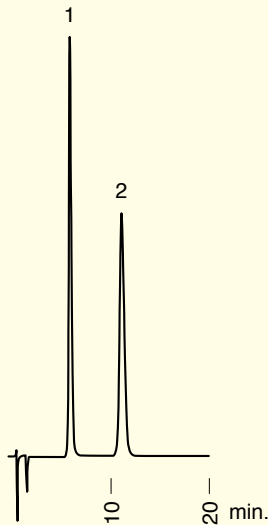


Fig. 6-14 Separation of methionine and acetylmethionine

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM CuSO₄/CH₃CN=90/10
Flow rate : 1.0 mL/min
Column temp. : 25°C
Detection : 254nm
Sample : 1. D-Met
2. L-Met
3. Acetyl-D-Met
4. Acetyl-L-Met

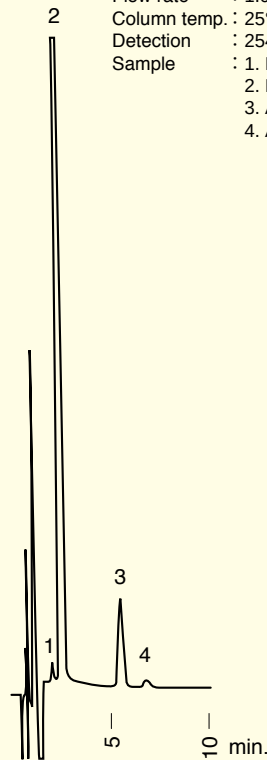
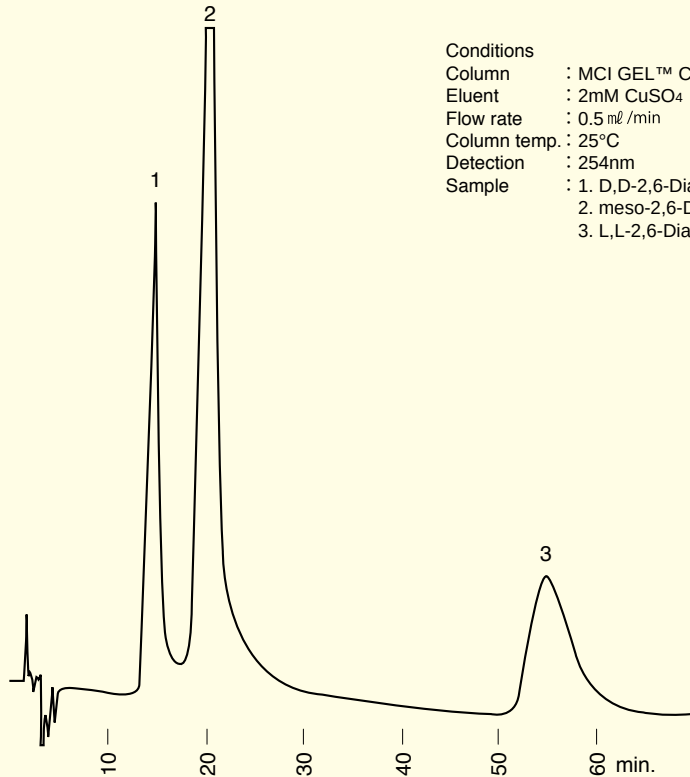


Fig. 6-15 Separation of diaminopimelic acid

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM CuSO₄
Flow rate : 0.5 mL/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. 6-16 Separation of 2-hydroxy carboxylic acids

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM CuSO₄/CH₃CN=90/10
Flow rate : 1.0 mL/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

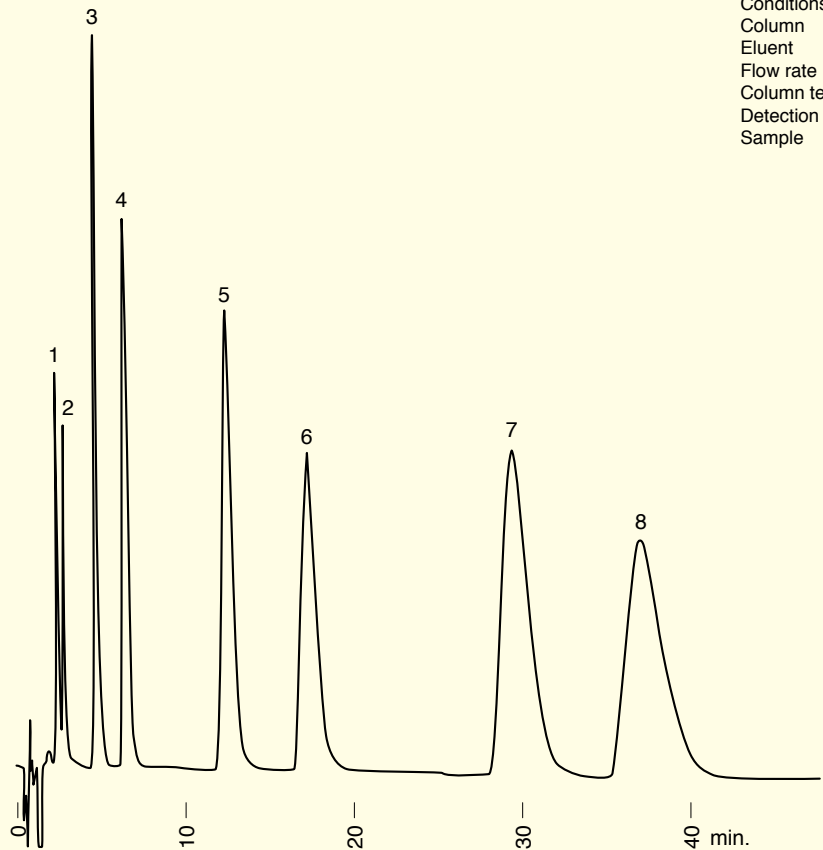
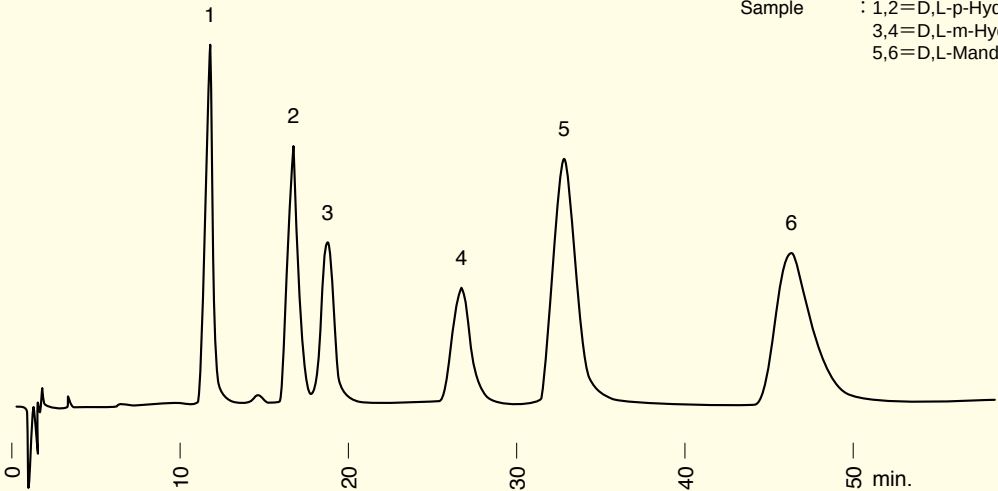


Fig. 6-17 Separation of 2-hydroxy carboxylic acids

Conditions
Column : MCI GEL™ CRS10W 4.6mm I.D.×50mm
Eluent : 2mM CuSO₄/CH₃CN=90/10
Flow rate : 1.0 mL/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



Comparison data of CRS10W and CRS15W

Fig. 6-18 Separation of DL-alanine

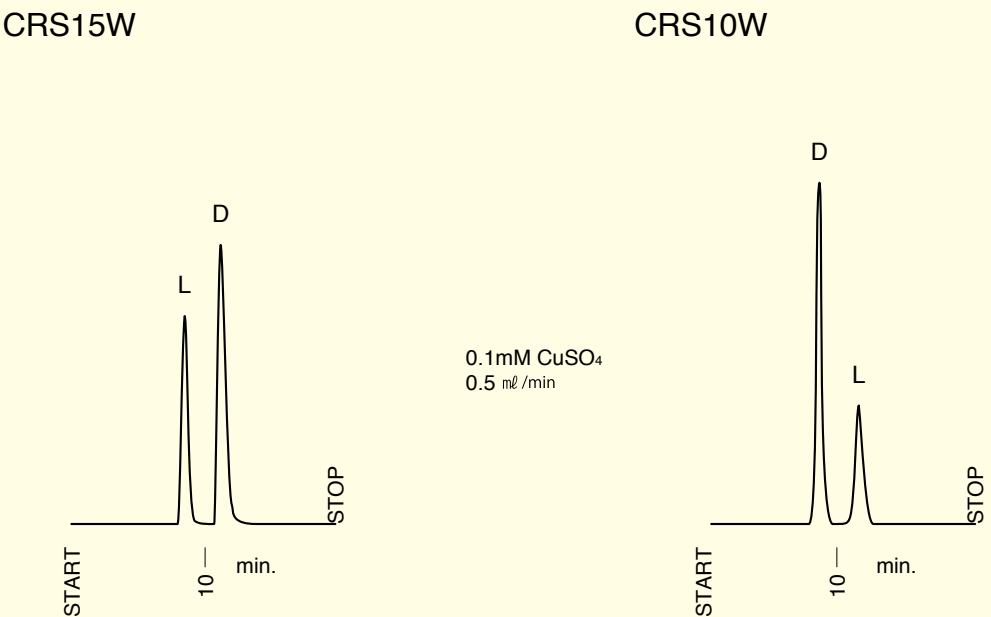
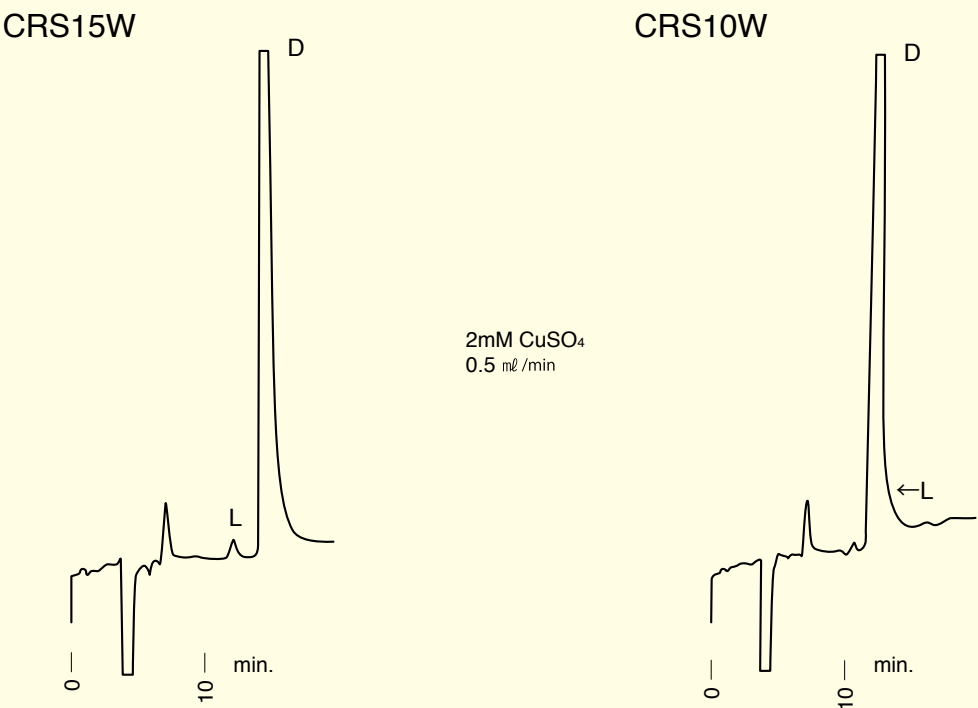


Fig. 6-19 Analysis of a trace of L-lactic acid in 50 ppm D-lactic acid

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 CuSO₄ of eluent.
2. For acidic amino acids, higher CuSO₄ 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 CuSO₄ in the eluent.
5. Please be careful not to flow both water soluble organic solvents (CH₃CN, CH₃OH, 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 CH₃CN or CH₃OH 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.

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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.

- CHP85/P120,CHP87/P120,CHPOD/P30: SPE sorbents with a controlled micro-pore size, high performance small molecule adsorption except large molecule mixture, like proteins.
- CSP800: SPE sorbents with high concentration ratio and high recovery, excellent for enrichment trace organic compounds and non-ionic substances such as trichloroethylene from environmental water. These SPE sorbents are to prepare samples for mutagenicity study or GC/MS analysis.
- SFP08/P25: SPE sorbents dedicated for small drug molecules extraction. Superior purity of this SPE extracts offers easier and faster sample preparation.
- CHL10P,CHL20P,CLB20P: SPE sorbents for rare earth metals that contains chelating functional group. CLB10P: SPE sorbents for borate, arsenic and selenium ions that contains glucamine groups on high porous ST/DVB matrix.

Material list

●Synthetic adsorbents and reversed-phase materials

Name	Mean particle size [μm]	Pore size	pH range	Typical Application
CHP85/P120	120	middle	full range	Small molecules extraction
CHP87/P120	120	small	full range	
CHPOD/P30	30	large	2~12	
CSP800	120	middle	full range	Enrichment of trace of organic compounds
SFP08/P25	25	middle	full range	Small molecules extraction

●Chelating type

Name	Functional group	Mean particle size [μm]	Ion exchange capacity [meq/ mL]	Effective pH range	Typical Application
CHL10P	Iminodiacetic acid	120	>1.5	2-6	Metal Extraction
CHL20P	Polyamine	120	>1.8	2-6	Metal Extraction
CLB10P	Glucamine	120	>1.0	>3	Extraction Bron Removal

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MCI GEL™

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				0-033-21	AFR2-PC	6×50
0-019-01	CK10U	6×120				
Ion exchange chromatography cation exchange resin for sugars				0-009-11	CK08SG	6×50
0-009-01	CK08S	8×500	L58	0-010-11	CK08EG	6×50
0-010-01	CK08E	8×300	L58	0-010-12	CK08ECG	6×50
0-010-02	CK08EC	8×300	L19	0-010-13	CK08ESG	6×50
0-010-03	CK08ES	8×300				
Ion exchange chromatography cation exchange resin for carboxylic acids				0-010-15	CK08EHG	6×50
0-010-05	CK08EH	8×300	L17			
Ion exchange chromatography cation exchange resin for oligosaccharides				0-001-11	CK02AG	8×10
0-001-01	CK02A	20×250	L58	0-001-12	CK02ASG	8×10
0-001-02	CK02AS	20×250		0-017-11	CK10SG	6×50
0-003-01	CK04S	10×200	L58	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				0-111-11	CA08FG	4×10
0-111-01	CA08F	4.6×250		0-119-11	CDR10G	4×10
0-119-01	CDR10	4.6×250				
Ion chromatography for cations				0-034-21	SCK-PC	6×50
0-034-01	SCK01	6×50				
0-034-04	SCK01	4.6×150				
Ion chromatography for anions				0-133-12	SCA04G	4.6×30
0-133-02	SCA04/PEEK	4.6×150	L31	0-130-22	SCA-PC	8×10
Bioseparation for size exclusion				0-213-11	CQP06G	4×50
0-213-01	CQP06	7.5×600	L25	0-214-11	CQP10G	4×50
0-214-01	CQP10	7.5×600	L38	0-215-11	CQP30G	4×50
0-215-01	CQP30	7.5×600	L37, 38			
Bioseparation for ion exchange chromatography						
0-146-03	ProtEx-DEAE	4.6×50				
0-146-04	ProtEx-DEAE	7.5×100				
0-037-03	ProtEx-SP	4.6×50				
0-037-04	ProtEx-SP	7.5×100				

Main column				Guard/Pre-column		
Code No.	Name	Column dimensions [mm]	USP	Code No.	Name	Column dimensions [mm]
Bioseparation for ion exchange chromatography						
0-126-01	CQA31S	7.5×75	L23			
0-130-01	CQA35S	7.5×75	L47			
0-036-01	CQK30S	7.5×75				
0-038-01	CQK31S	7.5×75				
Bioseparation for hydrophobic interaction chromatography						
0-216-01	CQH3BS	7.5×75				
0-217-01	CQH3ES	7.5×75				
0-218-01	CQH3PS	7.5×75				
Chiral separation columns						
0-219-01	CRS10W	4.6×50	L32			
0-220-01	CRS15W	4.6×50	L32			
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			
0-403-01	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				
0-406-01	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			
0-202-05	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				
0-504-01	CHPOD/C04	4.6X150				
0-504-04	CHPOD/C04	20X200				

9MCI GEL™

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 mean particle size of 4 μm to approximately 300 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	Mean particle size [μm]	Cross linkage [%]	Ion exchange capacity [meq/mL]	Typical Application
1-001-01	CK02A	10	ST/DVB	RSO ₃ ⁻	Na ⁺	20	2	>0.5	Oligosaccharides
1-003-01	CK04S	10	ST/DVB	RSO ₃ ⁻	Na ⁺	11	4	>0.8	Oligosaccharides
1-003-02	CK04S	25							
1-003-03	CK04S	50							
1-004-01	CK06S	10	ST/DVB	RSO ₃ ⁻	Na ⁺	11	6	>1.5	Oligosaccharides
1-004-02	CK06S	25							
1-004-03	CK06S	50							
1-009-01	CK08S	10	ST/DVB	RSO ₃ ⁻	Na ⁺	11	8	>1.9	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	>1.9	Sugars, Carboxylic acids
1-010-02	CK08E	25							
1-010-03	CK08E	50							
1-013-01	CK08Y	50	ST/DVB	RSO ₃ ⁻	Na ⁺	25	8	>1.9	Sugars, Carboxylic acids
1-013-02	CK08Y	300							
1-014-01	CK08P	100 mL	ST/DVB	RSO ₃ ⁻	H ⁺	120	8	>1.9	Sugars, Carboxylic acids
1-017-01	CK10S	10	ST/DVB	RSO ₃ ⁻	Na ⁺	11	10	>2.0	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	>2.0	Amino acids
1-018-02	CK10F	10							
1-019-01	CK10U	3	ST/DVB	RSO ₃ ⁻	Na ⁺	5	10	>2.0	Amino acids
1-019-03	CK10U	5						>2.0	
1-019-04	CK10U	10							
1-020-05	CK10M	5	ST/DVB	RSO ₃ ⁻	Na ⁺	4	10	>2.0	Amino acids
1-020-06	CK10M	3							
1-021-01	CK10Y	50	ST/DVB	RSO ₃ ⁻	Na ⁺	25	10	>1.9	Amino acids
1-033-01	AFR2	5	ST/DVB	RSO ₃ ⁻	H ⁺	25	—	>1.9	Ammonia trap

Abbreviation; ST/DVB = Styrene-divinylbenzene copolymer

●Ion exchange chromatography anion exchange resins [CA series, CDR series]

Code No.	Name	Packing size [g]	Base material	Functional group	Counter ion	Mean particle size [μm]	Cross linkage [%]	Ion exchange capacity [meq/mL]	Typical Application
1-104-01	CA06S	10	ST/DVB	QA	Cl ⁻	11	6	>1.2	Sugars, Carboxylic acids
1-104-02	CA06S	25							
1-104-03	CA06S	50							
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
1-116-01	CA10S	10	ST/DVB	QA	Cl ⁻	11	10	>1.2	Sugars, Carboxylic acids
1-116-02	CA10S	25							
1-116-03	CA10S	50							
1-119-01	CDR10	7	ST/DVB	QA	Cl ⁻	7	—	>0.3	Nucleic acids, Sugars
1-119-02	CDR10	14							

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	Mean particle size [μm]	Cross linkage [%]	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	Functional group	Counter ion	Mean 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	

Abbreviation; HMA = Polyhydroxymethacrylate

●Bioseparation columns –Ion exchange materials– [CQA series, CQK series]

Code No.	Name	Packing size [g]	Base material	Functional group	Counter ion	Mean particle size [μm]	Pore size [nm]	pH range	Typical Application
1-126-01	CQA31S	10	HMA	DEAE	Cl ⁻	10	60	<11	Proteins
1-126-02	CQA31S	25							
1-126-03	CQA31S	50							
1-127-01	CQA31P	100 mℓ							
1-130-01	CQA35S	10	HMA	QA	Cl ⁻	10	60	2~12	Proteins
1-130-02	CQA35S	25							
1-130-03	CQA35S	50							
1-131-01	CQA35P	100 mℓ							
1-036-01	CQK30S	10	HMA	SP	Na ⁺	10	60	1~13	Proteins
1-036-02	CQK30S	25							
1-036-03	CQK30S	50							
1-037-01	CQK30P	100 mℓ							
1-038-01	CQK31S	10	HMA	CM	Na ⁺	10	60	>4	Proteins
1-038-02	CQK31S	25							
1-038-03	CQK31S	50							
1-039-01	CQK31P	100 mℓ							

Abbreviations; HMA = Polyhydroxymethacrylate SP = Sulfopropyl CM = Carboxymethyl DEAE = Diethylaminoethyl
 QA = Quaternary ammonium

●Bioseparation columns –Hydrophobic interaction chromatography materials–

Code No.	Name	Packing size [g]	Base material	Functional group	Counter ion	Mean particle size [μm]	Pore size [nm]	Ion exchange capacity [meq/mℓ]	Typical Application
1-216-01	CQH3BS	10	HMA	Butyl	–	10	60	–	Proteins
1-216-02	CQH3BS	25							
1-216-03	CQH3BS	50							
1-217-01	CQH3ES	10	HMA	Ether	–	10	60	–	Proteins
1-217-02	CQH3ES	25							
1-217-03	CQH3ES	50							
1-218-01	CQH3PS	10	HMA	Phenyl	–	10	60	–	Proteins
1-218-02	CQH3PS	25							
1-218-03	CQH3PS	50							
1-226-01	CQH3BP	25	HMA	Butyl	–	30	60	–	Proteins
1-226-02	CQH3BP	100							
1-226-03	CQH3BP	1000 mℓ							
1-227-01	CQH3PP	25	HMA	Phenyl	–	30	60	–	Proteins
1-227-02	CQH3PP	100							
1-227-03	CQH3PP	1000 mℓ							

Abbreviation; HMA = Polyhydroxymethacrylate

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

Code No.	Product Name	Packing size [mℓ]	Base material	Mean 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					
1-312-01	CSP50/P10	10g	ST/DVB	10	25	full range	Reversed-phase chromatography
1-312-03	CSP50/P10	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					
1-308-02	CMG20/P150	100	MA	150	25	2~12	Reversed-phase chromatography
1-308-03	CMG20/P150	1,000					
1-308-04	CMG20/P150	10,000					
1-308-05	CMG20/P150	50,000					

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

●Synthetic adsorbent and reversed-phase materials

Code No.	Product Name	Packing size	Mean particle size [μm]	Pore size	pH range	Typical Application
1-315-02	CHP85/P120	100mL	120	Middle Small Large	Full range	Small molecules extraction
1-316-02	CHP87/P120	100mL	120		Full range	
1-505-02	CHPOD/P30	100g	30		2~12	
1-219-01	CSP800	50mL	120	Middle	Full range	Enrichment of trace of organic compounds
1-317-01	SFP08/P25	50g	25	Middle	Full range	Small molecules extraction

●Chelating resins for solid phase extraction in pretreatment

Code No.	Product Name	Packing size	Mean particle size [μm]	Pore size	pH range	Typical Application
1-601-02	CHL10P	100g	Iminodiacetic acid	120	>1.5	Metal Extraction
1-602-02	CHL20P	100g	Polyamine	120	>1.8	Metal Extraction
1-603-02	CLB10P	100g	Glucamine	120	>1.0	Bron Removal

Column selection guide

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Ion chromatography columns and materials

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MCI GEL™

Compounds index

	Compound	Classification	MCI GEL™ column	Figure	Page
1	Acetic acid	Acetic acid	CK08EH	2-12	11
2	Acetic acid	Acetic acid	CK08EH	2-17	12
3	Acetic acid	Acetic acid	CK08EH	2-18	12
4	Acetic acid	Acetic acid	CA08F	2-32	17
5	Acetic acid	Acetic acid	CA08F	2-33	18
6	Acetic acid	Acetic acid	CA08F	2-34	18
7	N-Acetylgalactosamine	N-Acetylgalactosamine	CK08EH	2-13	11
8	N-Acetylglucosamine	N-Acetylglucosamine	CK08EH	2-13	11
9	Acetyl-D-Met.	Acetyl-D-Met.	CRS10W	6-14	59
10	Acetyl-L-Met.	Acetyl-L-Met.	CRS10W	6-14	59
11	Adenine	Adenine	CDR10	2-35	19
12	Adenosine	Adenosine	SCK01	3-6	22
13	Adonitol	Adonitol	CK08EC	2-4	9
14	5'-ADP	5'-ADP	CDR10	2-35	19
15	Alanine	Alanine	CK10U	2-1	7
16	β-Alanine	β-Alanine	CK10U	2-2	8
17	D-Alanine	D-Alanine	CRS10W/CRS15W	6-18	61
18	L-Alanine	L-Alanine	CRS10W/CRS15W	6-18	61
19	γ-Aminobutyric acid	γ-Aminobutyric acid	CK10U	2-3	8
20	6-Aminopenicillanic acid	6-Aminopenicillanic acid	CHP50/P20	5-33	53
21	Ammonia	Ammonia	SCK01	3-2	22
22	Ammonium ion	Ammonium ion	SCK01	3-1	22
23	Ammonium ion	Ammonium ion	SCK01	3-3	22
24	2'-AMP	2'-AMP	CDR10	2-35	19
25	2'-AMP	2'-AMP	CDR10	2-36	19
26	3'-AMP	3'-AMP	CDR10	2-36	19
27	5'-AMP	5'-AMP	CDR10	2-35	19
28	5'-AMP	5'-AMP	CDR10	2-36	19
29	Amphotericin B	Amphotericin B	CHP20/C10	5-17	45
30	Angiotensin II	Angiotensin II	CMG20/C04	5-12	44
31	Antipyrine	Antipyrine	CMG20/C04	5-10	43
32	Arginine	Arginine	CK10U	2-1	7
33	Aspartic acid	Aspartic acid	CK10U	2-1	7
34	D-Aspartic acid	D-Aspartic acid	CRS10W	6-5	58
35	L-Aspartic acid	L-Aspartic acid	CRS10W	6-5	58
36	Aspirin	Aspirin	CMG20/C04	5-10	43
37	5'-ATP	5'-ATP	CDR10	2-35	19
38	Bacitracin	Bacitracin	CQH3PS	4-21	35
39	Barium ion	Barium ion	SCK01	3-7	23
40	Bovine Serum Albumin	Bovine Serum Albumin	ProtEx-DEAE	4-8	30
41	Bromide ion	Bromide ion	SCA04	3-12	24
42	Bromide ion	Bromide ion	SCA04	3-13	24
43	Buserelin	Buserelin	CHP20/C10	5-22	48
44	Buserelin	Buserelin	CMG20/C10	5-22	48
45	n-Butyl alcohol	n-Butyl alcohol	CK08EH	2-14	11
46	sec-Butyl alcohol	sec-Butyl alcohol	CK08EH	2-14	11
47	Cadmium ion	Cadmium ion	SCK01	3-8	23
48	Caffeine	Caffeine	CHP20/C04	5-4	40
49	Caffeine	Caffeine	CMG20/C04	5-10	43
50	Caffeine	Caffeine	CHP50/P20	5-34	53
51	Calcium ion	Calcium ion	SCK01	3-7	23
52	Calcium ion	Calcium ion	SCK01	3-8	23
53	Calcium ion	Calcium ion	SCK01	3-9	23
54	Calcium ion	Calcium ion	SCK01	3-10	23
55	Calcium ion	Calcium ion	SCK01	3-11	23
56	Candesartan	Candesartan	CHK40/C04	5-27	50
57	Carbonate ion	Carbonate ion	SCA04	3-15	25
58	Catechin	Catechin	CHP50/P20	5-34	53
59	Cellobiose	Cellobiose	CA08F	2-31	17
60	Cellobiose	Cellobiose	CDR10	2-37	20

	Compound	Classification	MCI GEL™ column	Figure	Page
61	Cesium ion	Cation	SCK01	3-1	22
62	Chloride ion	Anion	SCA04	3-12	24
63	Chloride ion	Anion	SCA04	3-13	24
64	Chloride ion	Anion	SCA04	3-14	24
65	Chloride ion	Anion	SCA04	3-15	25
66	Chloride ion	Anion	SCA04	3-17	25
67	Chloroacetic acid	Carboxylic acid	CK08EH	2-17	12
68	Chloroacetic acid	Carboxylic acid	CK08EH	2-18	12
69	Cholic acid	Bile acid	CHP20/C04	5-7	41
70	α-Chymotrypsinogen A	Protein	CQK30S	4-16	33
71	α-Chymotrypsinogen A	Protein	CQK31S	4-16	33
72	α-Chymotrypsinogen A	Protein	CQH3BP	4-22	36
73	α-Chymotrypsinogen A	Protein	CQH3BS	4-22	36
74	α-Chymotrypsinogen A	Protein	CQH3PP	4-23	36
75	α-Chymotrypsinogen A	Protein	CQH3PS	4-23	36
76	α-Chymotrypsinogen A	Protein	CMG20/C04	5-13	44
77	α-Chymotrypsinogen A	Protein	CMG20/C10	5-18	46
78	Cinchonine	Cinchona alkaloid	CHP20/C04	5-5	40
79	Citric acid	Carboxylic acid	CK08EH	2-12	11
80	Citric acid	Carboxylic acid	CA08F	2-32	17
81	Citric acid	Carboxylic acid	CA08F	2-33	18
82	2'-CMP	Nucleotide	CDR10	2-36	19
83	3'-CMP	Nucleotide	CDR10	2-36	19
84	5'-CMP	Nucleotide	CDR10	2-35	19
85	5'-CMP	Nucleotide	CDR10	2-36	19
86	Cobalt ion	Cation	SCK01	3-8	23
87	Coliform bacillus extract	Coliform bacillus extract	CQH3ES	4-19	35
88	Coliform bacillus extract	Coliform bacillus extract	CQH3PS	4-20	35
89	Conalbumin	Protein	CHP20/C10	5-19	46
90	Corticosterone	Adrenal cortical hormone	CHP20/C04	5-9	42
91	Crocin	Crocin	CMG20/P30	5-37	55
92	3',5'-Cyclic AMP	Nucleotide	CDR10	2-35	19
93	Cystine	Amino acid	CK10U	2-1	7
94	Cytidine	Nucleoside	SCK01	3-6	22
95	Cytochrome c	Protein	CQP30	4-3	28
96	Cytochrome c	Protein	CQK30S	4-15	33
97	Cytochrome c	Protein	CQK31S	4-15	33
98	Cytochrome c	Protein	CMG20/C04	5-13	44
99	Cytochrome c	Protein	CMG20/C10	5-18	46
100	β-Cytronellool	Perfume	CMG20/C10	5-25	49
101	Cytosine	Nucleic base	CDR10	2-35	19
102	Deoxycholic acid	Bile acid	CHP20/C04	5-7	41
103	11-Deoxycortisol	Adrenal cortical hormone	CHP20/C04	5-9	42
104	Deoxyribose	Deoxysugar	CA08F	2-31	17
105	Deoxyribose	Deoxysugar	CDR10	2-37	20
106	D,D-2,6-Diaminopimelic acid	D,D-Diamino carboxylic acid	CRS10W	6-15	59
107	L,L-2,6-Diaminopimelic acid	L,L-Diamino carboxylic acid	CRS10W	6-15	59
108	meso-2,6-Diaminopimelic acid	meso-Diamino carboxylic acid	CRS10W	6-15	59
109	Dibutyl phthalate	Aromatic ester	CHP50/P20	5-32	53
110	Dichloroacetic acid	Carboxylic acid	CK08EH	2-17	12
111	Dichloroacetic acid	Carboxylic acid	CK08EH	2-18	12
112	Diethylene glycol	Polyalcohol	CK08EH	2-16	12
113	Diethyl phthalate	Aromatic ester	CHP20/C04	5-3	40
114	Dimethylamine	Amine	SCK01	3-2	22
115	4-Dimethylaminoantipyrine	Medicine	CMG20/C04	5-10	43
116	Dimethyl phthalate	Aromatic ester	CHP20/C04	5-3	40
117	Dimethyl phthalate	Aromatic ester	CHP50/P20	5-32	53
118	Dipropyl phthalate	Aromatic ester	CHP20/C04	5-3	40
119	Dipropyl phthalate	Aromatic ester	CHP50/P20	5-32	53
120	Dopamine	Catecholamine	CHP20/C04	5-2	40
121	Epicatechin	Catechol	CHP50/P20	5-34	53
122	Epicatechin gallate	Catechol	CHP50/P20	5-34	53
123	Epigallocatechin	Catechol	CHP50/P20	5-34	53
124	Epigallocatechin gallate	Catechol	CHP50/P20	5-34	53
125	Epinephrine	Catecholamine	CHP20/C04	5-2	40

	Compound	Classification	MCI GEL™ column	Figure	Page
126	Erythritol	Sugar alcohol	CK08EC	2-11	10
127	meso-Erythritol	Sugar alcohol	CK08EC	2-4	9
128	D-Ethionine	D-Amino acid	CRS10W	6-2	58
129	L-Ethionine	L-Amino acid	CRS10W	6-2	58
130	Ethyl alcohol	Alcohol	CK08EC	2-11	10
131	Ethyl alcohol	Alcohol	CK08EH	2-14	11
132	Ethyl alcohol	Alcohol	CK08EH	2-15	11
133	Ethylene glycol	Polyalcohol	CK08EH	2-15	11
134	Ethylene glycol	Polyalcohol	CK08EH	2-16	12
135	Ferritin	Protein	CQP30	4-3	28
136	Filipin	Antibiotic	CHP20/C10	5-17	45
137	Fluoride ion	Anion	SCA04	3-12	24
138	Fluoride ion	Anion	SCA04	3-13	24
139	Formic acid	Carboxylic acid	CK08EH	2-12	11
140	Formic acid	Carboxylic acid	CA08F	2-32	17
141	Fructose	Sugar	CK08EC	2-4	9
142	Fructose	Sugar	CK08EC	2-5	9
143	Fructose	Sugar	CK08EC	2-7	10
144	Fructose	Sugar	CK08EC	2-8	10
145	Fructose	Sugar	CK08EC	2-9	10
146	Fructose	Sugar	CK08EC	2-10	10
147	Fructose	Sugar	CK08EC	2-11	10
148	Fructose	Sugar	CK04S	2-28	16
149	Fructose	Sugar	CK04S	2-29	16
150	Fructose	Sugar	CK04S	2-30	16
151	Fructose	Sugar	CA08F	2-31	17
152	Fructose	Sugar	CDR10	2-37	20
153	Fructo-oligosaccharide	Fructo-oligosaccharide	CK04S	2-30	16
154	Fucose	Sugar	CA08F	2-31	17
155	Galactose	Sugar	CK08EC	2-6	9
156	Galactose	Sugar	CA08F	2-31	17
157	Galactose	Sugar	CDR10	2-37	20
158	Galocatechin	Catechol	CHP50/P20	5-34	53
159	Gentiobiose	Disaccharide	CK08EC	2-4	9
160	Geraniol	Perfume	CMG20/C10	5-25	49
161	Ghrelin human	Peptide	CMG20/C10	5-21	47
162	Ghrelin rat	Peptide	CMG20/C10	5-21	47
163	Gluconic acid	Carboxylic acid	CA08F	2-33	18
164	Gluconic acid	Carboxylic acid	CA08F	2-34	18
165	Gluconic acid	Carboxylic acid	CQP06	4-4	28
166	Glucose	Sugar	CK08EC	2-4	9
167	Glucose	Sugar	CK08EC	2-5	9
168	Glucose	Sugar	CK08EC	2-7	10
169	Glucose	Sugar	CK08EC	2-8	10
170	Glucose	Sugar	CK08EC	2-9	10
171	Glucose	Sugar	CK08EC	2-10	10
172	Glucose	Sugar	CK08EC	2-11	10
173	Glucose	Sugar	CK08EH	2-13	11
174	Glucose	Sugar	CK04S	2-28	16
175	Glucose	Sugar	CK04S	2-29	16
176	Glucose	Sugar	CK04S	2-30	16
177	Glucose	Sugar	CA08F	2-31	17
178	Glucose	Sugar	CDR10	2-37	20
179	Glucose	Sugar	CQP06	4-4	28
180	Glutamic acid	Amino acid	CK10U	2-1	7
181	D-Glutamic acid	D-Amino acid	CRS10W	6-6	58
182	L-Glutamic acid	L-Amino acid	CRS10W	6-6	58
183	Glycerol	Polyalcohol	CK08EC	2-11	10
184	Glycerol	Polyalcohol	CK08EH	2-15	11
185	Glycine	Amino acid	CK10U	2-1	7
186	Glycohemoglobin	Protein	ProtEx-SP	4-12	31
187	Glycolic acid	Carboxylic acid	CK08EH	2-12	11
188	Glycolic acid	Carboxylic acid	CK08EH	2-18	12
189	Glycyrrhizic acid	Glycyrrhizic acid	CHP20/C04	5-8	42
190	Gly-Tyr	Peptide	CMG20/C04	5-12	44

	Compound	Classification	MCI GEL™ column	Figure	Page
191	3'-GMP	Nucleotide	CDR10	2-36	19
192	5'-GMP	Nucleotide	CDR10	2-36	19
193	5'-GTP	Nucleotide	CDR10	2-35	19
194	Guanosine	Nucleoside	SCK01	3-6	22
195	Hemoglobin A0	Protein	ProtEx-DEAE	4-5	30
196	Hemoglobin A2	Protein	ProtEx-DEAE	4-5	30
197	Hemoglobin S	Protein	ProtEx-DEAE	4-5	30
198	Histidine	Amino acid	CK10U	2-1	7
199	D-Histidine	D-Amino acid	CRS10W	6-7	58
200	L-Histidine	L-Amino acid	CRS10W	6-7	58
201	Human growth hormone	Hormone	ProtEx-DEAE	4-6	30
202	Human serum	Serum	CQH3ES	4-18	35
203	Human serum	Serum	CQH3PS	4-18	35
204	Hydrocortisone	Adrenal cortical hormone	CHP20/C04	5-9	42
205	5-Hydroxytryptophan	Amino acid	CHP20/C04	5-2	40
206	D-2-Hydroxy-n-butyric acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	60
207	L-2-Hydroxy-n-butyric acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	60
208	D-α-Hydroxy isocaproic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	60
209	L-α-Hydroxy isocaproic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	60
210	D-α-Hydroxy-n-valeric acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	60
211	L-α-Hydroxy-n-valeric acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	60
212	D-m-Hydroxymandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	60
213	L-m-Hydroxymandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	60
214	D-p-Hydroxymandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	60
215	L-p-Hydroxymandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	60
216	Hypoxanthine	6-Hydroxypurine	CHP20/C04	5-6	41
217	IgG1	Monoclonal antibody	ProtEx-DEAE	4-11	31
218	IgG2b	Monoclonal antibody	ProtEx-DEAE	4-10	31
219	5'-IMP	Nucleotide	CDR10	2-36	19
220	Insulin human recombinant	Peptide	CHP20/C10	5-20	47
221	Insulin largesin	Peptide	CHP20/C10	5-20	47
222	Insulin human recombinant	Peptide	CMG20/C10	5-20	47
223	Insulin largesin	Peptide	CMG20/C10	5-20	47
224	Irbesartan	Sartan	CHK40/C04	5-27	50
225	Isoleucine	Amino acid	CK10U	2-1	7
226	D-Isoleucine	D-Amino acid	CRS10W	6-1	57
227	L-Isoleucine	L-Amino acid	CRS10W	6-1	57
228	allo-D-Isoleucine	D-Amino acid	CRS10W	6-1	57
229	allo-L-Isoleucine	L-Amino acid	CRS10W	6-1	57
230	Isopropyl alcohol	Alcohol	CK08EH	2-14	11
231	Isopropyl alcohol	Alcohol	CK08EH	2-15	11
232	Lactic acid	Carboxylic acid	CK08EH	2-12	11
233	Lactic acid	Carboxylic acid	CA08F	2-32	17
234	Lactic acid	Carboxylic acid	CA08F	2-34	18
235	D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-11	58
236	L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-11	58
237	D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	60
238	L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	60
239	D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W/CRS15W	6-19	61
240	L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W/CRS15W	6-19	61
241	β-Lactoglobulin	Protein	CQA31S	4-14	32
242	β-Lactoglobulin	Protein	CQA35S	4-14	32
243	β-Lactoglobulin	Protein	CMG20/C10	5-18	46
244	Lactose	Disaccharide	CK08EC	2-4	9
245	Lactose	Disaccharide	CK08EC	2-6	9
246	Lactose	Disaccharide	CA08F	2-31	17
247	Lactose	Disaccharide	CDR10	2-37	20
248	Lactulose	Disaccharide	CK08EC	2-6	9
249	Leucine	Amino acid	CK10U	2-1	7
250	D-Leucine	D-Amino acid	CRS10W	6-2	58
251	L-Leucine	L-Amino acid	CRS10W	6-2	58
252	Leu-Enkephalin	Peptide	CQH3PS	4-21	35
253	Leu-Enkephalin	Peptide	CMG20/C04	5-12	44
254	Leuprorelin	Peptide	CHP20/C10	5-22	48
255	Leuprorelin	Peptide	CMG20/C10	5-22	48

	Compound	Classification	MCI GEL™ column	Figure	Page
256	LH-RH human	Peptide	CHP20/C10	5-22	48
257	LH-RH human	Peptide	CMG20/C10	5-22	48
258	LH-RH salmon	Peptide	CHP20/C10	5-22	48
259	LH-RH salmon	Peptide	CMG20/C10	5-22	48
260	Linalool	Perfume	CMG20/C10	5-25	49
261	Linalool	Perfume	CMG20/C10	5-26	50
262	Linalyl acetate	Perfume	CMG20/C10	5-25	49
263	Lipoxidase	Enzyme	CQA31S	4-17	33
264	Lithium ion	Cation	SCK01	3-1	22
265	Losartan	Sartan	CHK40/C04	5-27	50
266	Lysine	Amino acid	CK10U	2-1	7
267	D-Lysine	D-Amino acid	CRS10W	6-8	58
268	L-Lysine	L-Amino acid	CRS10W	6-8	58
269	Lysozyme	Protein	CQK30S	4-15	33
270	Lysozyme	Protein	CQK31S	4-15	33
271	Magnesium ion	Cation	SCK01	3-7	23
272	Magnesium ion	Cation	SCK01	3-9	23
273	Magnesium ion	Cation	SCK01	3-10	23
274	Magnesium ion	Cation	SCK01	3-11	23
275	Malic acid	Carboxylic acid	CK08EH	2-12	11
276	Malic acid	Carboxylic acid	CA08F	2-32	17
277	Malonic acid	Carboxylic acid	CK08EH	2-12	11
278	Malonic acid	Carboxylic acid	CA08F	2-32	17
279	Maltose	Disaccharide	CA08F	2-31	17
280	Maltose	Disaccharide	CDR10	2-37	20
281	D-Mandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	60
282	L-Mandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	60
283	Manganese ion	Cation	SCK01	3-8	23
284	Mannitol	Sugar alcohol	CK08EC	2-4	9
285	Mannitol	Sugar alcohol	CK08EC	2-11	10
286	Mannose	Sugar	CK08EC	2-4	9
287	Mannose	Sugar	CA08F	2-31	17
288	Mannose	Sugar	CDR10	2-37	20
289	Melibiose	Disaccharide	CA08F	2-31	17
290	Melibiose	Disaccharide	CDR10	2-37	20
291	Met-Enkephalin	Peptide	CMG20/C04	5-12	44
292	Methionine	Amino acid	CK10U	2-1	7
293	D-Methionine	D-Amino acid	CRS10W	6-3	58
294	L-Methionine	L-Amino acid	CRS10W	6-3	58
295	D-Methionine	D-Amino acid	CRS10W	6-14	59
296	L-Methionine	L-Amino acid	CRS10W	6-14	59
297	Methyl alcohol	Alcohol	CK08EH	2-15	11
298	Methylamine	Amine	SCK01	3-2	22
299	Met-Leu-Tyr	Peptide	CQH3PS	4-21	35
300	Mevastatin	Medicine	CHP20/C10	5-16	45
301	Myoglobin	Protein	CQP30	4-3	28
302	Myoglobin	Protein	CQA31S	4-13	32
303	Myoglobin	Protein	CQA35S	4-13	32
304	Myoglobin	Protein	CQA31S	4-14	32
305	Myoglobin	Protein	CQA35S	4-14	32
306	Myoglobin	Protein	CQK30S	4-15	33
307	Myoglobin	Protein	CQK31S	4-15	33
308	Nerol	Perfume	CMG20/C10	5-25	49
309	Nitrate ion	Anion	SCA04	3-12	24
310	Nitrate ion	Anion	SCA04	3-13	24
311	Nitrate ion	Anion	SCA04	3-14	24
312	Nitrate ion	Anion	SCA04	3-15	25
313	Nitrate ion	Anion	SCA04	3-17	25
314	Nitrate ion	Anion	SCA04	3-12	24
315	Nitrate ion	Anion	SCA04	3-13	24
316	D-Norleucine	D-Amino acid	CRS10W	6-3	58
317	L-Norleucine	L-Amino acid	CRS10W	6-3	58
318	D-Norvaline	D-Amino acid	CRS10W	6-3	58
319	L-Norvaline	L-Amino acid	CRS10W	6-3	58
320	Nystatin	Antibiotic	CHP20/C10	5-17	45

	Compound	Classification	MCI GEL™ column	Figure	Page
321	Oligosaccharide	Dp1-Dp9	CK04S	2-21	15
322	Oligosaccharide	Dp1-Dp13	CK04SS	2-22	15
323	Oligosaccharide	Dp1-Dp16	CK02A	2-23	15
324	Oligosaccharide	Dp1-Dp20	CK02AS	2-24	15
325	Oligosaccharide	Dp1-Dp7	CK04S	2-25	16
326	Oligosaccharide	Dp1-Dp7	CK04SS	2-26	16
327	Oligosaccharide	Dp1-Dp7	CK02AS	2-27	16
328	Orotic acid	Carboxylic acid	CHP20/C04	5-6	41
329	Ovalbumin	Protein	CQP30	4-3	28
330	Ovalbumin	Protein	CQA31S	4-13	32
331	Ovalbumin	Protein	CQA35S	4-13	32
332	Oxalic acid	Carboxylic acid	CK08EH	2-12	11
333	Penicillin G	Antibiotic	CHP50/P20	5-33	53
334	Penicillin V	Antibiotic	CHP50/P20	5-33	53
335	Phenacetin	Medicine	CMG20/C04	5-10	43
336	Phenylalanine	Amino acid	CK10U	2-1	7
337	D-Phenylalanine	D-Amino acid	CRS10W	6-2	58
338	L-Phenylalanine	L-Amino acid	CRS10W	6-2	58
339	D-Phenylalanine	D-Amino acid	CRS10W	6-9	58
340	L-Phenylalanine	L-Amino acid	CRS10W	6-9	58
341	D-α-Phenylglycine	D-Amino acid	CRS10W	6-13	59
342	L-α-Phenylglycine	L-Amino acid	CRS10W	6-13	59
343	Phosphate ion	Anion	SCA04	3-12	24
344	PEG MW 145,000	PEG	CQP30	4-2	28
345	PEG MW 40,000	PEG	CQP30	4-2	28
346	PEG MW 6,000	PEG	CQP30	4-2	28
347	Polyphenon 60	Polyphenol	CHP07/C04	5-28	51
348	Polyphenon 60	Polyphenol	CHP20/C04	5-29	51
349	Potassium ion	Cation	SCK01	3-1	22
350	Potassium ion	Cation	SCK01	3-3	22
351	Potassium ion	Cation	SCK01	3-4	22
352	Potassium ion	Cation	SCK01	3-5	22
353	Prabastatin Na	Medicine	CHP20/C10	5-16	45
354	Procainamide	Anesthetic	CMG20/C04	5-14	44
355	Procaine	Anesthetic	CMG20/C04	5-14	44
356	Proline	Amino acid	CK10U	2-1	7
357	D-Proline	D-Amino acid	CRS10W	6-2	58
358	L-Proline	L-Amino acid	CRS10W	6-2	58
359	Propylene glycol	Polyalcohol	CK08EH	2-15	11
360	n-Propyl alcohol	Alcohol	CK08EH	2-14	11
361	Quinine	Cinchona alkaloid	CHP20/C04	5-5	40
362	Rhamnose	Sugar	CA08F	2-31	17
363	Rhamnose	Sugar	CDR10	2-37	20
364	Ribonuclease A	Protein	CQK30S	4-16	33
365	Ribonuclease A	Protein	CQK31S	4-16	33
366	Ribonuclease A	Protein	CQH3BP	4-22	36
367	Ribonuclease A	Protein	CQH3BS	4-22	36
368	Ribonuclease A	Protein	CQH3PP	4-23	36
369	Ribonuclease A	Protein	CQH3PS	4-23	36
370	Ribonuclease A	Protein	CMG20/C04	5-13	44
371	Ribonuclease A	Protein	CMG20/C10	5-18	46
372	Ribonuclease A	Protein	CHP20/C10	5-19	46
373	Ribose	Sugar	CK08EC	2-4	9
374	Ribose	Sugar	CA08F	2-31	17
375	Ribose	Sugar	CDR10	2-37	20
376	RNA	RNA	ProtEx-DEAE	4-9	31
377	Rubidium ion	Cation	SCK01	3-1	22
378	Salicin	Phenol glycoside	CK08EC	2-4	9
379	Sennoside A	Sennoside A	CHP20/C10	5-35	54
380	Sennoside B	Sennoside B	CHP20/C10	5-35	54
381	Sennoside A	Sennoside A	CHP20/P20	5-35	54
382	Sennoside B	Sennoside B	CHP20/P20	5-35	54
383	Sennoside A	Sennoside A	CHP20/P30	5-35	54
384	Sennoside B	Sennoside B	CHP20/P30	5-35	54
385	Sennoside A	Sennoside A	CHP20/P30	5-36	54

	Compound	Classification	MCI GEL™ column	Figure	Page
386	Serine	Amino acid	CK10U	2-1	7
387	D-Serine	D-Amino acid	CRS10W	6-4	58
388	L-Serine	L-Amino acid	CRS10W	6-4	58
389	Serotonin	Catecholamine	CHP20/C04	5-2	40
390	Sifuvirtide	Peptide	CMG20/C10	5-23	48
391	Simvastatin	Medicine	CHP20/C10	5-16	45
392	Sodium ion	Cation	SCK01	3-1	22
393	Sodium ion	Cation	SCK01	3-3	22
394	Sodium ion	Cation	SCK01	3-4	22
395	Sodium ion	Cation	SCK01	3-5	22
396	Sorbitol	Sugar alcohol	CK08EC	2-5	9
397	Sorbitol	Sugar alcohol	CK08EH	2-15	11
398	ssRNA	RNA	CHP20/C10	5-24	49
399	Stachyose	Tetrasaccharide	CK08EC	2-4	9
400	Strontium ion	Cation	SCK01	3-7	23
401	Strontium ion	Cation	SCK01	3-8	23
402	Succinylsulfathiazole	Sulfa drug	CMG20/C04	5-11	43
403	Sucrose	Disaccharide	CK08EC	2-5	9
404	Sucrose	Disaccharide	CK08EC	2-7	10
405	Sucrose	Disaccharide	CK08EC	2-8	10
406	Sucrose	Disaccharide	CK04S	2-30	16
407	Sulfate ion	Anion	SCA04	3-12	24
408	Sulfate ion	Anion	SCA04	3-13	24
409	Sulfate ion	Anion	SCA04	3-14	24
410	Sulfamerazine	Sulfa drug	CMG20/C04	5-11	43
411	Sulfanilamide	Sulfa drug	CMG20/C04	5-11	43
412	Sulfathiazole	Sulfa drug	CMG20/C04	5-11	43
413	Tartaric acid	Carboxylic acid	CK08EH	2-12	11
414	Tartaric acid	Carboxylic acid	CA08F	2-32	17
415	Theobromine	Purine alkaloid	CHP20/C04	5-4	40
416	Theophylline	Purine alkaloid	CHP20/C04	5-4	40
417	Theophylline	Purine alkaloid	CHP20/C04	5-6	41
418	Thiocyanic ion	Anion	SCA04	3-16	25
419	Thiosulfuric ion	Anion	SCA04	3-16	25
420	Threonine	Amino acid	CK10U	2-1	7
421	Thymine	Nucleic base	CDR10	2-35	19
422	D-α-Tocopherol	Vitamin	CMG20/C04	5-39	56
423	D-γ-Tocopherol	Vitamin	CMG20/C04	5-39	56
424	D-δ-Tocopherol	Vitamin	CMG20/C04	5-39	56
425	D-α-Tocopherol	Vitamin	CMG20/P30	5-40	56
426	D-γ-Tocopherol	Vitamin	CMG20/P30	5-40	56
427	D-δ-Tocopherol	Vitamin	CMG20/P30	5-40	56
428	D-α-Tocopherol	Vitamin	CMG20/C04	5-41	56
429	D-β-Tocopherol	Vitamin	CMG20/C04	5-41	56
430	D-γ-Tocopherol	Vitamin	CMG20/C04	5-41	56
431	D-δ-Tocopherol	Vitamin	CMG20/C04	5-41	56
432	D-α-Tocopherol	Vitamin	CMG20/P150	5-42	56
433	D-β-Tocopherol	Vitamin	CMG20/P150	5-42	56
434	D-γ-Tocopherol	Vitamin	CMG20/P150	5-42	56
435	D-δ-Tocopherol	Vitamin	CMG20/P150	5-42	56
436	D-α-Tocopherol	Vitamin	CMG20/C10	5-39	56
437	D-γ-Tocopherol	Vitamin	CMG20/C10	5-39	56
438	D-δ-Tocopherol	Vitamin	CMG20/C10	5-39	56
439	D-γ-Tocotrienol	Vitamin	CMG20/C04	5-39	56
440	D-γ-Tocotrienol	Vitamin	CMG20/P30	5-40	56
441	D-α-Tocotrienol	Vitamin	CMG20/C04	5-41	56
442	D-β-Tocotrienol	Vitamin	CMG20/C04	5-41	56
443	D-γ-Tocotrienol	Vitamin	CMG20/C04	5-41	56
444	D-δ-Tocotrienol	Vitamin	CMG20/C04	5-41	56
445	D-α-Tocotrienol	Vitamin	CMG20/P150	5-42	56
446	D-β-Tocotrienol	Vitamin	CMG20/P150	5-42	56
447	D-γ-Tocotrienol	Vitamin	CMG20/P150	5-42	56
448	D-δ-Tocotrienol	Vitamin	CMG20/P150	5-42	56
449	D-γ-Tocotrienol	Vitamin	CMG20/C10	5-39	56
450	TPN	Nucleotide	CDR10	2-35	19

	Compound	Classification	MCI GEL™ column	Figure	Page
451	Transferrin	Protein	CQA31S	4-14	32
452	Transferrin	Protein	CQA35S	4-14	32
453	Transferrin	Protein	CQH3BP	4-22	36
454	Transferrin	Protein	CQH3BS	4-22	36
455	Transferrin	Protein	CQH3PP	4-23	36
456	Transferrin	Protein	CQH3PS	4-23	36
457	Transferrin	Protein	CMG20/C10	5-18	46
458	Trichloroacetic acid	Carboxylic acid	CK08EH	2-17	12
459	Triethylene glycol	Polyalcohol	CK08EH	2-16	12
460	Trimethylamine	Amine	SCK01	3-2	22
461	TritonX-100	Surfactant	CHPOD/04	5-30	51
462	TritonX-100	Surfactant	ODS-1HU	5-31	51
463	Trypsin inhibitor	Enzyme	CQA31S	4-13	32
464	Trypsin inhibitor	Enzyme	CQA35S	4-13	32
465	Trypsinogen	Protein	CQK30S	4-16	33
466	Trypsinogen	Protein	CQK31S	4-16	33
467	Tryptophan	Amino acid	CHP20/C04	5-2	40
468	D-Tryptophan	D-Amino acid	CRS10W	6-10	58
469	L-Tryptophan	L-Amino acid	CRS10W	6-10	58
470	Tyrosine	Amino acid	CK10U	2-1	7
471	D-Tyrosine	D-Amino acid	CRS10W	6-2	58
472	L-Tyrosine	L-Amino acid	CRS10W	6-2	58
473	3'-UMP	Nucleotide	CDR10	2-36	19
474	5'-UMP	Nucleotide	CDR10	2-36	19
475	Uracil	Nucleic base	CDR10	2-35	19
476	Uric acid	2,6,8-Trioxypurine	CHP20/C04	5-6	41
477	Uridine	Nucleoside	SCK01	3-6	22
478	Urine	Urine	CDR10	2-38	20
479	Ursodeoxycholic acid	Bile acid	CHP20/C04	5-7	41
480	Valine	Amino acid	CK10U	2-1	7
481	Valine	Amino acid	CK10U	2-2	8
482	D-Valine	D-Amino acid	CRS10W	6-2	58
483	L-Valine	L-Amino acid	CRS10W	6-2	58
484	Valsartan	Sartan	CHK40/C04	5-27	50
485	Vitamin B3	Water soluble vitamin	CMG20/C04	5-15	44
486	Vitamin B6	Water soluble vitamin	CMG20/C04	5-15	44
487	Vitamin B12	Water soluble vitamin	CMG20/C04	5-15	44
488	Vitamin C	Water soluble vitamin	CMG20/C04	5-15	44
489	Xanthine	2,6-Dihydroxypurine	CHP20/C04	5-6	41
490	Xylitol	Sugar alcohol	CK08EC	2-4	9
491	Xylitol	Sugar alcohol	CK08EH	2-15	11
492	Xylose	Sugar	CA08F	2-31	17
493	Xylose	Sugar	CDR10	2-37	20
494	Zinc ion	Cation	SCK01	3-7	23

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