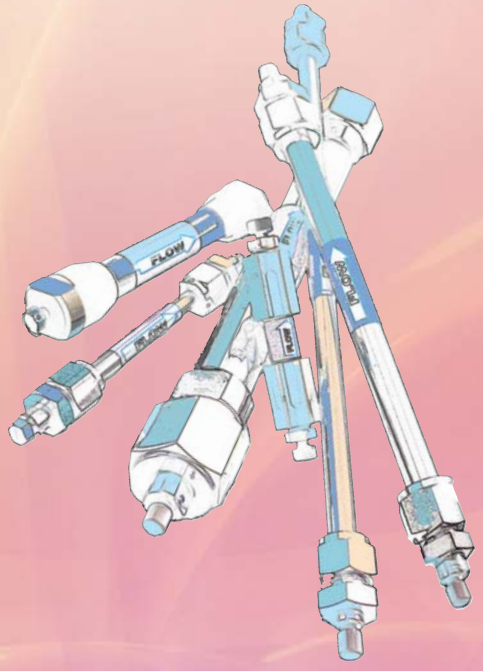
MITSUBISHI CHEMICAL CORPORATION

TECHNICAL
INFORMATION
2008-2009

MCI® GEL

Mitsubishi chemical's packed columns and packing material for HPLC



ISO 9001 Certified
Working to enhance quality management

excellent performance

spherical and sharp particle size distribution

persistence and highest quality

offeres packing materials and packed columns,
under strict quality control

wide range of product line

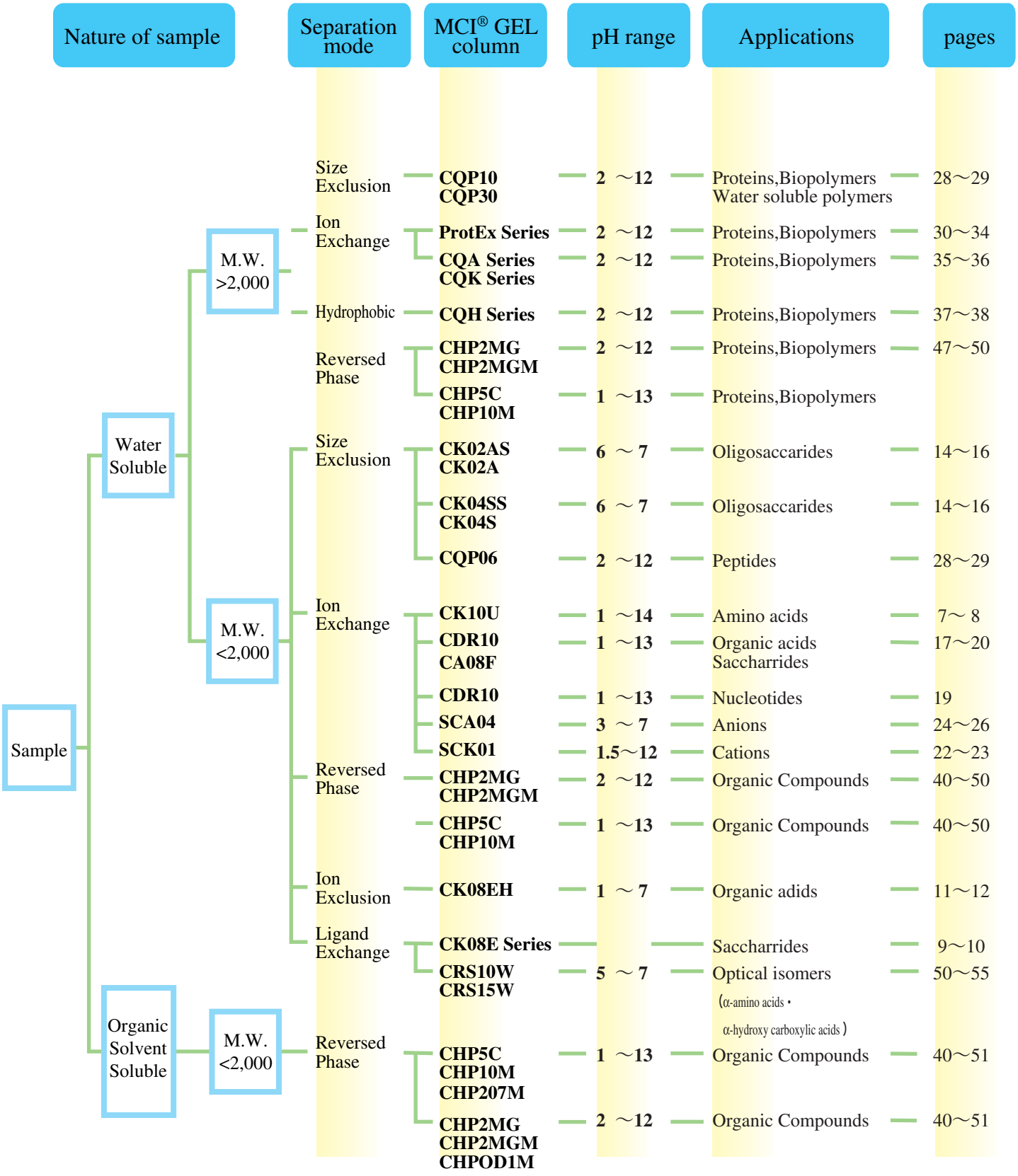
MCI® GEL has been designed based on technology of
the world famous Diaion® and Sepabeads®,
specialized in polymeric packing medias including
from analytical to preparative use,
for ion exchange, reversed phase mode

abundant accumulation of technology and experience

for more than 20 years, MCI® GEL has been used for
HPLC applications

CONTENTS

1 MCI® GEL Column selection guide



Column selection guide

●Variation of MCI® GEL products line

Particle size [μm]	Analytical		Preparative		
	5	10	30	50	150
Ion exchange	CK CA CDR10 ProtEx	CK CA CQA_S CQK_S	CK CA PrepEx CQA_P CQK_P		CK CA
Ion chromatography	SCA	SCK			
Size exclusion		CQP	CQP_P		
Hydrophobic		CQH3_S	CQH3_P		
Reversed phase	CHP10M CHP2MGM	CHP5C CHP2MG	CHP55A CHP55Y CHP20A CHP20Y CHP2MGY	CHP20P	CHP20P
Ligand exchange	CRS_W				

2 MCI® GEL Ion exchange columns

○Polystyrenic cation exchange resins —CK series—
○Polystyrenic anion exchange resins —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 45 years of manufacturing experience of Diaion® product line. MCI® GEL ion exchange resins for HPLC have been developed with the same attention to performance and quality. For several decades, Mitsubishi Chemical has been providing MCI® GEL ion exchange columns are offered in a variety of chemistries, particle sizes and counter ions to support a broad range of applications.

Features

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

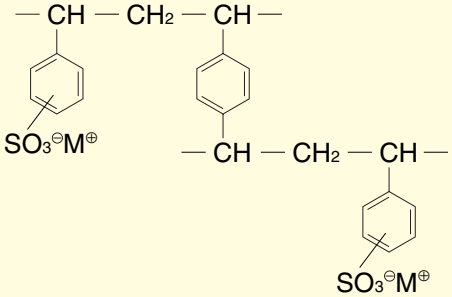
2. Persistence of high quality, excellent separation performance

3. Accumulation of abundant knowledge and experience of applications

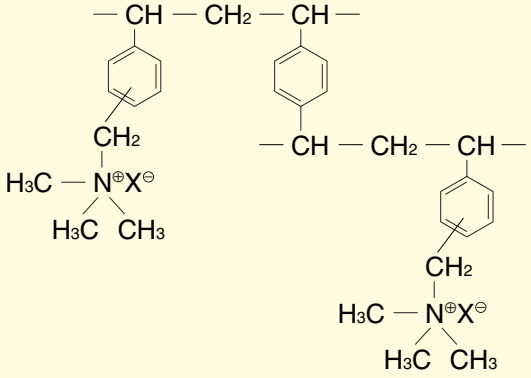
Ion exchange resins are generally used for analysis of amino acids, sugars, organic acids and amines, etc. MCI® GEL custom pre-packed columns are specifically designed for each application using the most appropriate packing material among our product line and using the most suitable column dimensions.
Typical application for each column is shown in this catalog. These data will suggest an appropriate column.

●Chemical structure of ion exchange resin

〈Strongly acidic cation exchange resin〉



〈Strongly basic anion exchange resin〉



●MCI® GEL Columns for HPLC

	Description					Typical usage					
	Product name	Column dimensions I.D×L (mm)	Packing material			Amino acid	Mono, small-saccharide	Oligo-saccharide	Carboxylic acid	Amine	Physiological fluid
			Cross linkage (%)	Counter ion	Particle size (μm)						
MCI® GEL Cation exchange columns	MCI® GEL CK10U	6×120	10	Na^+	5	○				○	
	MCI® GEL CK08S	8×500	8	Na^+	11		○				
	MCI® GEL CK08E	8×300	8	Na^+	9		○				
	MCI® GEL CK08EC	8×300	8	Ca^{2+}	9		○				
	MCI® GEL CK08ES	8×300	8	Ag^+	9		○	○			
	MCI® GEL CK08EH	8×300	8	H^+	9		○		○	○	
	MCI® GEL CK04S	10×200	4	Na^+	11			○			
	MCI® GEL CK04SS	10×200	4	Ag^+	11			○			
	MCI® GEL CK02A	20×250	2	Na^+	20			○			
	MCI® GEL CK02AS	20×250	2	Ag^+	20			○			
MCI® GEL Anion exchange columns	MCI® GEL CA08F	4.6×250	8	$C\ell^-$	7		○		○		
	MCI® GEL CDR10	4.6×250	porous	AcO^-	7		○		○		○

●Description of a gel type ion exchange column

MCI® GEL CK08EC

- for HPLC use
- Cation=K, Anion=A
- DVB%
- Particle size (mode): A=20μm, S=11μm, E=9μm, F=7μm, U=5μm
- Counter ion: no letter=Na^+, C=Ca^{2+}, S=Ag^+, H=H^+

●Note ; Pre-column and guard column

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

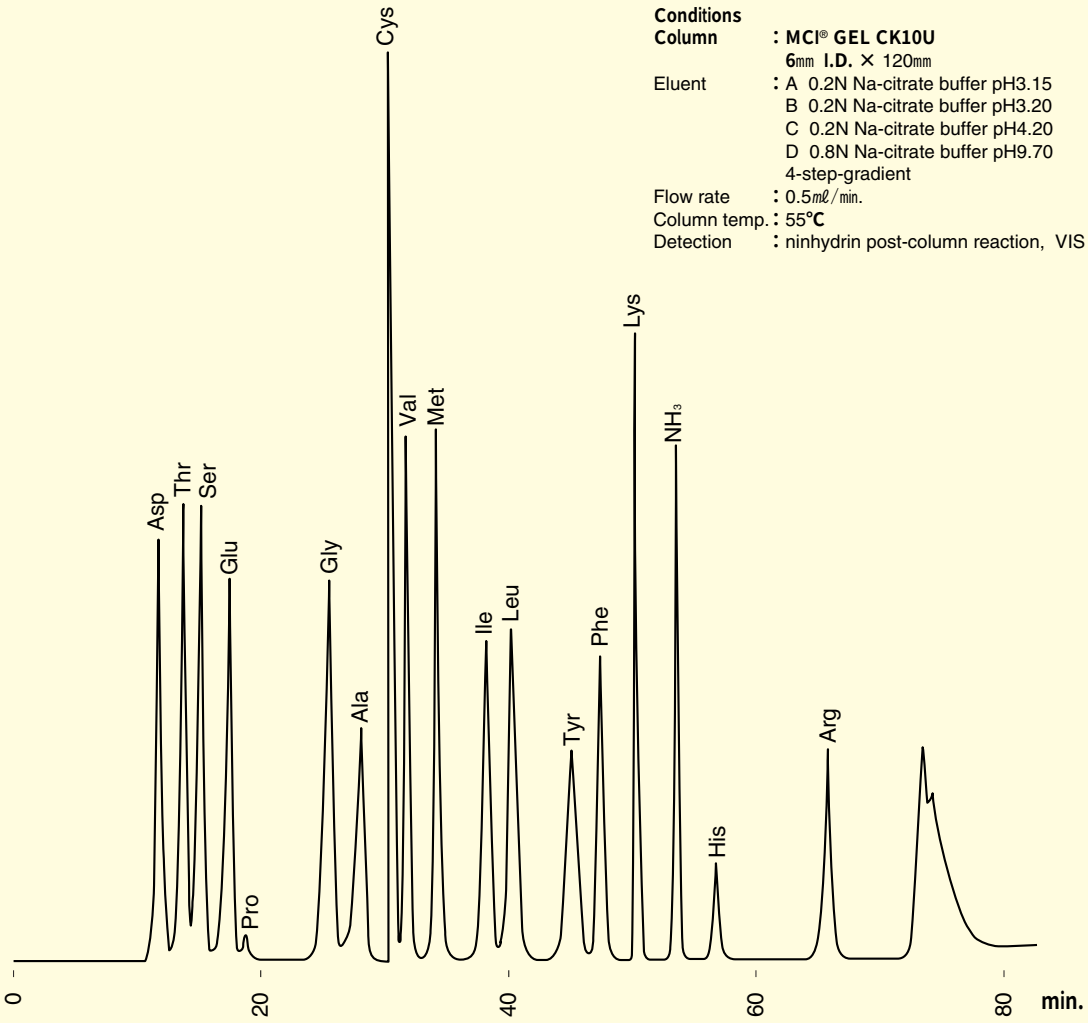
CK10U

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

CK10U 6×120

Separation of amino acids

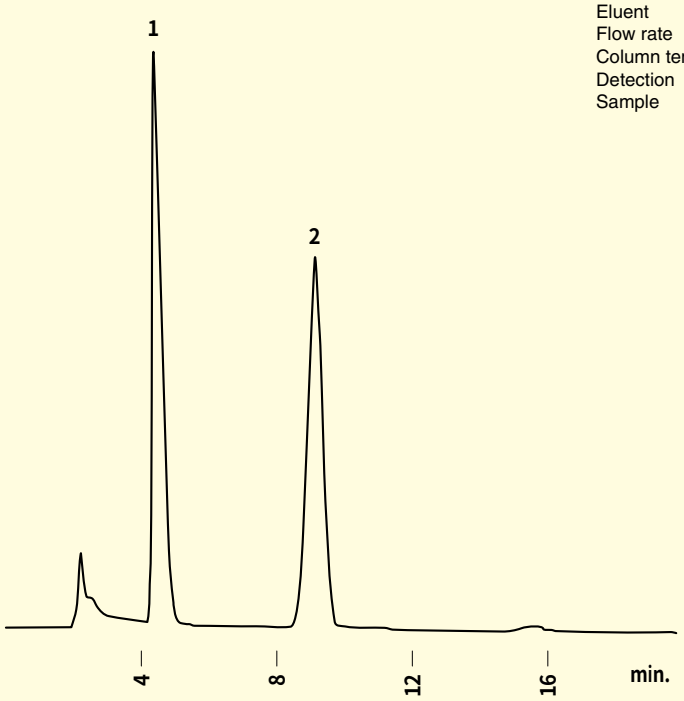
Fig. 2-1 Protein hydrolyzates amino acids



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.

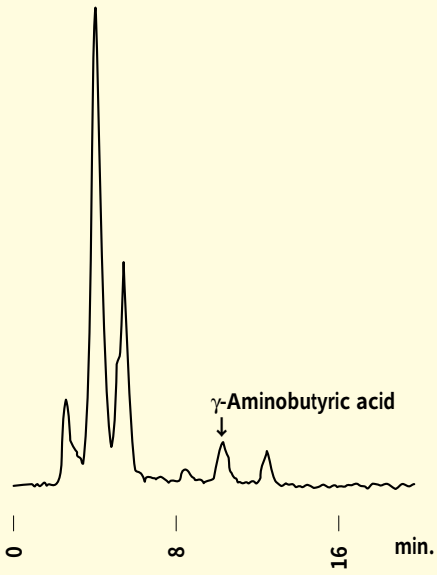
Separation of amino acids

Fig. 2-2 Valine, β-Alanine



Conditions
Column : **MCI® GEL CK10U**
6mm I.D.×120mm
Eluent : **0.3M Na-phosphate pH5.0**
Flow rate : **0.5mℓ/min**
Column temp. : **40°C**
Detection : **210nm**
Sample : **1. Valine**
2. β-Alanine

Fig. 2-3 γ-Aminobutyric acid



Conditions
Column : **MCI® GEL CK10U**
6mm I.D.×120mm
Eluent : **0.2N Na-Citrate buffer pH5.2**
Flow rate : **0.5mℓ/min**
Column temp. : **55°C**
Detection : **570nm**

2 MCI® GEL

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
MCI® GEL CK08S MCI® GEL CK08E	Na^+	General sugar separation columns
MCI® GEL CK08EC	Ca^{2+}	The most general sugar separation column Highly recommended for fructose and glucose
MCI® GEL CK08ES	Ag^+	Gel permeation chromatographic effect
MCI® GEL CK08EH	H^+	Organic acids with H_3PO_4 eluent; sugars with distilled water eluent

Application data of CK08EC

Fig. 2-4 Sugars

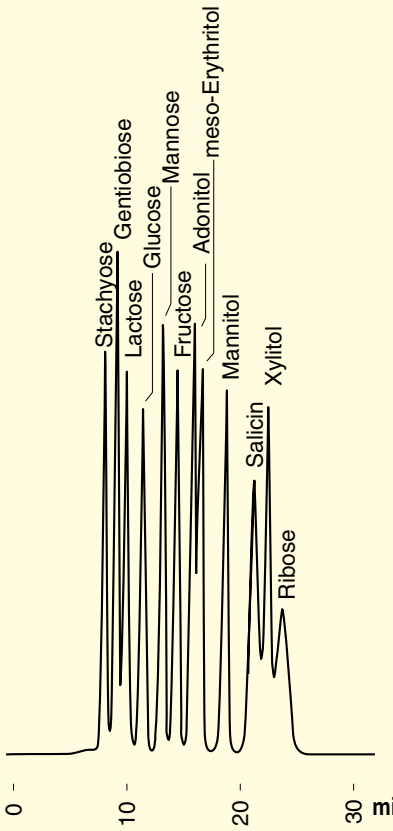
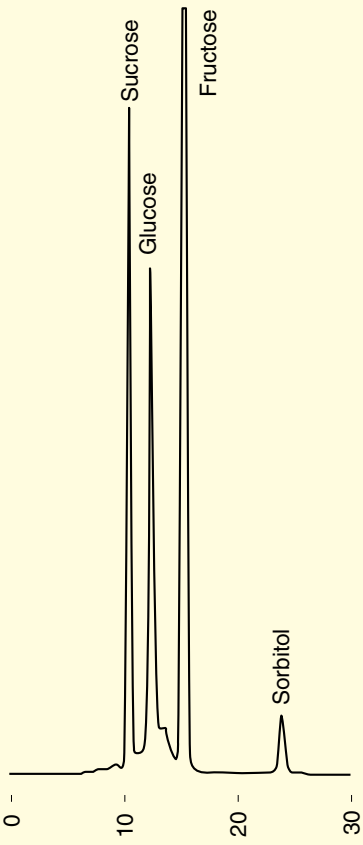
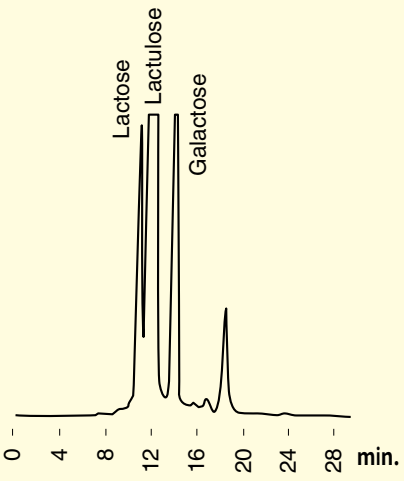


Fig. 2-5 Apple juice



Conditions
Column : MCI® GEL CK08EC 8㎜ I.D.×300㎜
Eluent : H_2O
Flow rate : 0.6㎖/min
Column temp. : 75℃
Detection : RI

Fig. 2-6 Lactulose syrup



Application data of CK08EC

Fig. 2-7 Sports drink A

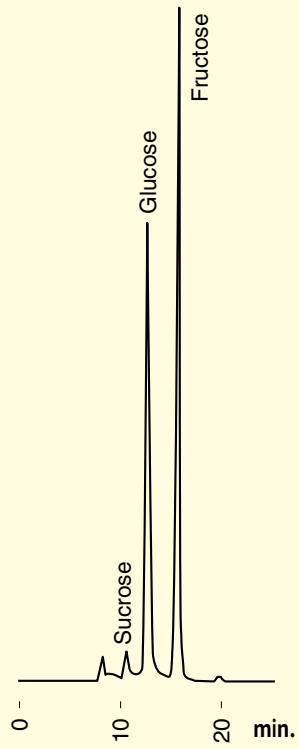


Fig. 2-8 Sports drink B

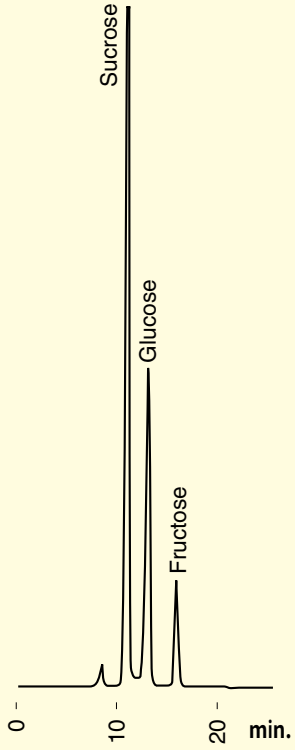


Fig. 2-9 Honey

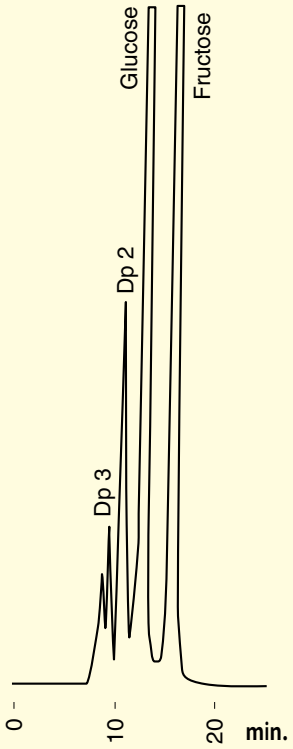


Fig. 2-10 Jam

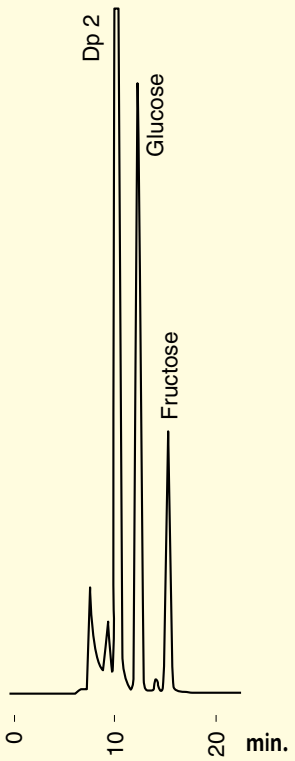
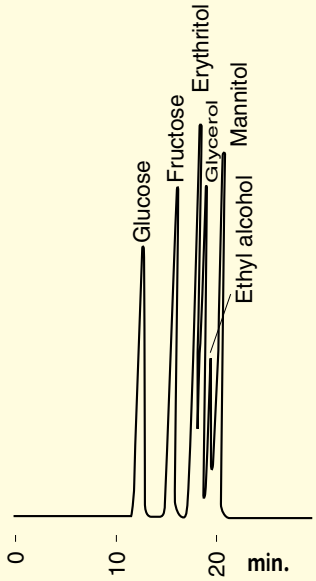


Fig. 2-11 Sugars/Alcohols



Conditions

Column	**: MCI® GEL CK08EC 8㎜ I.D.×300㎜**
Eluent	**: H_2O**
Flow rate	**: 0.6㎖/min**
Column temp.	**: 75℃**
Detection	**: RI**

Application data of CK08EH

Fig. 2-12 Carboxylic acids

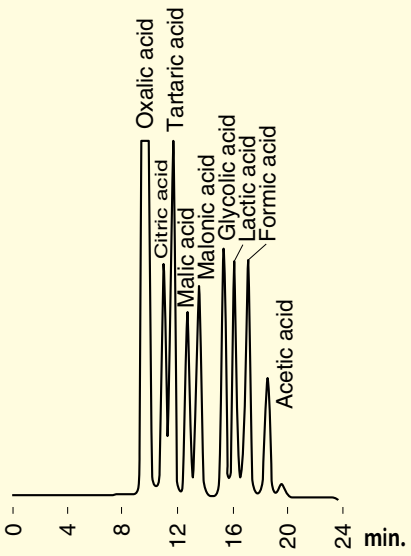


Fig. 2-13 Amino sugars

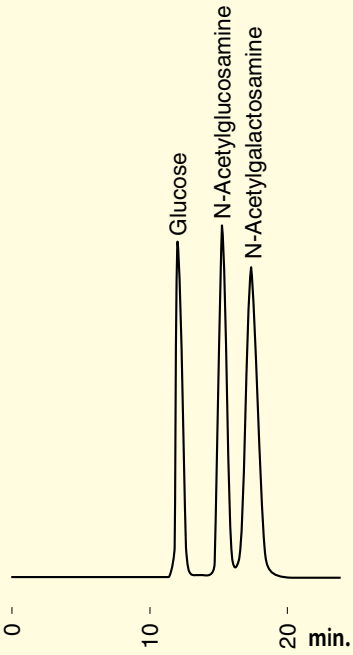
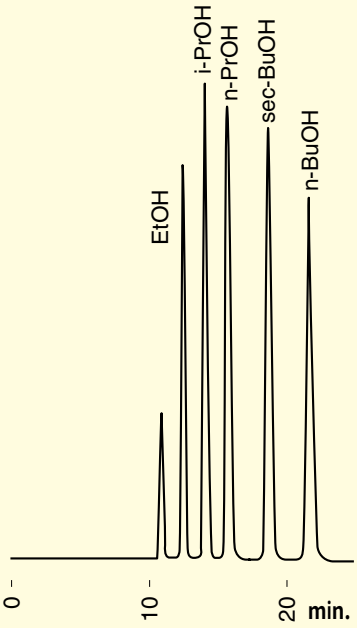


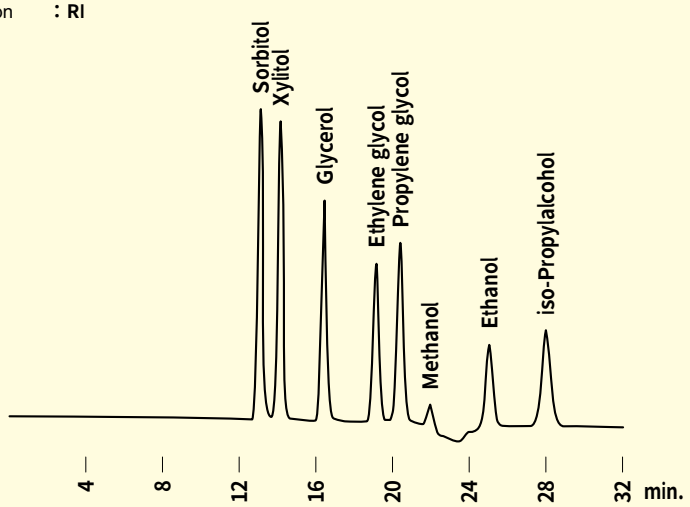
Fig. 2-14 Alcohols



Conditions
Column : MCI® GEL CK08EH, 8mm I.D.×300mm
Eluent : 1% H_3PO_4 (Fig.2-12,2-13), H_2O (Fig. 2-14)
Flow rate : 0.6mℓ/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 : H_2O
Flow rate : 0.6mℓ/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% H_3PO_4**
Flow rate : **0.6mℓ/min**
Column temp. : **25°C**
Detection : **RI**

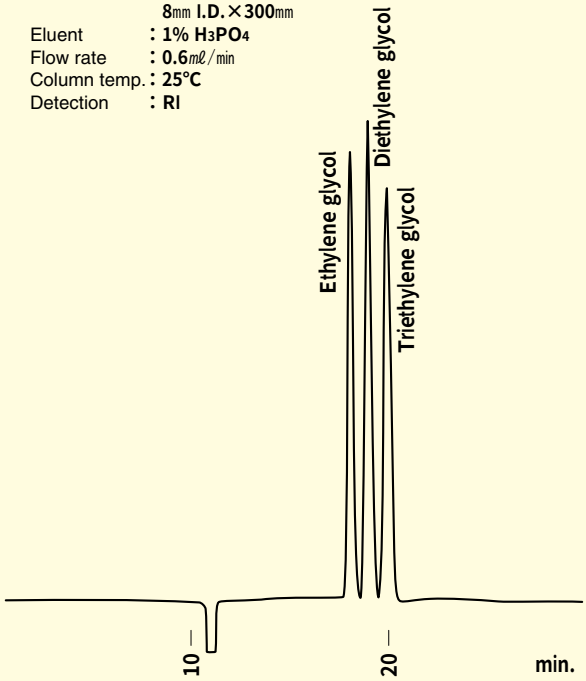


Fig. 2-17 Chloroacetic acids

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

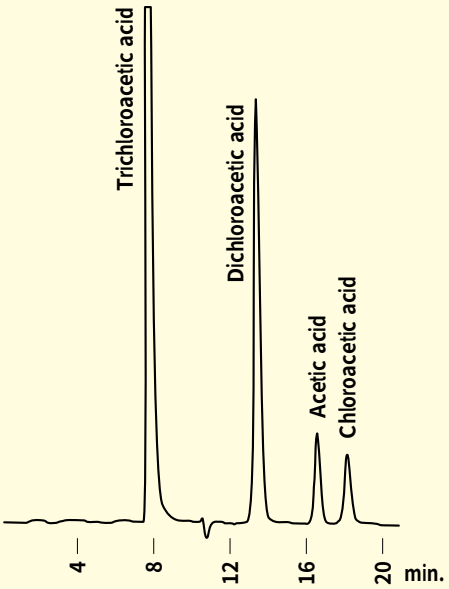
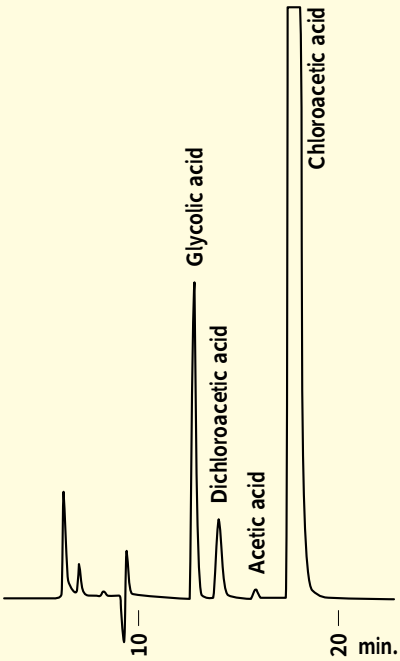
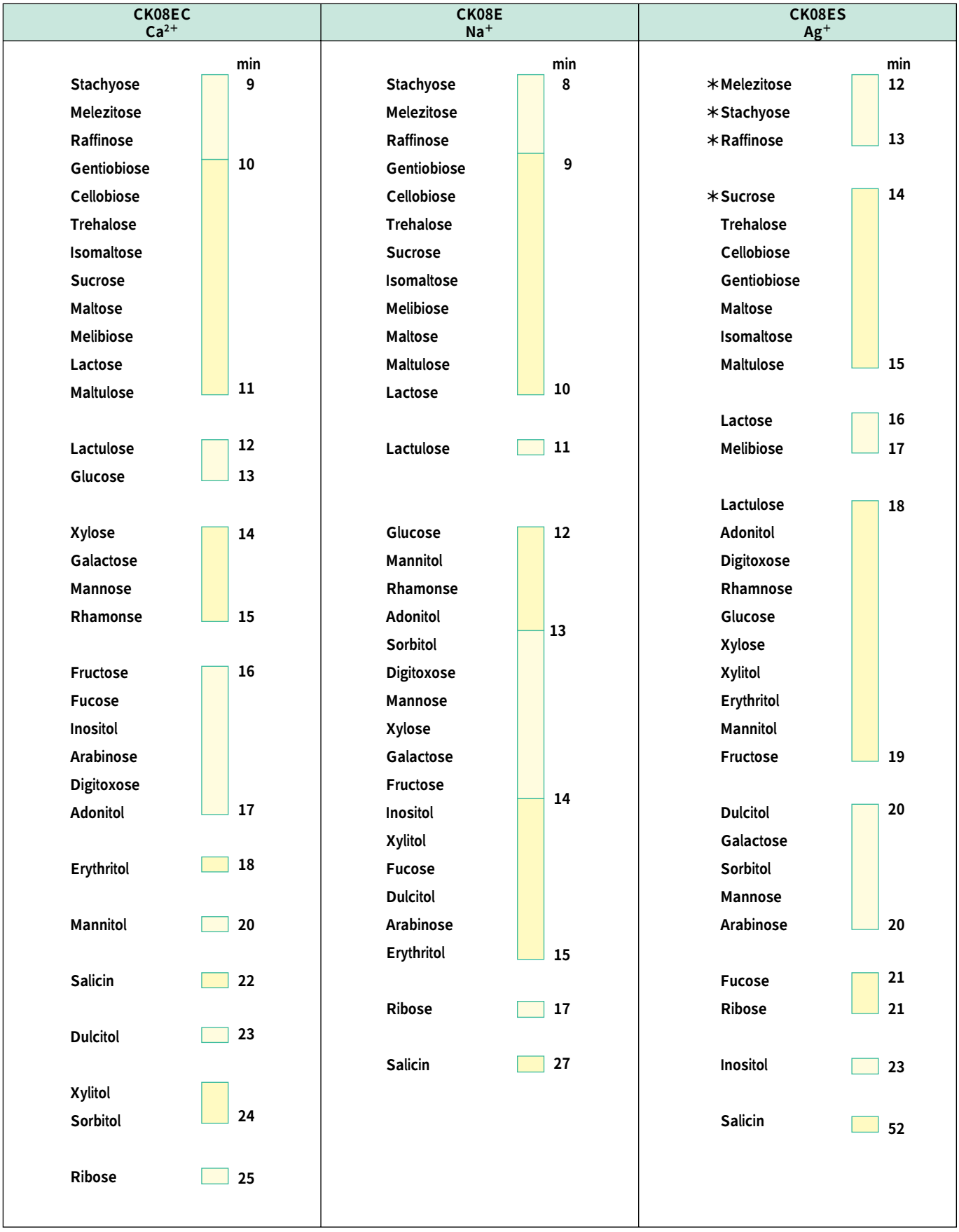


Fig. 2-18 Carboxylic acids

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



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



Column temp : CK08EC…75°C, CK08E…45°C, CK08ES…75°C
Column size : 8㎜ I.D.×300㎜
Elueunt : H_2O
Flow rate : 0.6㎖/min
Sample : 1% aq. solution
Injection vol. : 20μl

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

CK04S, CK04SS, CK02A, CK02AS

Cation exchange columns applications ; oligosaccharides

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

CK02A 20×250

CK04S 10×200

CK04SS 10×200

●Separation ability of each column

MCI® GEL column	Counter ion	Separation ability (degrees 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 curve of malto-oligosaccharides

Fig. 2-19

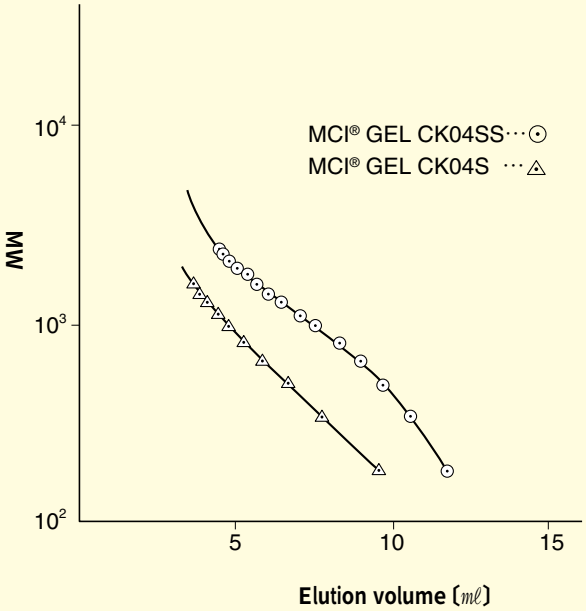
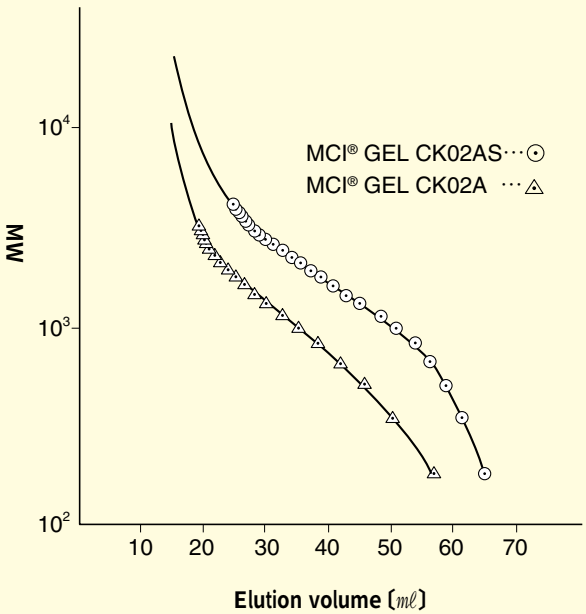


Fig. 2-20



Comparison data of malto-oligosaccharides

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

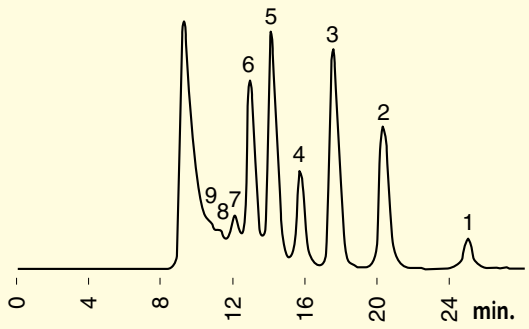


Fig. 2-22 MCI® GEL CK04SS
10mm I.D.×200mm

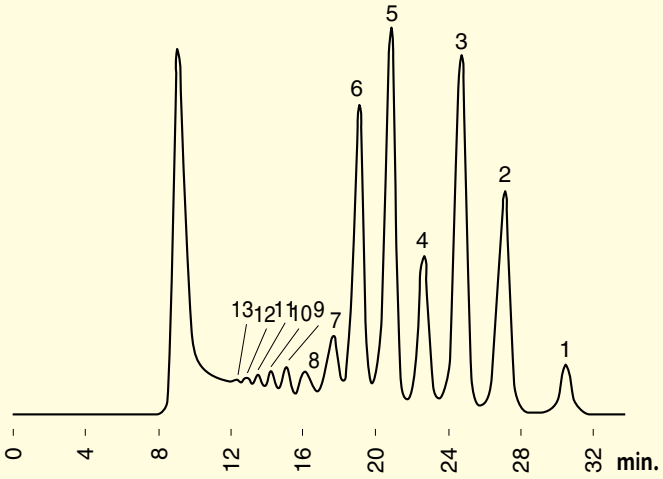


Fig. 2-23 MCI® GEL CK02A
20mm I.D.×250mm

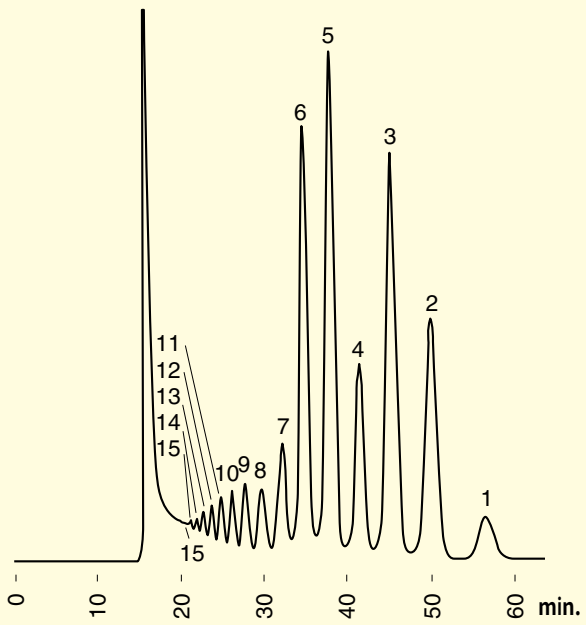
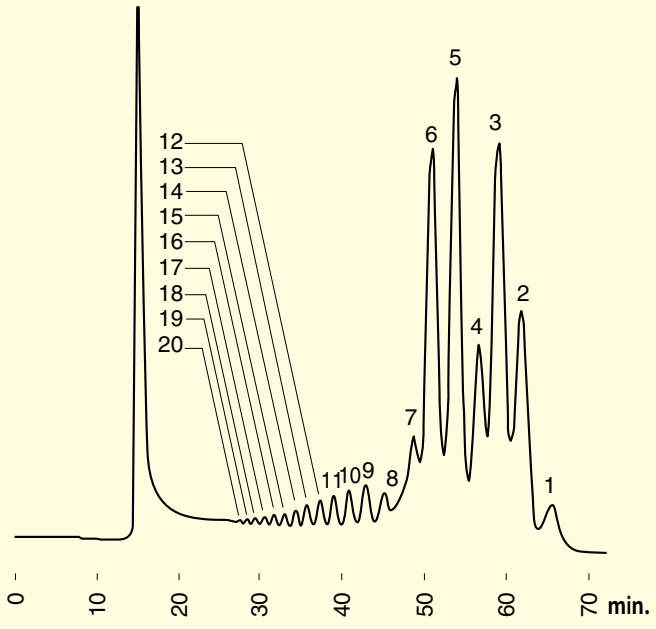


Fig. 2-24 MCI® GEL CK02AS
20mm I.D.×250mm



Conditions
Eluent : H_2O
Flow rate : 0.4mℓ/min (Fig. 2-21, 2-22, 2-25, 2-26)
1.0mℓ/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

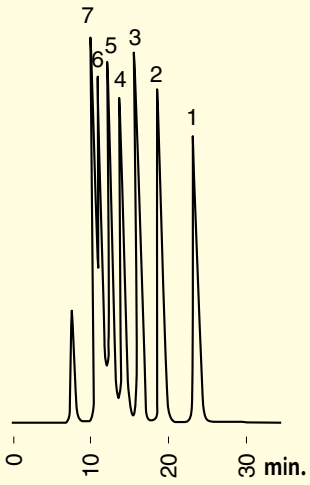


Fig. 2-26 MCI® GEL CK04SS 10mm I.D.×200mm

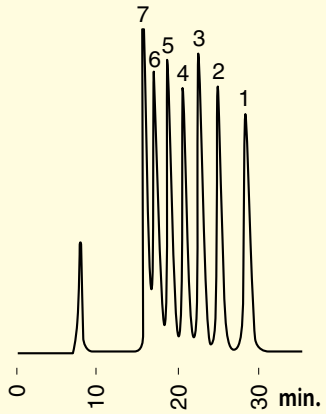
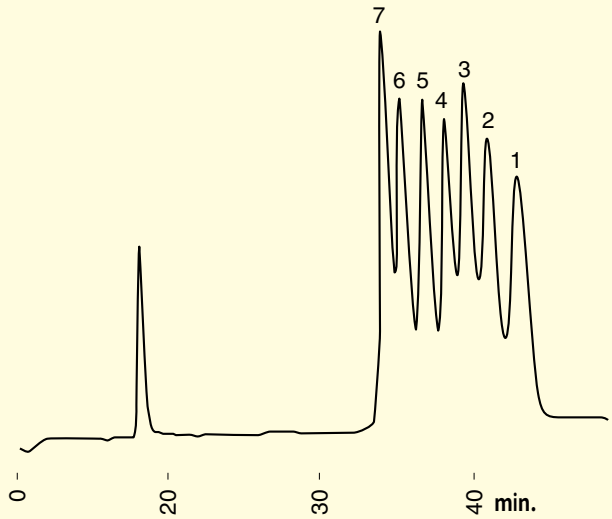


Fig. 2-27 MCI® GEL CK02AS 20mm I.D.×250mm



Application data of CK04S

Fig. 2-28 Honey

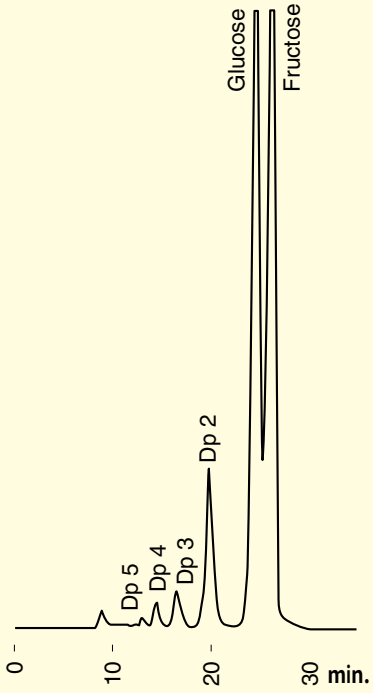


Fig. 2-29 Jam

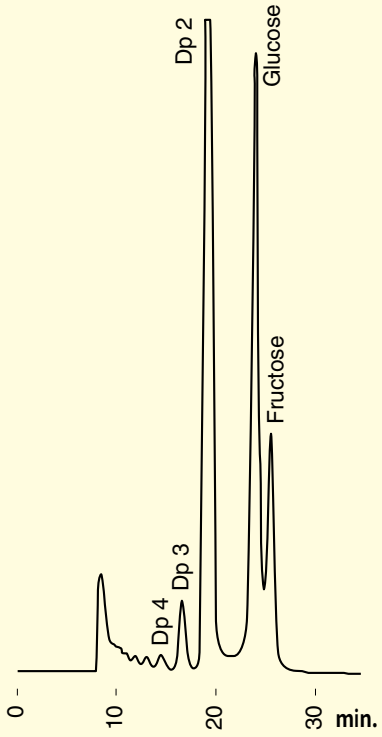
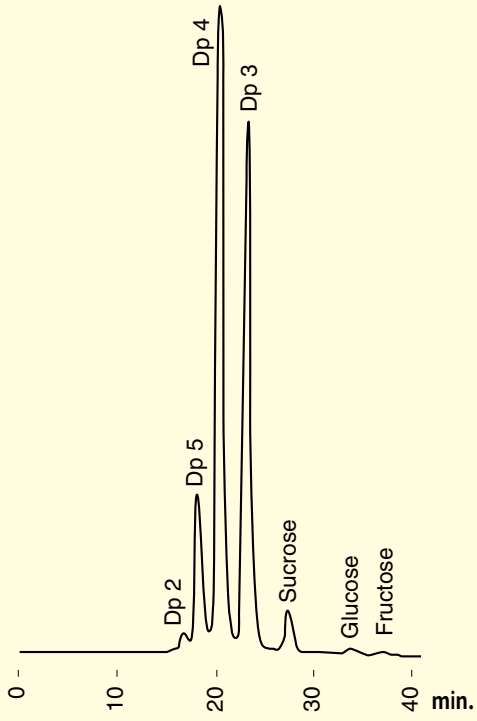


Fig. 2-30 Fructo-oligosaccharides



Conditions

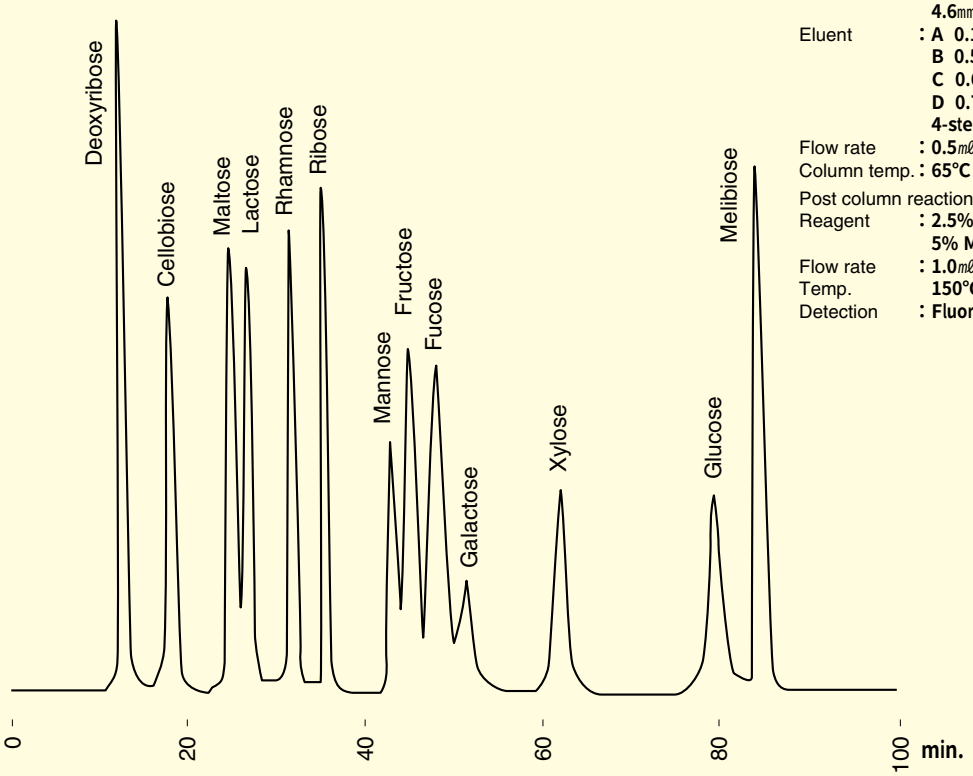
Column	**: MCI® GEL CK04S 10mm I.D.×200mm**
Eluent	**: H_2O**
Flow rate	**: 0.4mℓ/min (Fig. 2-28, 2-29) 0.3mℓ/min (Fig. 2-30)**
Column temp.	**: 85°C (Fig. 2-28, 2-29) 45°C (Fig. 2-30)**
Detection	**: RI**

CA08F

Anion exchange column
applications ; sugars, carboxylic acids, nucleotides

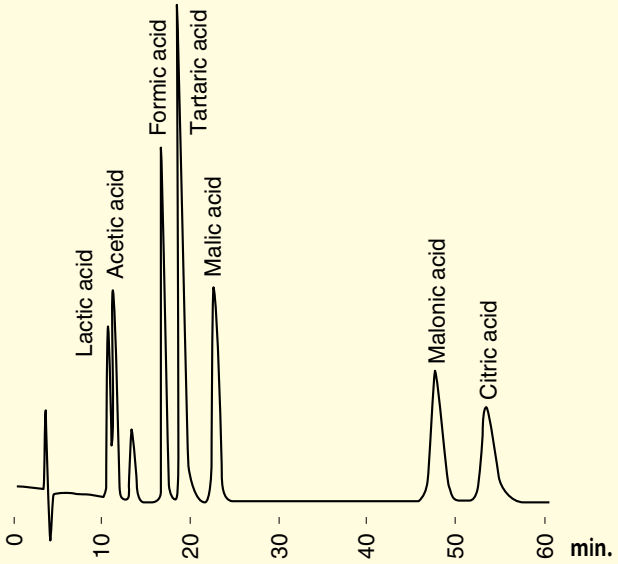
Application data of CA08F

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

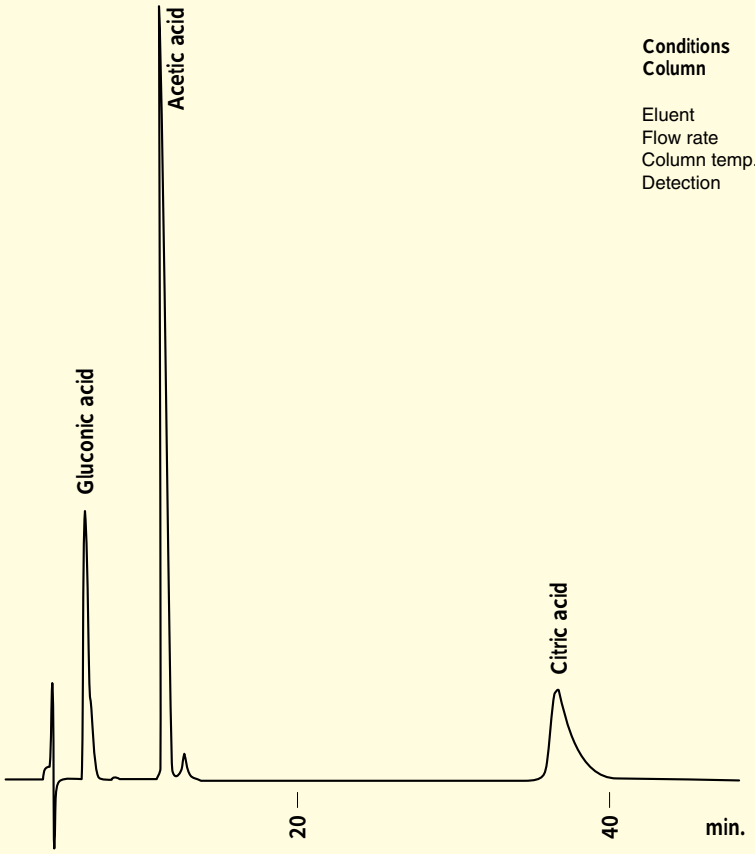
Fig. 2-32 Carboxylic acids



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

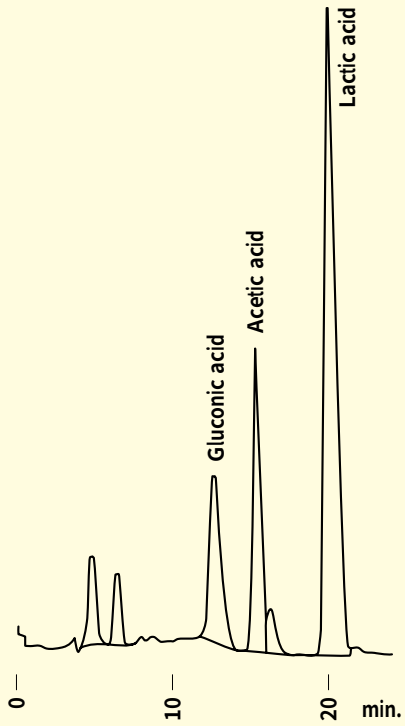
Application data of CA08F

Fig. 2-33 Carboxylic acids



Conditions
Column : MCI® GEL CA08F
4.6㎜ I.D × 250㎜
Eluent **: 0.6M Na_2SO_4 pH2.0**
Flow rate **: 0.5㎖/min**
Column temp. **: 60℃**
Detection **: 210nm**

Fig. 2-34 Carboxylic acids



Conditions
Column : MCI® GEL CA08F
4.6㎜ I.D × 250㎜
Eluent **: 0.1M NaH_2PO_4 pH3.3**
Flow rate **: 0.4㎖/min**
Column temp. **: 55℃**
Detection **: 210nm**

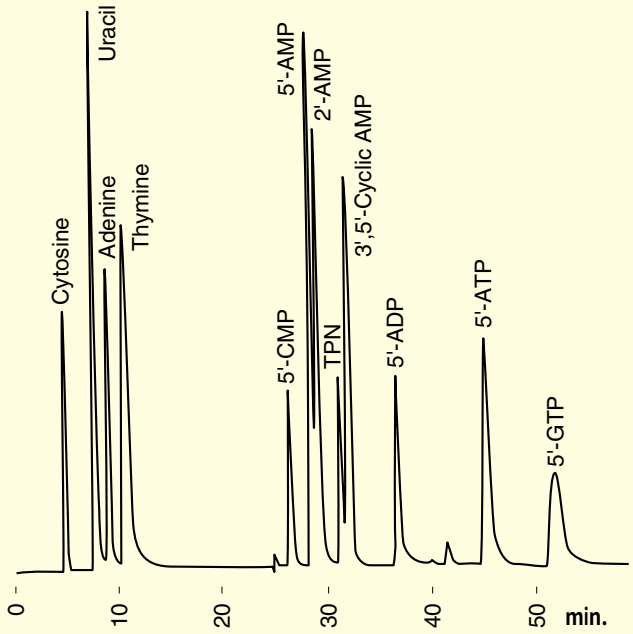
CDR10

Highly porous type anion exchange column

Packing material of MCI® GEL CDR10 column is based on a highly 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.

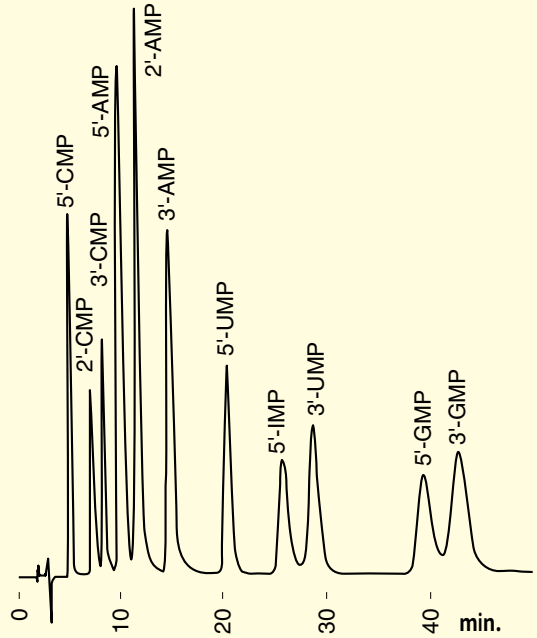
Application data of CDR10

Fig. 2-35 Nucleic acids and related substances



Conditions
Column : MCI® GEL CDR10 4.6mm I.D.×250mm
Eluent : A H_2O
B 6M Acetate buffer pH4.4
A→B 30min linear gradient
Flow rate : 0.5mℓ/min
Column temp. : 60°C
Detection : 254nm

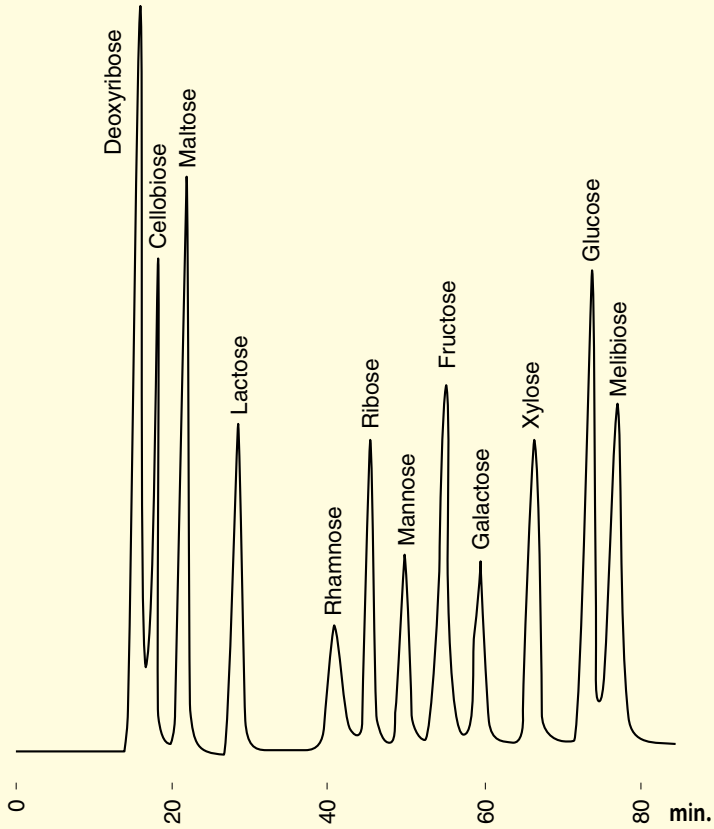
Fig. 2-36 Mono-nucleotides



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

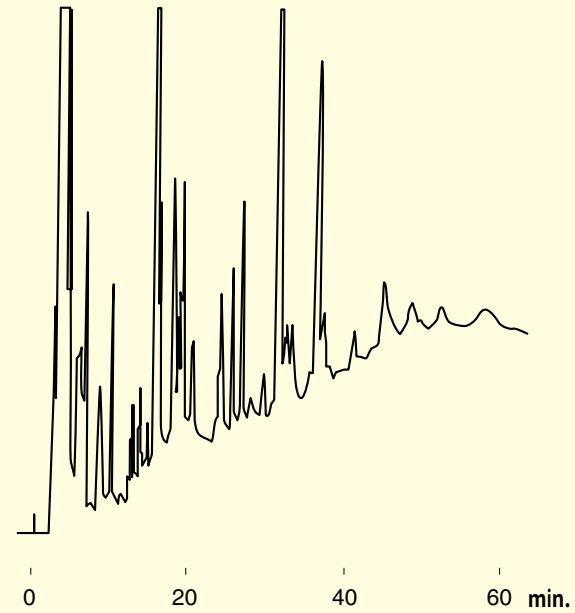
Application data of CDR10

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 : **0.5mℓ/min**
Column temp. : **65°C**
Post column reaction
Reagent : **2.5% Boric acid, 5% Monoethanolamine pH7.9**
Flow rate : **0.5mℓ/min**
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 : **1.0mℓ/min**
Column temp. : **60°C**
Detection : **254nm**

3 MCI® GEL Packed columns for ion chromatography

○For cation analysis : MCI® GEL SCK01, 6mmI.D×50mm
○For anion analysis : MCI® GEL SCA04, 4.6mmI.D×150mm

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.

For cation analysis 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.

For anion analysis MCI® GEL SCA04

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

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

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

Application data of SCK01

Fig. 3-1 Monovalent cations

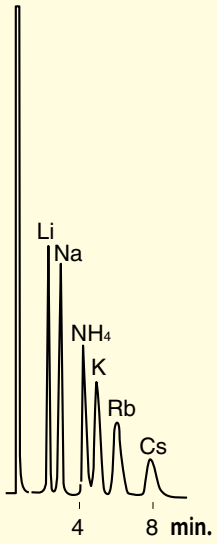


Fig. 3-2 Amines

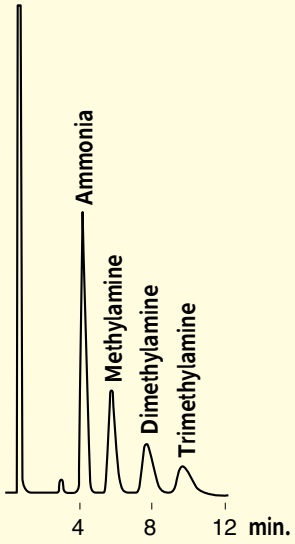


Fig. 3-3 Monovalent cations in rain

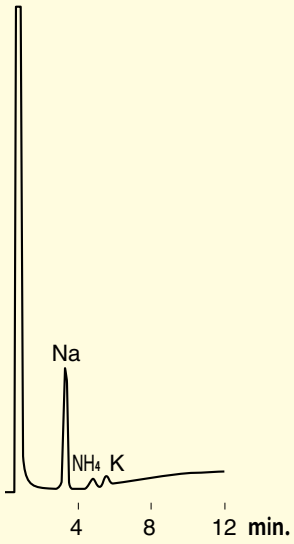


Fig. 3-4 Monovalent cations in tap water

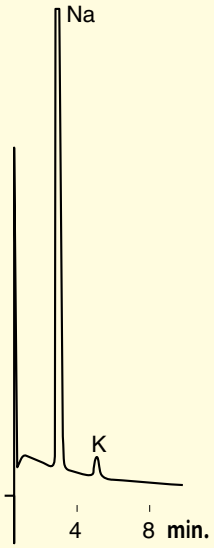


Fig. 3-5 Sports drink

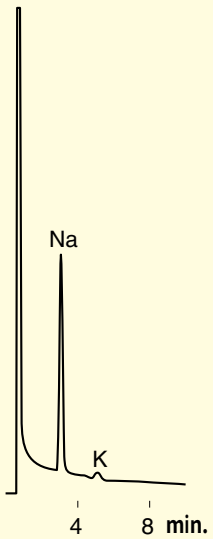
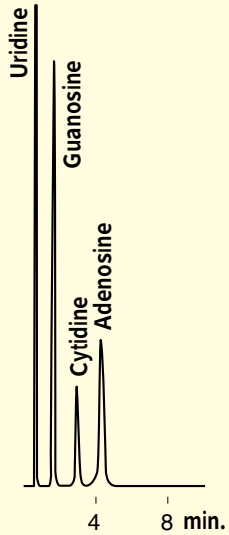


Fig. 3-6 Nucloside



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

Application data of SCK01

Fig. 3-7 Alkaline earth metals

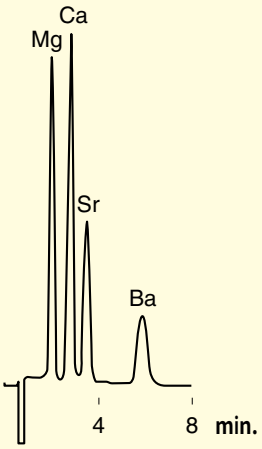


Fig. 3-8 Transition metals

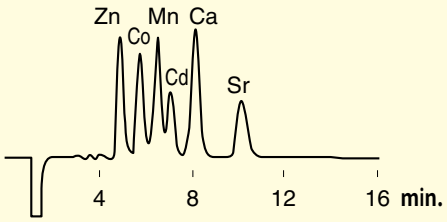


Fig. 3-9 Divalent cations

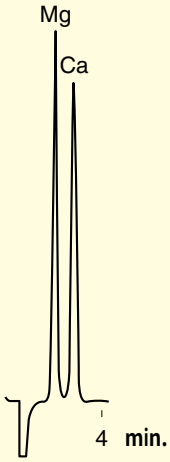


Fig. 3-10 Sports drink A

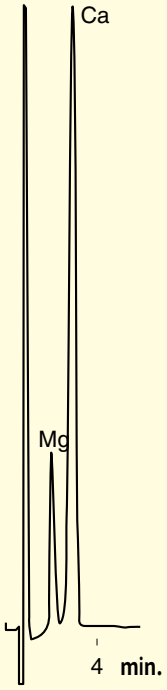
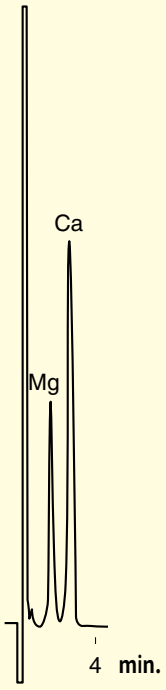


Fig. 3-11 Sports drink B



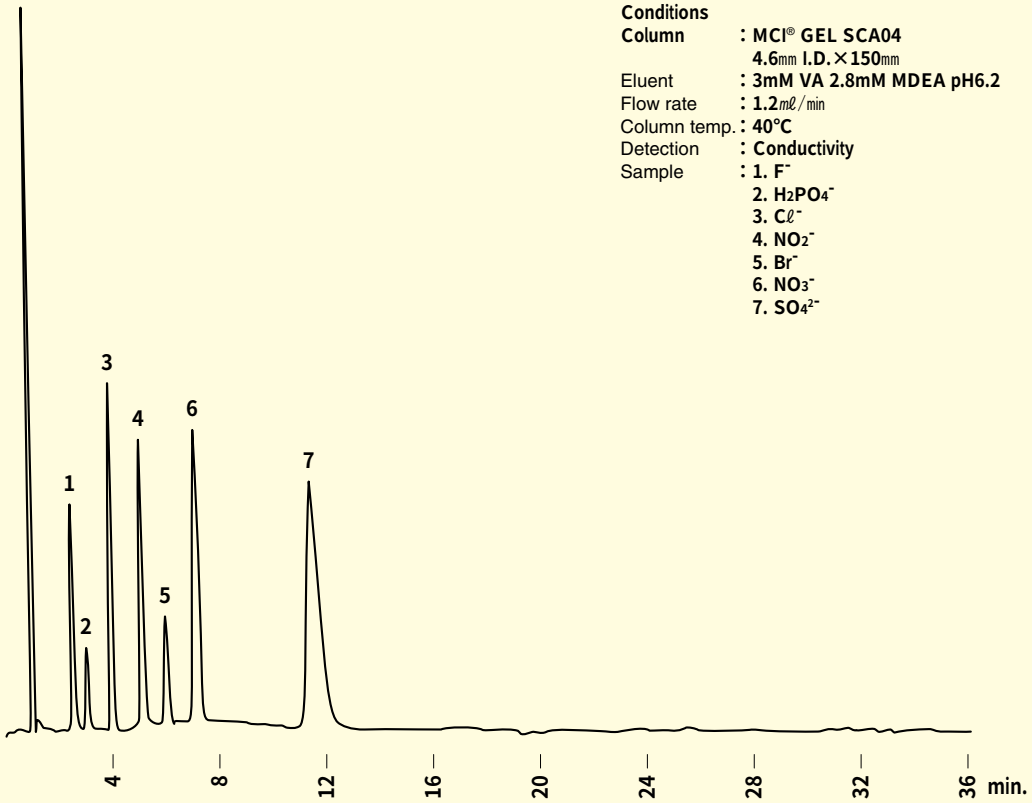
Conditions

Column	**: MCI® GEL SCK01 6㎜ I.D.×50㎜**
	(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㎖/min**
Column temp.	**: 40°C**
Detection	**: Conductivity**

SCA04 4.6×150 PEEK

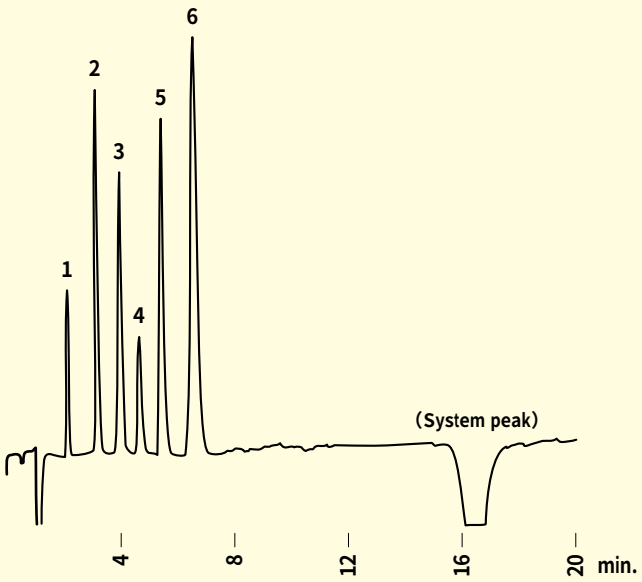
Application data of SCA04

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



Conditions
Column : **MCI® GEL SCA04**
4.6mm I.D.×150mm
Eluent : **3mM VA 2.8mM MDEA pH6.2**
Flow rate : **1.2mℓ/min**
Column temp. : **40°C**
Detection : **Conductivity**
Sample : **1. F^-**
2. $H_2PO_4^-$
3. $Cℓ^-$
4. NO_2^-
5. Br^-
6. NO_3^-
7. SO_4^{2-}

Fig. 3-13 Standard anions eluent ; Potassium hydrogenphthalate

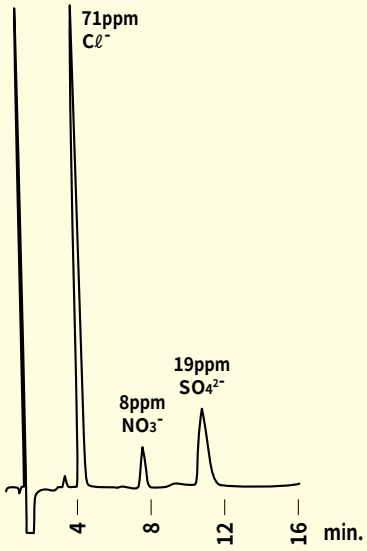


Conditions
Column : **MCI® GEL SCA04**
4.6mm I.D.×150mm
Eluent : **3mM KHP**
Flow rate : **1.2mℓ/min**
Column temp. : **40°C**
Detection : **Conductivity**
Sample : **1. F^-**
2. $Cℓ^-$
3. NO_2^-
4. Br^-
5. NO_3^-
6. SO_4^{2-}

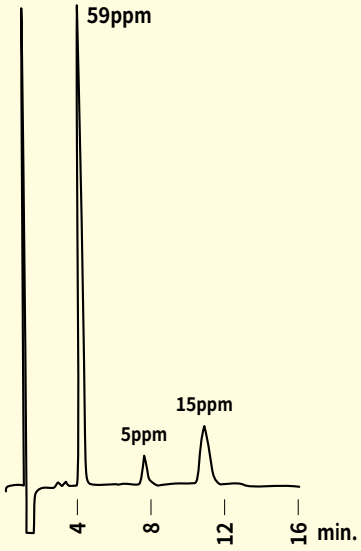
Application data of SCA04

Fig. 3-14 Rain

A; Beginning of rain fall



B; After 4 hours



C; After 38 hours

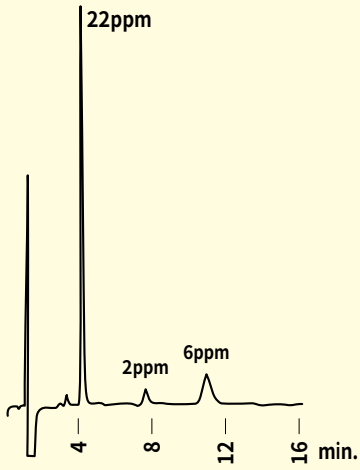
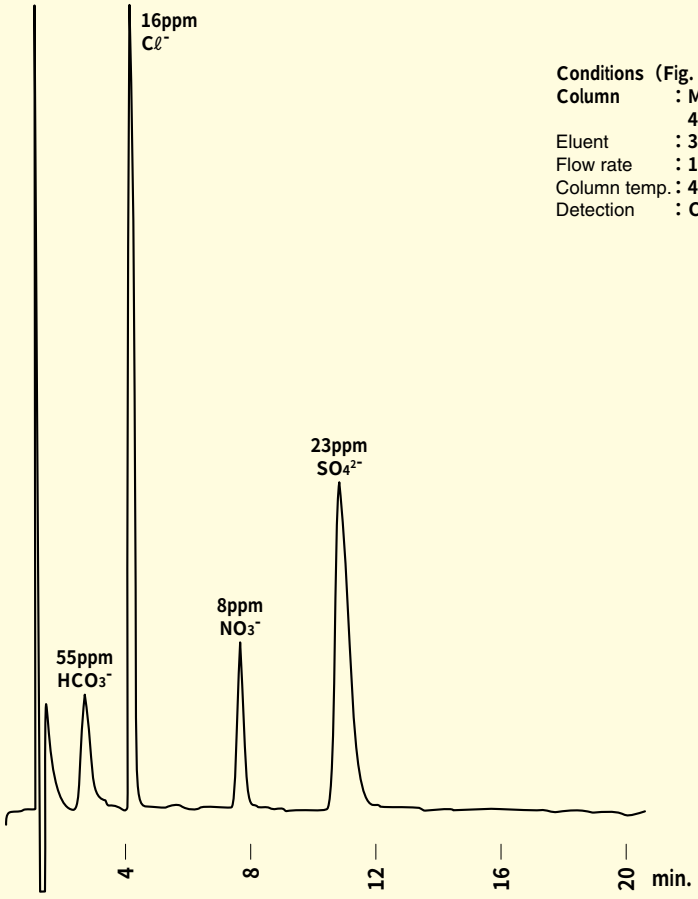


Fig. 3-15 River water

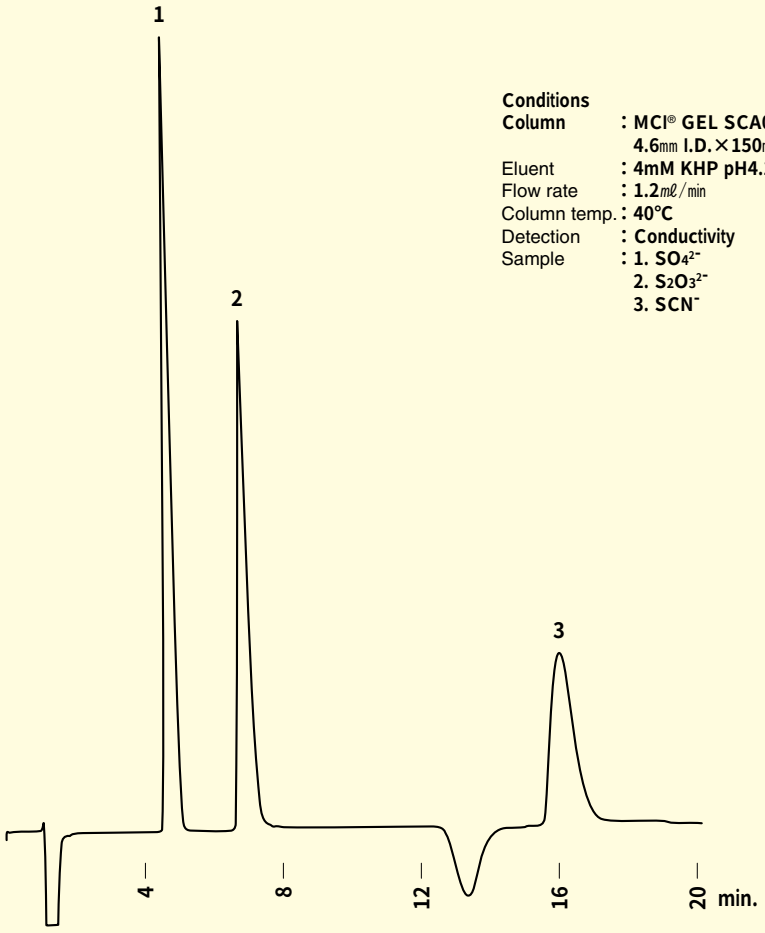


Conditions (Fig. 3-14, 3-15)

Column	: MCI® GEL SCA04 4.6mm I.D.×150mm
Eluent	: 3mM VA 2.8mM MDEA pH6.2
Flow rate	: 1.2mℓ/min
Column temp.	: 40°C
Detection	: Conductivity

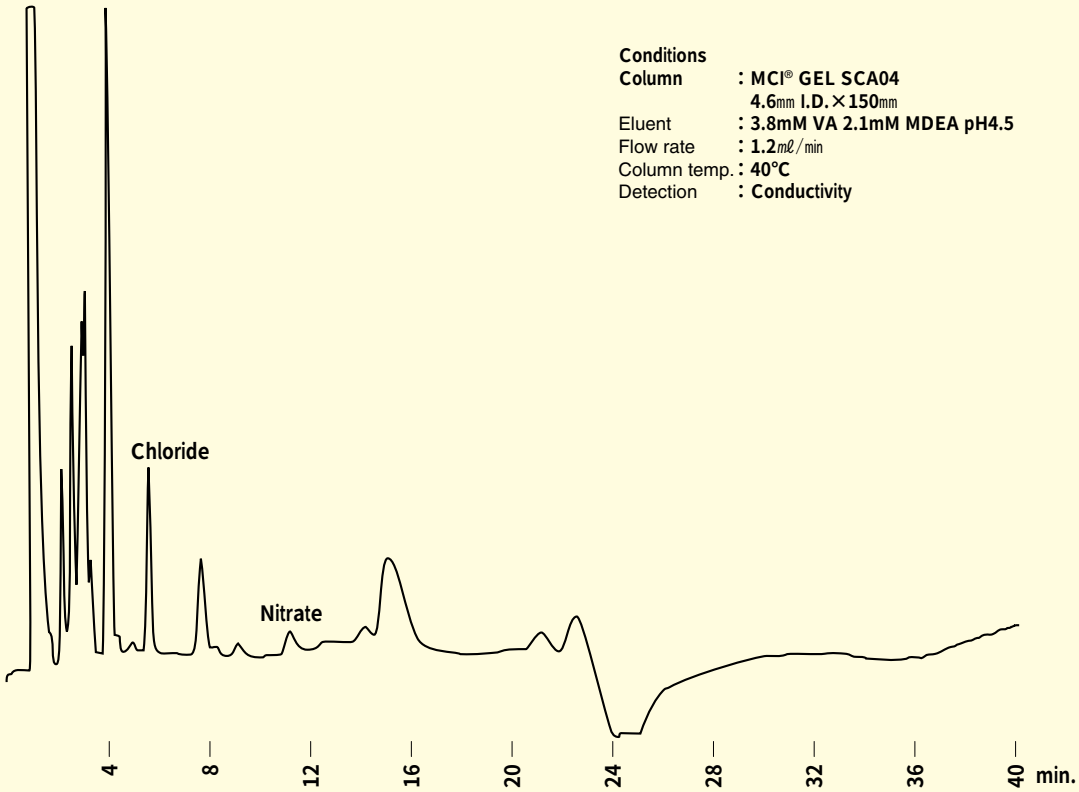
Application data of SCA04

Fig. 3-16 Sulfur compounds



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

Fig. 3-17 Instant coffee



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

4 MCI® GEL Bioseparation columns

◯For size exclusion chromatography
MCI® GEL CQP series
◯For ion exchange chromatography
MCI® GEL ProtEx series,
MCI® GEL CQA/CQK series
◯For hydrophobic interaction chromatography
MCI® GEL CQH series

MCI® GEL 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 is 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 is for hydrophobic interaction chromatography.

Column name	Separation mode	Type
MCI® GEL CQP06	Size exclusion	Exclusion limit MW ~10^3
MCI® GEL CQP10	〃	〃 ~10^4
MCI® GEL CQP30	〃	〃 ~10^6
MCI® GEL ProtEx-DEAE	Anion exchange	DEAE
MCI® GEL CQA31S	〃	DEAE
MCI® GEL CQA35S	〃	QA
MCI® GEL ProtEx-SP	Cation exchange	SP
MCI® GEL CQK30S	〃	SP
MCI® GEL CQK31S	〃	CM
MCI® GEL CQH3ES	Hydrophobic interaction	Ether
MCI® GEL CQH3BS	〃	Butyl
MCI® GEL CQH3PS	〃	Phenyl

CQP series

Aqueous size exclusion columns

Size exclusion chromatography

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	Column dimensions	Packing materials		Theoretical plates number (TP／column)	Exclusion limit (PEG)
		Particle size (μm)	Pore size (nm)		
MCI® GEL CQP06	7.5mm I.D.×600mm	10	12	10000	～1×10^3
MCI® GEL CQP10	7.5mm I.D.×600mm	10	20	6000	～1×10^4
MCI® GEL CQP30	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 available

Package size; 10 g , 25 g , 50 g

Application data of CQP series

Fig. 4-1 Calibration curve

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

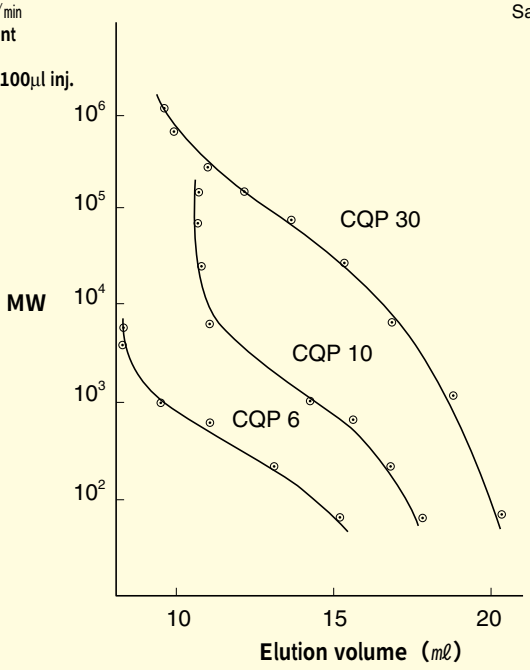


Fig. 4-2 Separation of PEG mixture

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

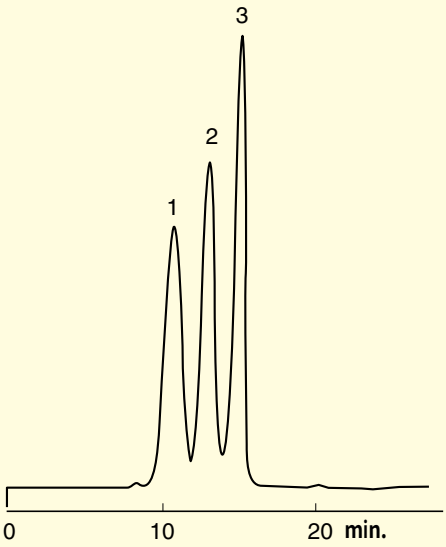


Fig. 4-3 Separation of protein mixture

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

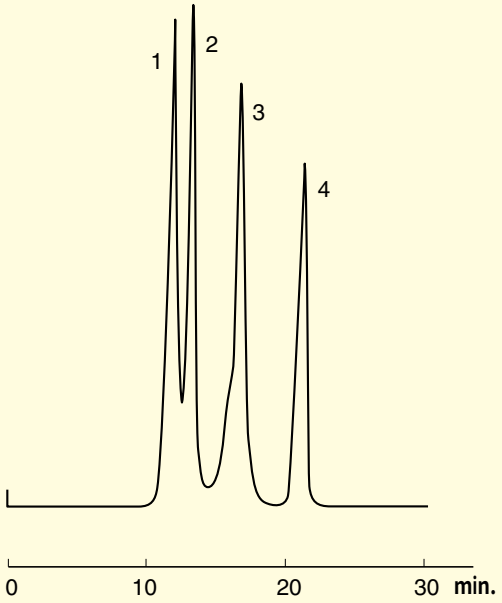
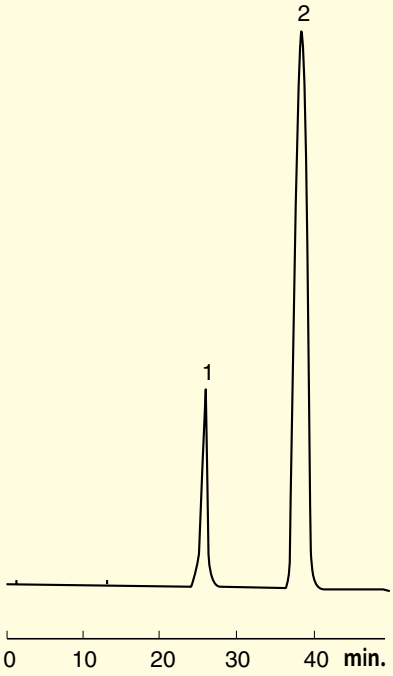


Fig. 4-4 Separation of gluconic acid and glucose

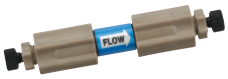
Conditions
Column : MCI® GEL CQP06 7.5mm I.D.×600mm
Eluent : H_2O
Flow rate : 0.8mℓ/min
Column temp. : ambient
Detection : RI
Sample : 1. 5% Gluconic acid
2. 5% Glucose



ProtEx series

Ion exchange chromatography columns

ProtEx-DEAE 4.6×50



ProtEx-SP 4.6×50

ProtEx-DEAE 7.5×100

ProtEx-SP 7.5×100

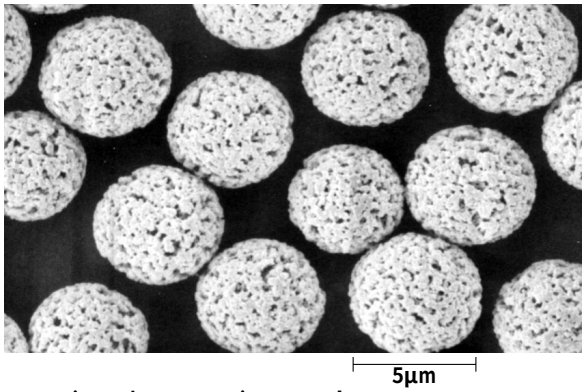
Separation mechanism and Characteristic of ProtEx columns

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.

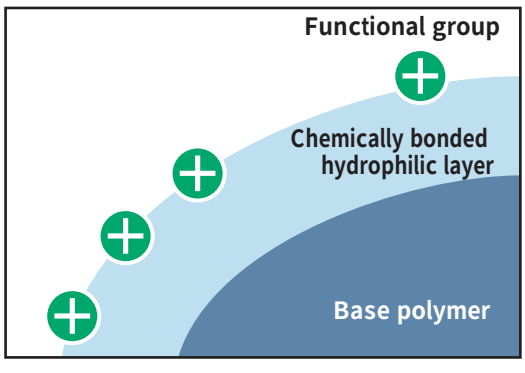
Column list

Column name	Column dimensions	Column format	Packing material		pH range
			Particle size	Functional group	
MCI® GEL ProtEx-DEAE	4.6mm I.D.× 50mm	PEEK	5μm	diethylaminoethyl	2～12
	7.5mm I.D.×100mm	PEEK	5μm	diethylaminoethyl	2～12
MCI® GEL ProtEx-SP	4.6mm I.D.× 50mm	PEEK	5μm	sulfopropyl	1～13
	7.5mm I.D.×100mm	PEEK	5μm	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 proteins mixture

Conditions
Column : MCI® GEL ProtEx-DEAE 4.6mm I.D.×50mm
Eluent : A 20mM Tris-HCl pH8.0
B A+0.5M NaCl
A → B 30min linear gradient
Flow rate : 0.5mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Myoglobin 25μg
2. Conalbumin 25μg
3. Trypsin Inhibitor 50μg

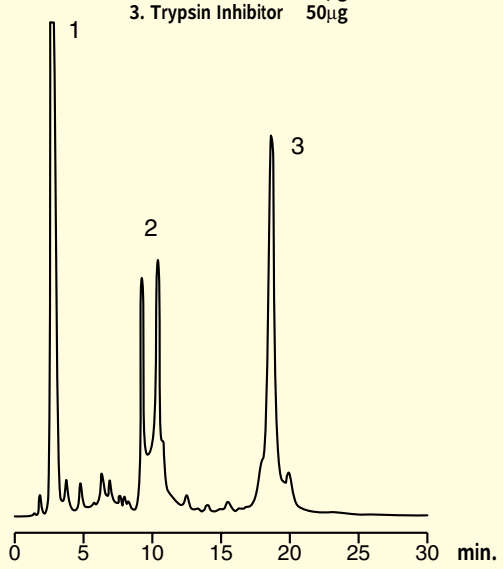


Fig. 4-6 Separation of hemoglobin (Hb) isoforms

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 : 0.5mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Hb A_2 100μg
2. Hb S 100μg
3. Hb A0 100μg

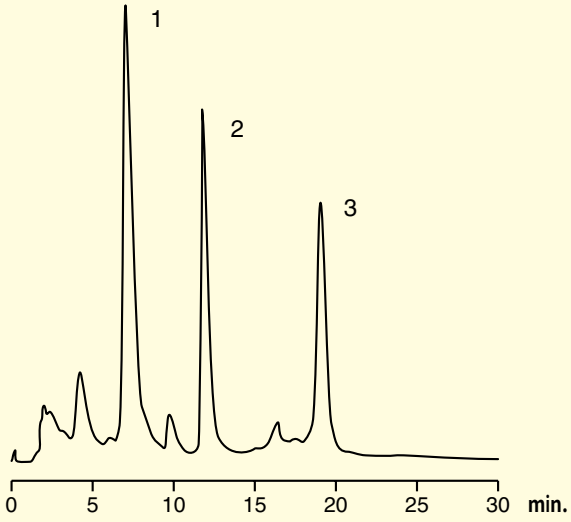


Fig. 4-7 Separation of human growth hormone (hGH)

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 : 0.5mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : recombinant hGH 10μg

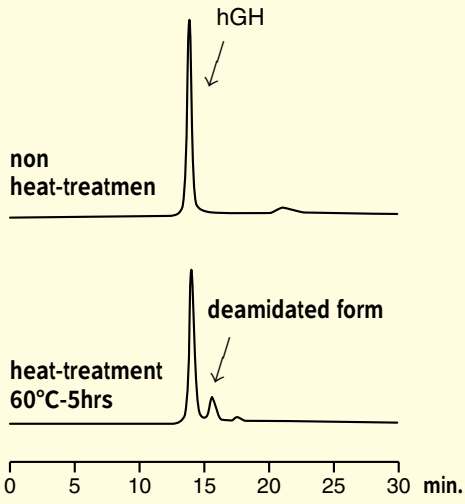


Fig. 4-8 Protein recovery

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 : 0.5mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : recombinant epidermal growth factor (EGF)

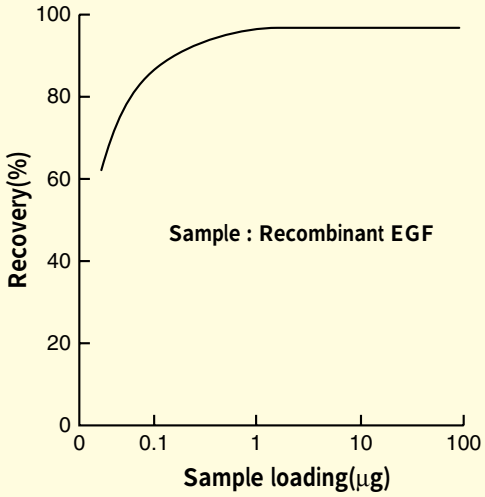


Fig. 4-9 Separation of interleukin 2 (IL-2) coexisting large amount of bovine serum albumin (BSA) as a stabilizer

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 : 0.5mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : recombinant IL-2 1.5μg
1. BSA (stabilizer) 400μg
2. IL-2 (Met-ox)
3. IL-2

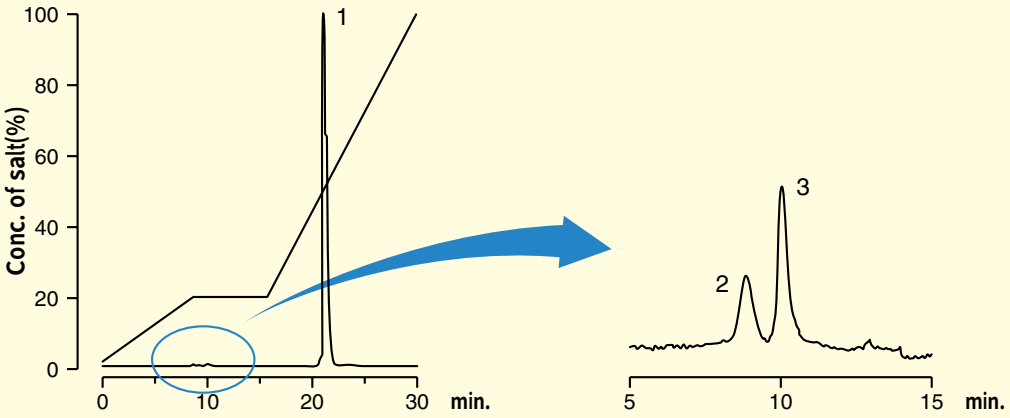


Fig. 4-10 Separation of protein mixture

Conditions
Column : MCI® GEL ProtEx-SP 4.6mm I.D.×50mm
Eluent : A 20mM Phosphate buffer pH6.0
B A+0.5M NaCl
A → B 20min linear gradient
Flow rate : 0.5mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Ribonuclease A 10μg
2. α-Chymotrypshinogen A 5μg
3. Cytochrome C 5μg

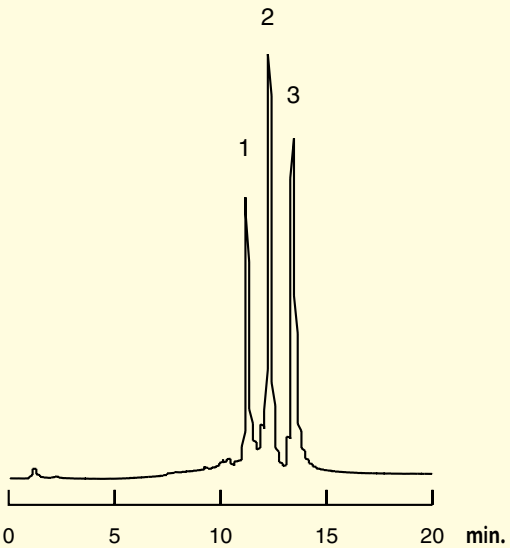


Fig. 4-11 Separation of glycohemoglobin (GHb)

Conditions
Column : MCI® GEL ProtEx-SP 4.6mm I.D.×50mm
Eluent : A 20mM Bis-Tris HCl buffer pH6.0
B A+0.5M NaCl
7% B → 40% B 20min linear gradient
Flow rate : 0.5mℓ/min
Column temp. : ambient
Detection : 415nm
Sample : GHb
1. GHb A1c
2. Hb A0

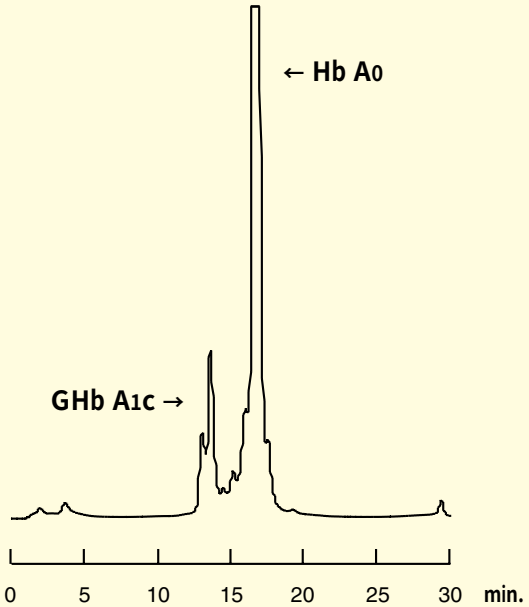
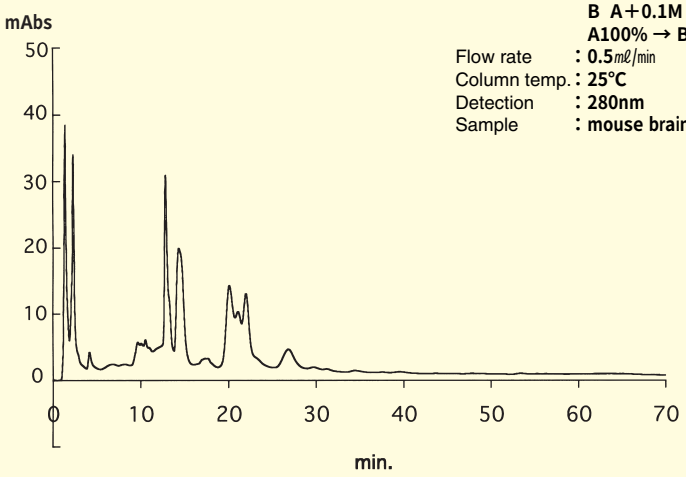


Fig. 4-12 Separation of mouse brain sap



Conditions
Column : MCI® GEL ProtEx-DEAE 4.6mm I.D.×50mm
Eluent : A 20mM HEPES buffer pH8.0
B A+0.1M NaCl
A100% → B100% in 60min. linear gradient
Flow rate : 0.5mℓ/min
Column temp. : 25°C
Detection : 280nm
Sample : mouse brain sap

Fig. 4-13 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 : 0.5mℓ/min
Column temp. : 25°C
Detection : 280nm
Sample : RNA type III from bakers yeast 20μg

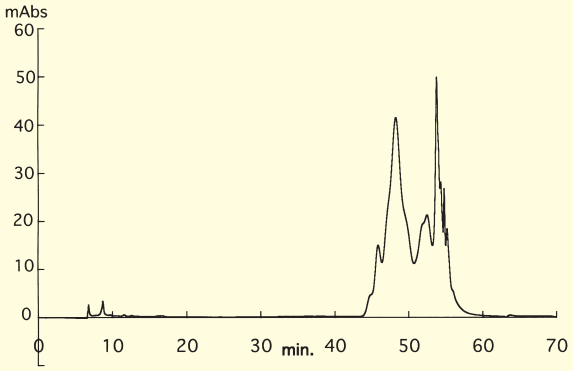


Fig. 4-14 Separation of IgG2b、K(mouse)

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 : 0.5mℓ/min
Column temp. : 25°C
Detection : 280nm
Sample : IgG2b、K (mouse) 10μg

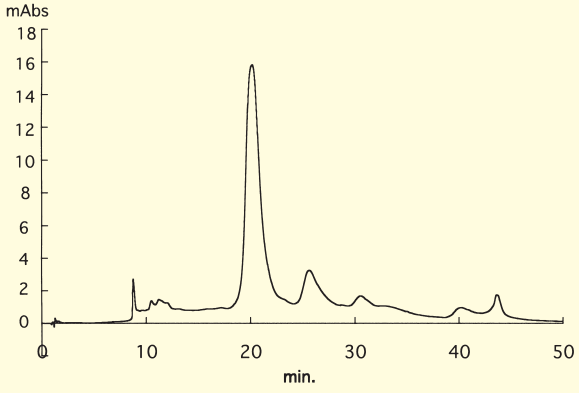


Fig. 4-15 Separation of collagenase

Conditions
Column : **MCI® GEL ProtEx-DEAE 4.6mm I.D.×50mm**
Eluent : **A 20mM HEPES buffer pH8.0**
B A+1.0M NaCl
A100% → B100% in 30min. linear gradient
Flow rate : **0.5mℓ/min**
Column temp. : **25°C**
Detection : **280nm**
Sample : **Collagenase 100μg**

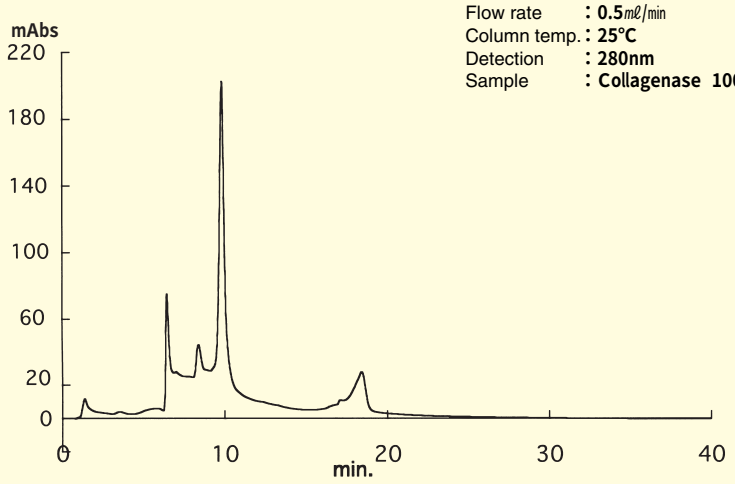


Fig. 4-16 Separation of IgG1 MOPC21 (mouse)

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 : **0.5mℓ/min**
Column temp. : **25°C**
Detection : **280nm**
Sample : **IgG1 MOPC21 (mouse) 10μg**

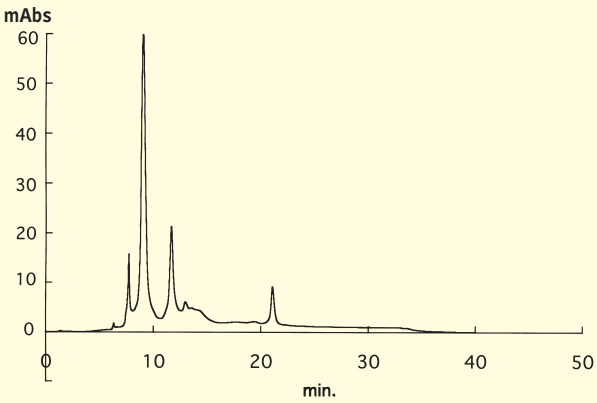
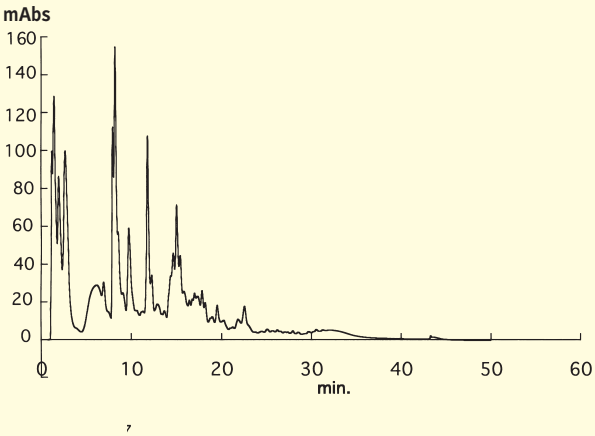


Fig. 4-17 Separation of pancreatin

Conditions
Column : **MCI® GEL ProtEx-DEAE 4.6mm I.D.×50mm**
Eluent : **A 20mM HEPES buffer pH8.0**
B A+1.0M NaCl
A100% → B40% in 30min. linear gradient
Flow rate : **0.5mℓ/min**
Column temp. : **25°C**
Detection : **280nm**
Sample : **Pancreatin 200μg**



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、CQK Series

Column name	Column dimensions	Packing material		pH range
		Particle size (μm)	Functional group	
MCI® GEL CQA31S	7.5mm I.D.×75mm	10	DEAE	2～12
MCI® GEL CQA35S	7.5mm I.D.×75mm	10	QA	2～12
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 available

Package size; 10 g , 25 g , 50 g

Application data of CQA and CQK series

Fig. 4-18 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 : 1.0mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Myoglobin 60μg
2. Ovalbumin 200μg
3. Trypsin Inhibitor 200μg

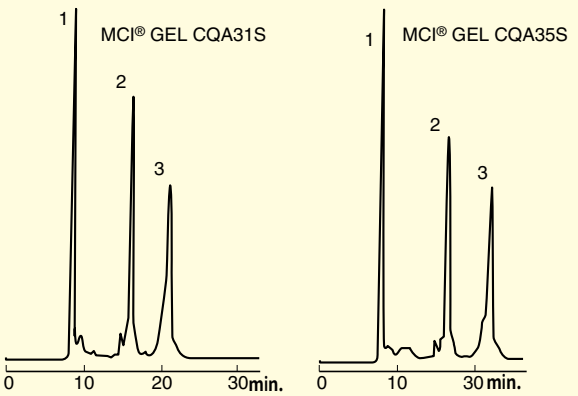
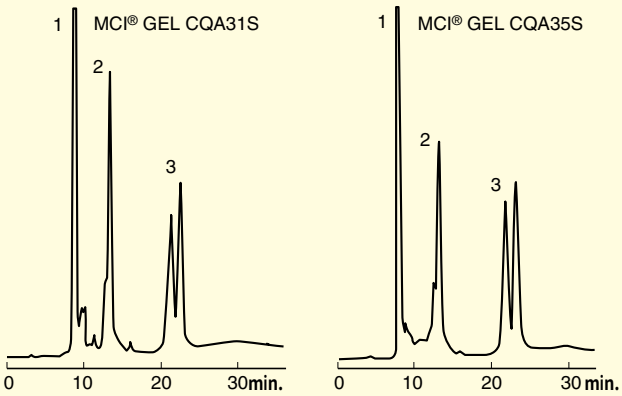


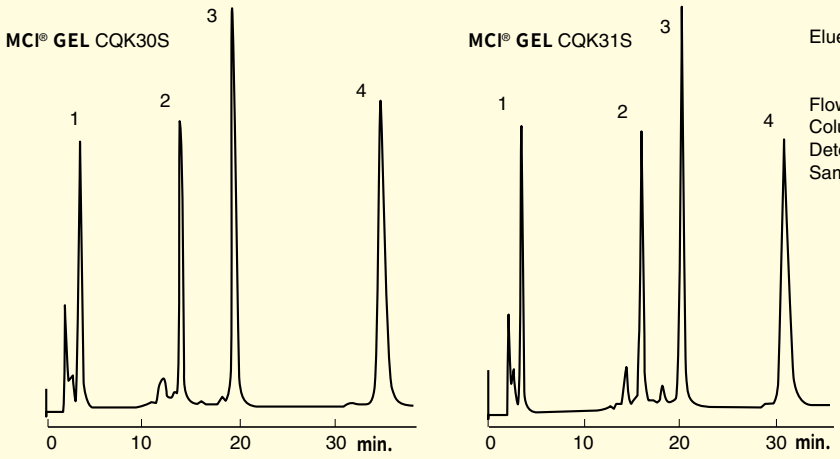
Fig. 4-19 Separation of protein mixture

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 : 1.0mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Myoglobin 120μg
2. Transferrin 160μg
3. β -Lactoglobulin 400μg



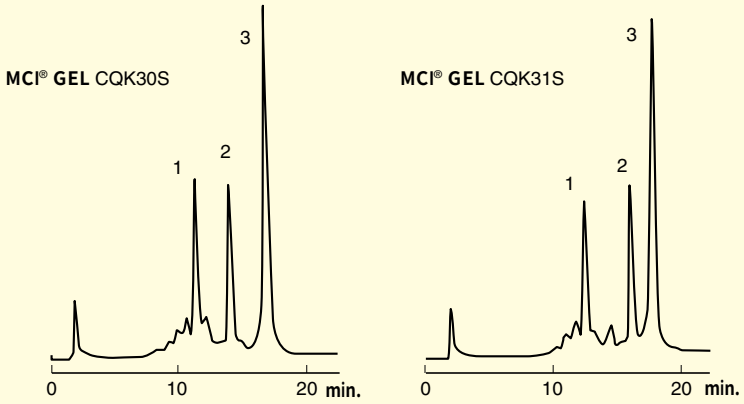
Application data of CQA and CQK series

Fig. 4-20 Separation of protein mixture



Conditions
Column : MCI® GEL CQK30S 7.5mm I.D.×75mm
MCI® GEL CQK31S 7.5mm I.D.×75mm
Eluent : A 20mM Phosphate buffer pH6.8
B A +0.5M NaCl
A → B 30min linear gradient
Flow rate : 1.0mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Myoglobin 50μg
2. Ribonuclease A 200μg
3. Cytochrome C 60μg
4. Lysozyme 80μg

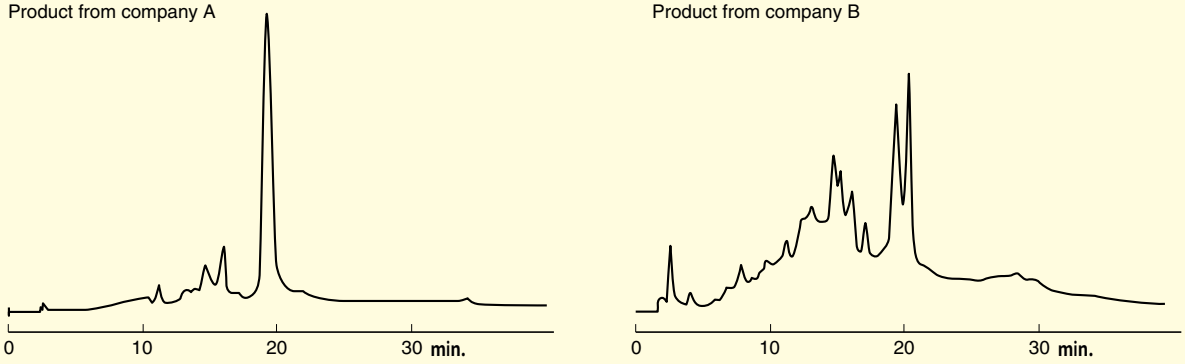
Fig. 4-21 Separation of protein mixture



Conditions
Column : MCI® GEL CQK30S 7.5mm I.D.×75mm
MCI® GEL CQK31S 7.5mm I.D.×75mm
Eluent : A 20mM Phosphate buffer pH6.8
B A +0.5M NaCl
A → B 30min linear gradient
Flow rate : 1.0mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : 1. Trypsinogen 80μg
2. Ribonuclease A 90μg
3. α-Chymotrypshinogen A 60μg

Fig. 4-22 Separation of lipoxidase

Conditions
Column : MCI® GEL CQA31S 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 : 1.0mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : Lipoxidase



CQH series

Hydrophobic interaction columns

MCI® GEL CQH series packed columns are for hydrophobic interaction chromatography mode. Functional groups of the packing materials are phenyl, butyl and ether.
The relative hydrophobicity of the CQH series columns decrease in the following order. CQH3PS>CQH3BS>CQH3ES

Column list

●CQH Series

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

●Packing materials available

Package size; 10 g , 25 g , 50 g

Application data of CQH series

Fig. 4-23 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$(NH_4)_2SO_4$
B 0.1M Phosphate buffer pH6.8
A → B 60min linear gradient
Flow rate : 1mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : Human serum

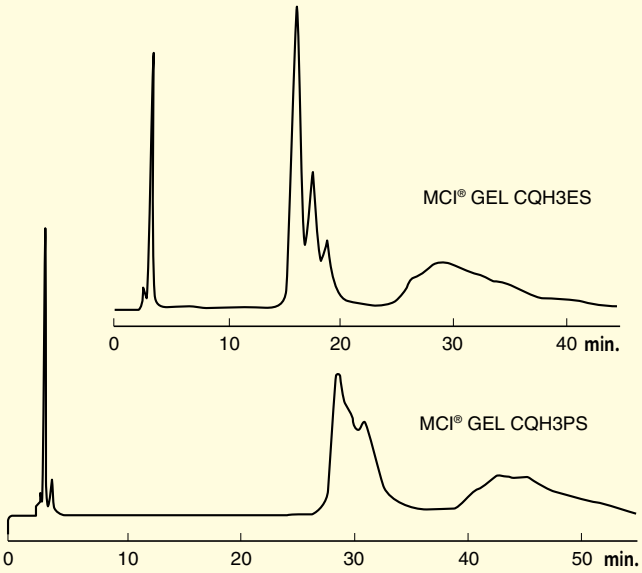


Fig. 4-24 Separation of colibacillus extract

Conditions
Column : MCI® GEL CQH3ES 7.5mm I.D.×75mm
Eluent : A B+1.7M$(NH_4)_2SO_4$
B 0.1M Phosphate buffer pH6.8
A → B 30min linear gradient
Flow rate : 1.0mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : Colibacillus extract

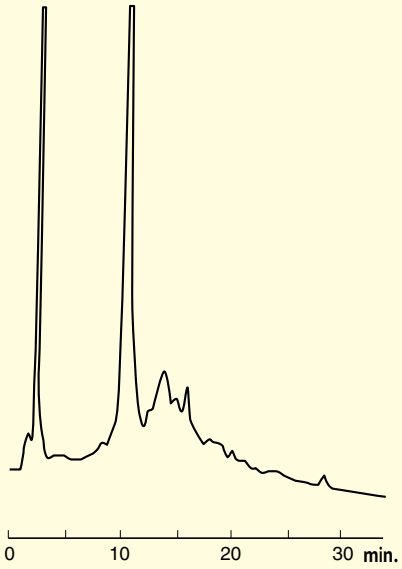


Fig. 4-25 Separation of colibacillus extract

Conditions
Column : MCI® GEL CQH3PS 7.5mm I.D.×75mm
Eluent : A B+1.7M$(NH_4)_2SO_4$
B 0.1M Phosphate buffer pH6.8
A → B 30min linear gradient
Flow rate : 1.0mℓ/min
Column temp. : ambient
Detection : 280nm
Sample : Colibacillus extract

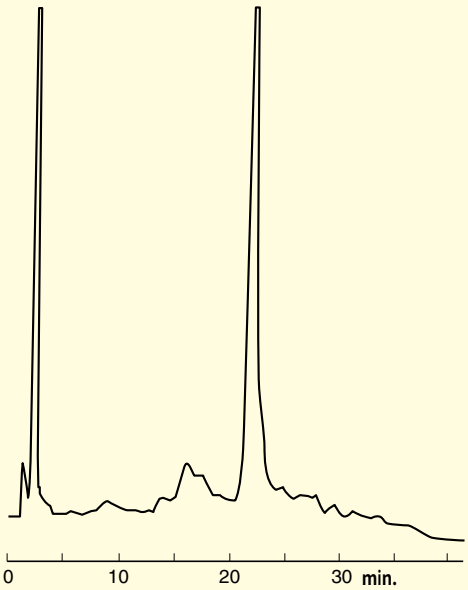
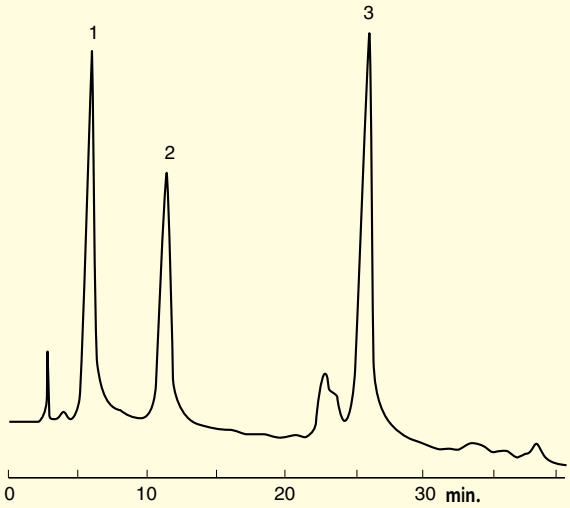


Fig. 4-26 Separation of mixture of peptides

Conditions
Column : MCI® GEL CQH3PS 7.5mm I.D.×75mm
Eluent : A B+1.7M$(NH_4)_2SO_4$
B 0.1M Phosphate buffer pH6.8
A → B 30min linear gradient
Flow rate : 1.0mℓ/min
Column temp. : ambient
Detection : 220nm
Sample : 1. Met-Leu-Tyr
2. Leu-Enkephalin
3. Bacitracin



○MCI® GEL CHP series

MCI® GEL Polymeric reversed phase columns

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 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.

For packing materials of the RP chromatography, silica based and synthetic polymer based materials are widely used.

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 packings 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 packings are available as packed columns for analytical applications and as bulk packings for analytical, preparative and production chromatography applications.

MCI® GEL CHP20P bulk polymer resin is widely used as a reversed phase resin for preparative extractive separation in biopharmaceutical applications.

CHP series

Reversed phase chromatography columns

Columns packed with polymers, MCI® GEL CHP series, are suitable for reversed phase chromatography and there are four kinds of columns of various hydrophobicity; Porous polystyrene, Modified Porous polystyrene, Acrylates and Octadecyl-alkylated aliphatic Porous polymers. Thus proper kind of columns can be selected in accordance with the properties of the target compounds.

Modified polystyrene packing	: MCI® GEL CHP207M
Polystyrene packing	: MCI® GEL CHP10M、CHP5C
Octadecyl-alkylated aliphatic packing	: MCI® GEL CHPOD1M
Acrylates packing	: MCI® GEL CHP2MGM、CHP2MG

The hydrophobicities of the columns are in the following order:

MCI® GEL CHP207M ＞ CHP10M=CHP5C ＞ CHPOD1M ≧ ODS columns ≧ CHP2MGM

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 CHP207M column.
3) Polymer columns can be washed with acidic and/or basic solutions when deteriorated by contamination.

＜Reversed phase distribution chromatography＞
Acrylates, CHP2MGM and CHP2MG, can be applied not only for reversed phase distribution chromatography but also for normal phase one.

CHP10M 4.6×150

CHP5C 4.6×250

CHP2MGM 4.6×150

Column list

●CHP series

Column Name	Chemical Structures	particle size	HPLC Column	Preparative Column	pH range
MCI® GEL CHP10M	Styrene Divinylbenzene	4μm	4.6mm* 150mmL	NEW 20mm* 150mmL	Whole range
MCI® GEL CHP5C	Styrene Divinylbenzene	10μm	4.6mm* 250mmL	—	Whole range
MCI® GEL CHP2MGM	Methacrylates	4μm	4.6mm* 150mmL	NEW 20mm* 150mmL	2～12
MCI® GEL CHP2MG	Methacrylates	10μm	4.6mm* 250mmL	—	2～12
MCI® GEL CHP207M	Brominated Styrene Divinylbenzene	4μm	NEW 4.6mm* 150mmL	(20mm* 200mmL)	Whole range
MCI® GEL CHPOD1M	C18-alkylated aliphatics	4μm	NEW 4.6mm* 150mmL	NEW 20mm* 200mmL	2～12

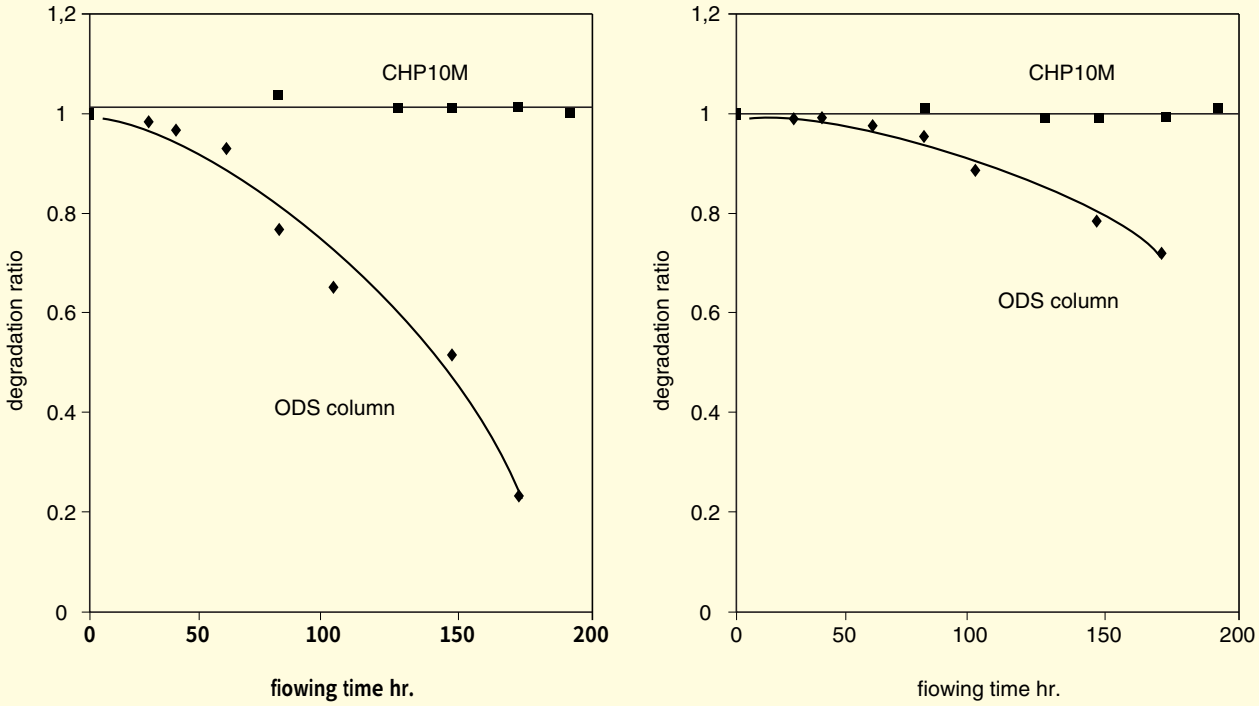
○MCI® GEL CHP5C and CHP2MG are both available in bulk.

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 CHP10M, there is no change of column performance.

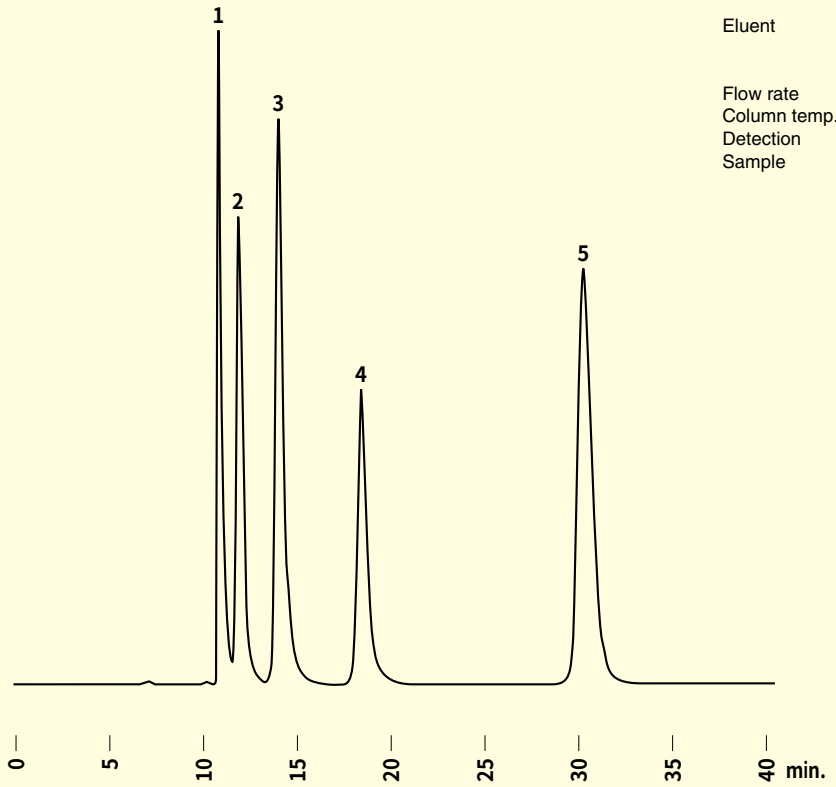
Fig. 5-1 Column durability at pH12 comparison between CHP10M and an ODS column

Conditions
Column : MCI® GEL CHP10M 4.6㎜I.D × 150㎜
Eluent **: 20mM Na_2HPO_4 pH12/CH_3CN/=60/40**
Flow rate **: 0.4㎖/min**
Column temp. **: 25℃**
Detection **: 254nm**
Sample : 1000ppm **Dimethyl phthalate** 5μL



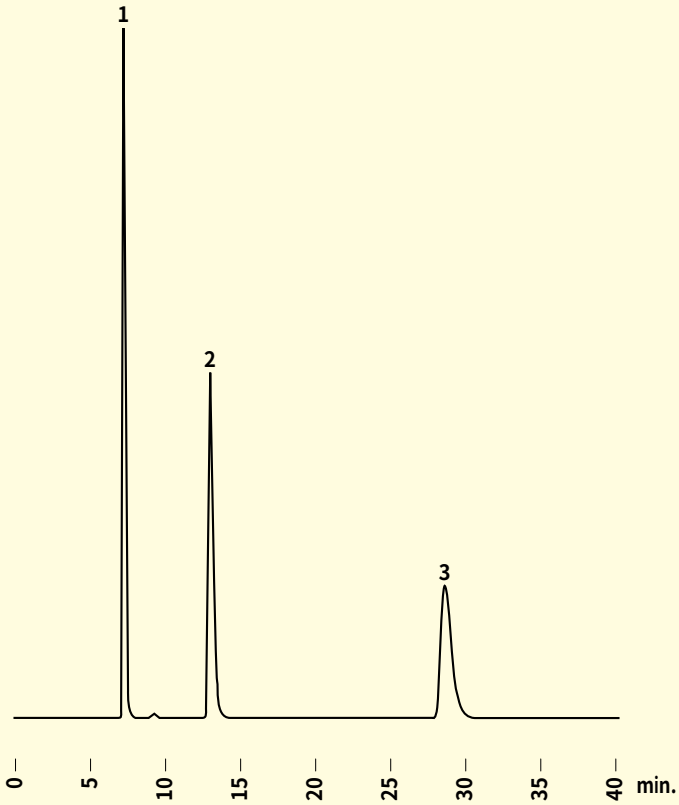
Application data of CHP series

Fig. 5-2 Separation of catecholamines



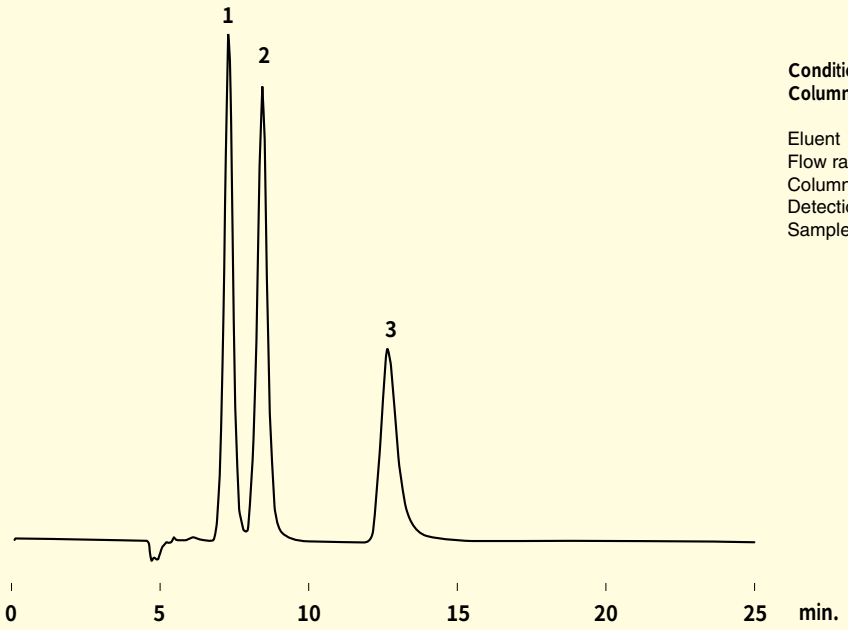
Conditions
Column : **MCI® GEL CHP10M 4.6mm I.D.×150mm**
Eluent : **50mM Na-phosphate pH2.0, 1.5% Hexanesulfonic acid / CH_3CN=80/20**
Flow rate : **0.25mℓ/min**
Column temp. : **ambient**
Detection : **280nm**
Sample : **1. Epinephrine**
2. Dopamine
3. 5-Hydroxy tryptophan
4. Serotonin
5. Tryptophan

Fig. 5-3 Separation of phthalic acid esters



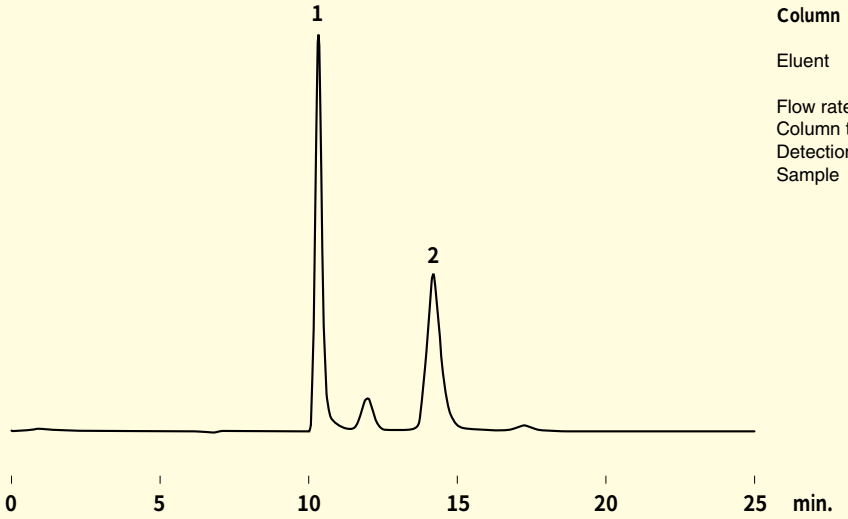
Conditions
Column : **MCI® GEL CHP10M 4.6mm I.D.×150mm**
Eluent : **H_2O/CH_3CN=50/50**
Flow rate : **0.75mℓ/min**
Column temp. : **60°C**
Detection : **254nm**
Sample : **1. Dimethyl phthalate**
2. Diethyl phthalate
3. Dipropyl phthalate

Fig. 5-4 Purine alkaloids



Conditions
Column : **MCI® GEL CHP10M 4.6mm I.D.×150mm**
Eluent : **H_2O/CH_3CN=10/90**
Flow rate : **0.4mℓ/min**
Column temp. : **25°C**
Detection : **275nm**
Sample : **1.Theophylline 2.Theobromine 3.Caffeine**

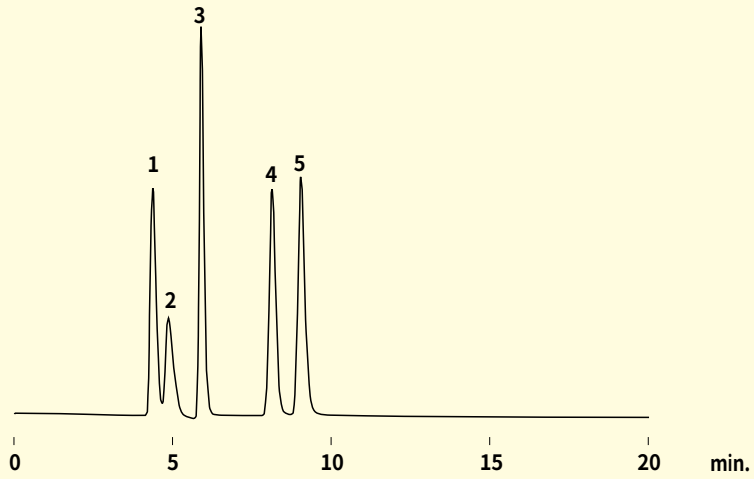
Fig. 5-5 Cinchona alkaloids



Conditions
Column : **MCI® GEL CHP10M 4.6mm I.D.×150mm**
Eluent : **0.1M NaH_2PO_4 pH2.0 CH_3CN=88/12**
Flow rate : **0.3mℓ/min**
Column temp. : **25°C**
Detection : **275nm**
Sample : **1.Cinchonine 2.Quinine**

Application data of CHP series

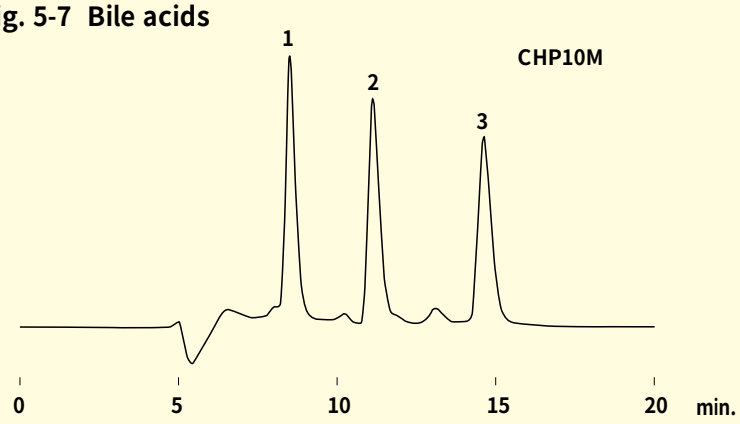
Fig. 5-6 Uric acid and related compounds



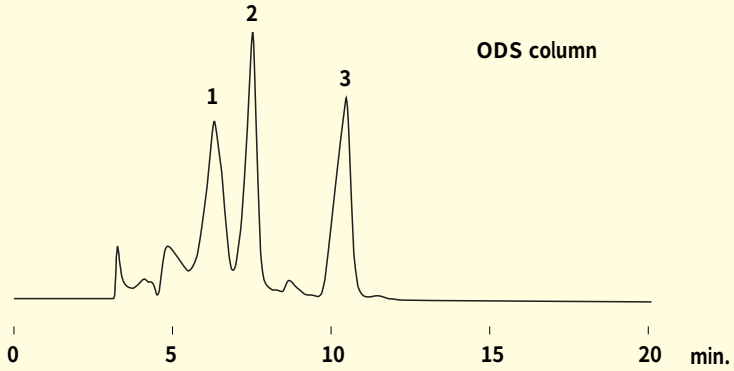
Conditions
Column : MCI® GEL CHP10M 4.6mm I.D.×150mm
Eluent : 10mM TBA/CH3CN=75/25
Flow rate : 0.4mℓ/min
Column temp. : 25°C
Detection : 284nm
Sample : 1.Hypoxanthine
2.Xanthine
3.Theophylline
4.Uric acid
5.Orotic acid

Comparison with an ODS column

Fig. 5-7 Bile acids

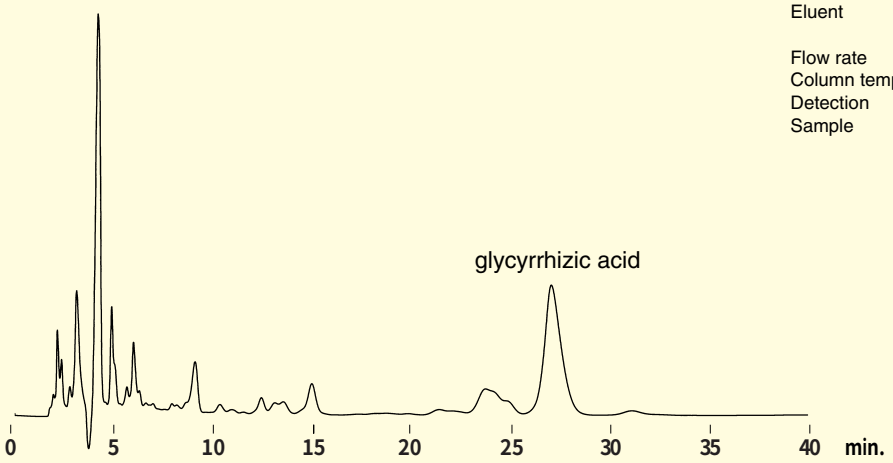


Conditions
Column : MCI® GEL CHP10M 4.6mm I.D.×150mm
Eluent : 50mM NaH_2PO_4 pH2.0 /CH_3CN=40/60
Flow rate : 0.3mℓ/min
Column temp. : 25°C
Detection : 210nm
Sample : 1.Cholic acid
2.Ursodeoxycholic acid
3.Deoxycholic acid



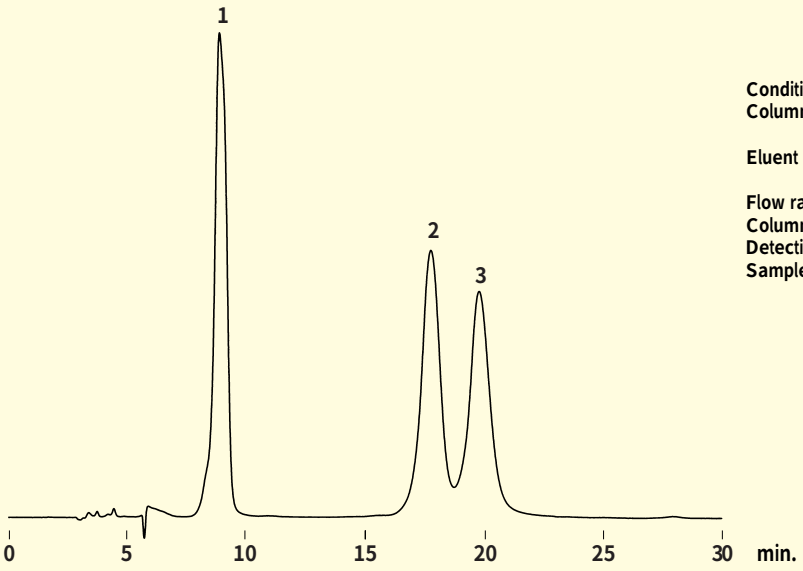
Conditions
Column : ODS column (5micron) 4.6mm I.D.×150mm
Eluent : 50mM NaH_2PO_4 pH6.0 /CH_3CN=40/60
Flow rate : 0.3mℓ/min
Column temp. : 25°C
Detection : 210nm
Sample : 1.Cholic acid
2.Ursodeoxycholic acid
3.Deoxycholic acid

Fig. 5-8 Glycyrrhizae radix



Conditions
Column : **MCI® GEL CHP10M 4.6mm I.D.×150mm**
Eluent : **2.06% acetic acid/CH_3CN =63/37**
Flow rate : **0.5mℓ/min**
Column temp. : **45°C**
Detection : **254nm**
Sample : **extract of glycyrrhizae radix**

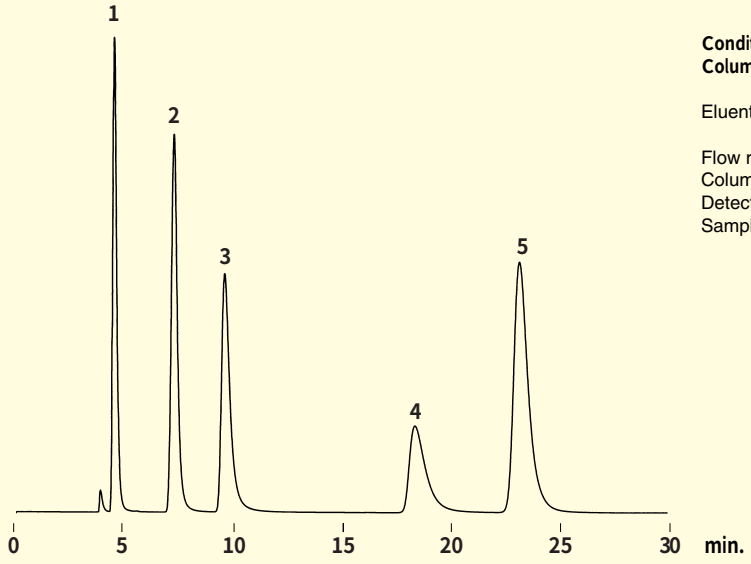
Fig. 5-9 Adrenal cortex hormones



Conditions
Column : **MCI® GEL CHP10M 4.6mm I.D.×150mm**
Eluent : **H_2O/CH_3CN : 60/40**
Flow rate : **0.5mℓ/min**
Column temp. : **45°C**
Detection : **280nm**
Sample : **1.Hydrocortisone 2.Corticosterone 3.11-Deoxycortisol**

Application data of CHP series

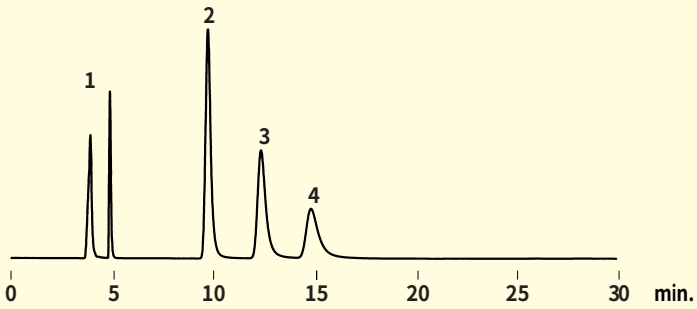
Fig. 5-10 Ingredients of medicine



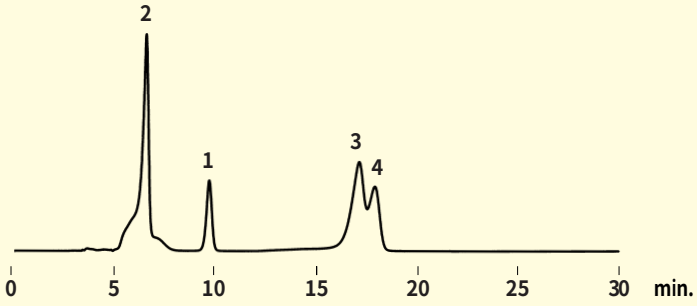
Conditions
Column : **MCI® GEL CHP2MGM 4.6㎜ I.D.×150㎜**
Eluent : **50mM phosphoric acid(pH2.0)/CH_3OH =60/40**
Flow rate : **0.5㎖/min**
Column temp. : **45°C**
Detection : **254nm**
Sample : **1.4-Dimethylaminoantipyrine**
2.Antipyrine
3.Caffeine
4.Aspirin
5.Phenacetin

Comparison with an ODS column

Fig. 5-11 Sulfa drugs



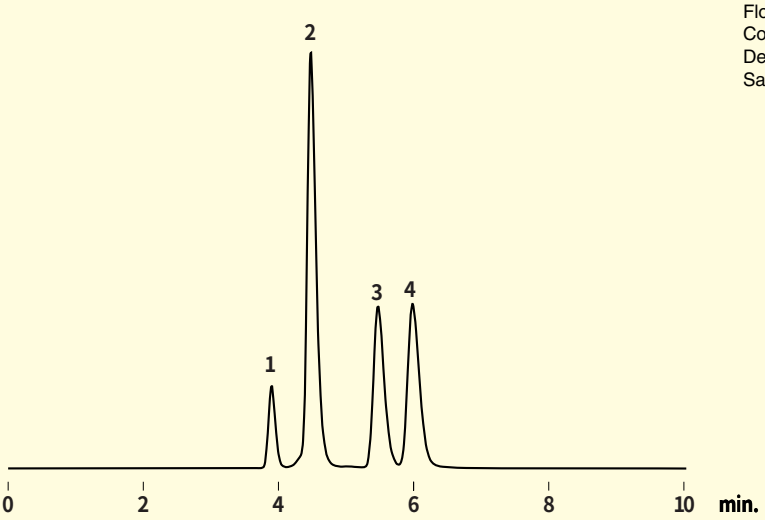
Conditions
Column : **MCI® GEL CHP2MGM 4.6㎜ I.D.×150㎜**
Eluent : **20mM phosphate pH6.8/CH_3CN =82/18**
Flow rate : **0.5㎖/min**
Column temp. : **45°C**
Detection : **254nm**
Sample : **1.Succinylsulfathiazole**
2.Sulfanilamide
3.Sulfathiazole
4.Sulfamerazine



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

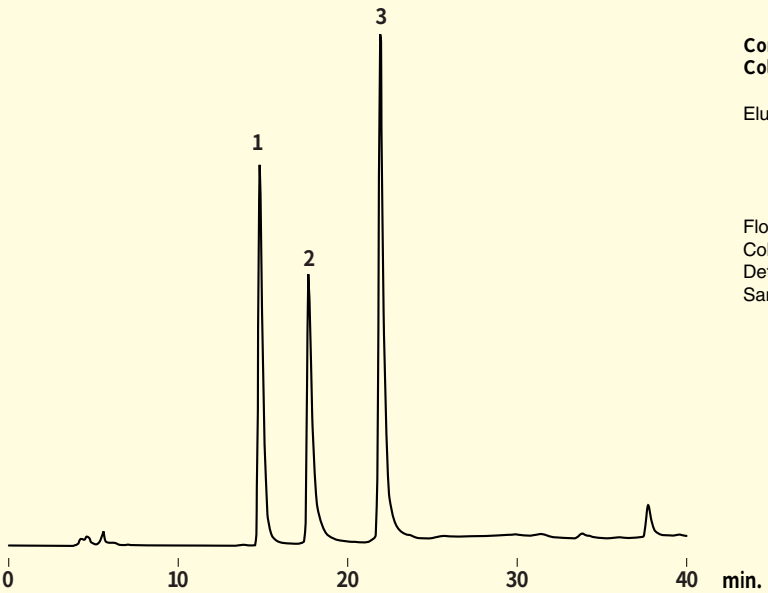
Application data of CHP series

Fig. 5-12 Peptides



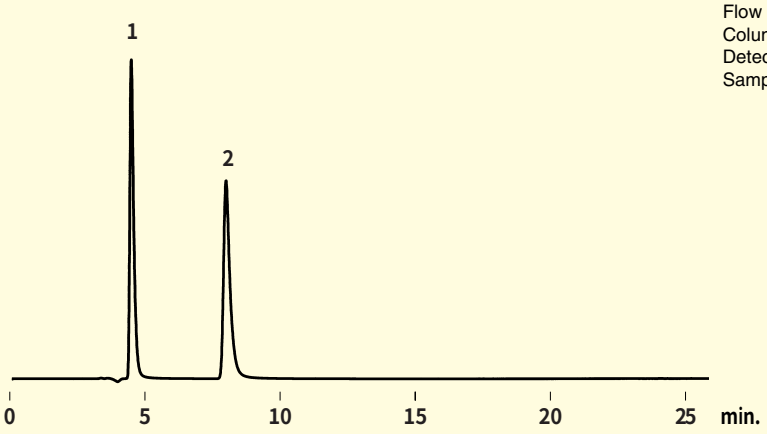
Conditions
Column : **MCI® GEL CHP2MGM 4.6mm I.D.×150mm**
Eluent : **0.1%TFA/CH_3CN =70/30**
Flow rate : **0.5mℓ/min**
Column temp. : **25°C**
Detection : **220nm**
Sample : **1.Gly-Tyr**
2.Met Enkephalin
3.Leu Enkephalin
4.Angiotensin ll

Fig. 5-13 Proteins



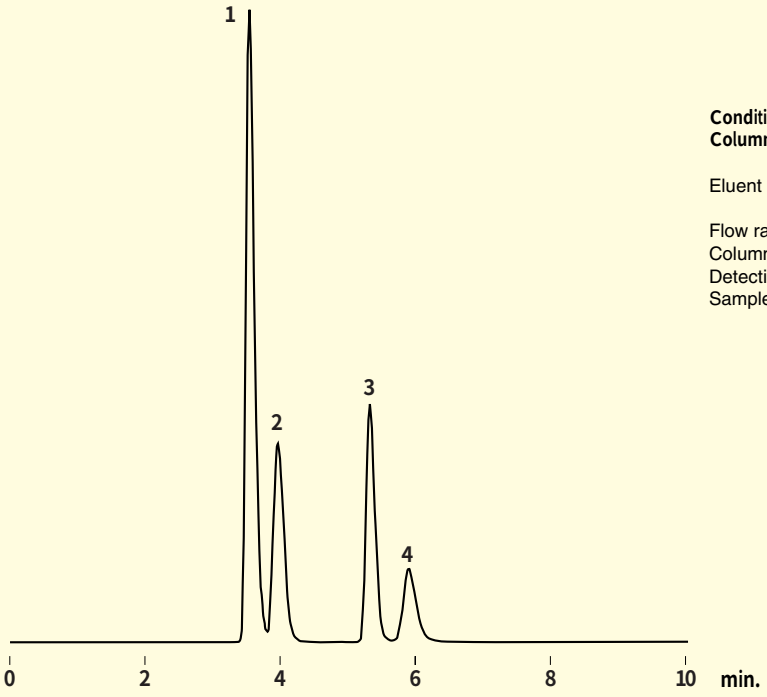
Conditions
Column : **MCI® GEL CHP2MGM 4.6mm I.D.×150mm**
Eluent : **A;0.05%TFA/CH_3CN =80/20**
B;0.05%TFA/CH_3CN =20/80
A→B 30min.linear
Flow rate : **0.5mℓ/min**
Column temp. : **25°C**
Detection : **280nm**
Sample : **1.Ribonuclease A**
2.Cytochrome c
3.α-Chymotrypsinogen A

Fig. 5-14 Procainamide,Procaine



Conditions
Column : **MCI® GEL CHP2MGM 4.6mm I.D.×150mm**
Eluent : **20mM phosphate pH7.2/CH_3CN =65/35**
Flow rate : **0.5mℓ/min**
Column temp. : **45°C**
Detection : **254nm**
Sample : **1.Procainamide 2.Procaine**

Fig. 5-15 Water-soluble vitamins



Conditions
Column : **MCI® GEL CHP2MGM 4.6mm I.D.×150mm**
Eluent : **8mM Na_2HPO_4 pH7.0/CH_3CN =85/15**
Flow rate : **0.5mℓ/min**
Column temp. : **25°C**
Detection : **254nm**
Sample : **1.Vitamin C 2.Vitamin B6 3.Vitamin B3 4.Vitamin B12**

Fig. 5-16 Tetracycline

Conditions
Column : MCI® GEL CHP5C
Eluent : **4.6mm I.D.×250mm**
: pottassium phosphate buffer (pH9.0) (the Japanese pharmacopoeia)
Flow rate : **0.5mℓ/min**
Column temp. : **60°C**
Detection : **254nm**
Sample : **tetracycline HCl heat-treatment 90°C for 60min.**

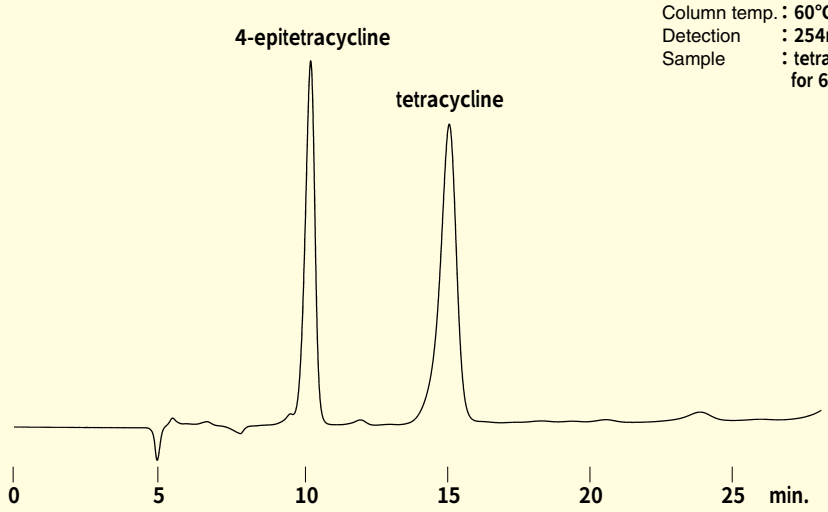
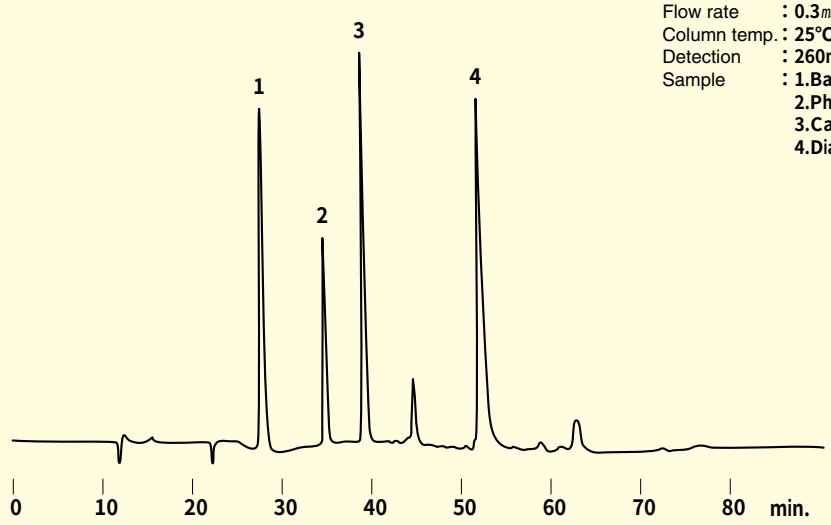


Fig. 5-17 Anticonvulsants

Conditions
Column : MCI® GEL CHP5C
4.6mm I.D.×250mm
Eluent : **A ; 0.01M Na_2HPO_4**
pH7.0/CH_3CN=70/20
B ; 100% CH_3CN
A→B 25min linear gradient
Flow rate : **0.3mℓ/min**
Column temp. : **25°C**
Detection : **260nm**
Sample : **1.Barbital**
2.Phenobarbital
3.Carbamazepine
4.Diazepam



Application data of CHP series

Fig. 5-18 Oxine copper,Thiuram

Conditions
Column : MCI® GEL CHP2MG
4.6mm I.D.×250mm
Eluent : 25mM KH_2PO_4(pH3.0)/CH_3CN
=45/55
Flow rate : 0.8mℓ/min
Column temp. : 40°C
Detection : 240nm
Sample : 1.Oxine copper 3ppm
2.Thiuram 3ppm

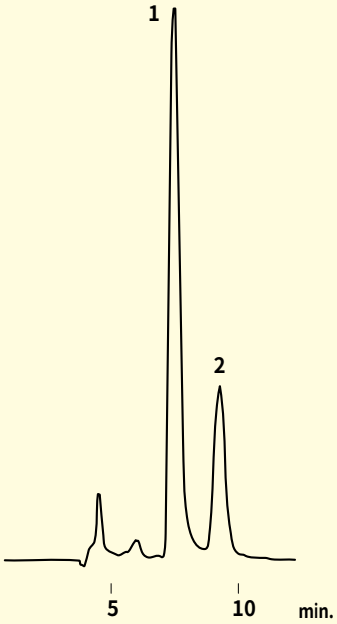


Fig. 5-19 Aromatic carboxylic acids

Conditions
Column : MCI® GEL CHP2MG
4.6mm I.D.×250mm
Eluent : 0.1M NaH_2PO_4(pH5.8)/CH_3CN
=90/10
Flow rate : 0.5mℓ/min
Column temp. : 25°C
Detection : 260nm
Sample : 1. Terephthalic acid 0.7%
2. 4 -Carboxybenzaldehyde 100ppm
3. Benzoic acid 100ppm
4. p-Toluic acid 100ppm

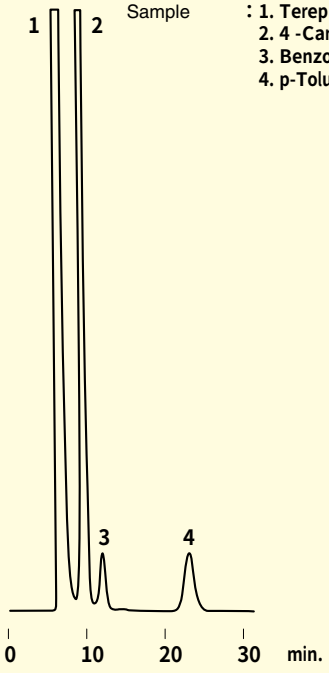


Fig. 5-20 Proteins

Conditions
Column : MCI® GEL CHP2MG
4.6mm I.D.×250mm
Eluent : A 0.05% TFA/CH_3CN=80/20
B 0.05% TFA/CH_3CN=30/70
A → B 45min linear gradient
Flow rate : 0.5mℓ/min
Column temp. : 25°C
Detection : 280nm
Sample : 1. Ribonuclease A
2. Cytochrome C
3. Transferrin
4. α-Chymotrypshinogen A
5. β-Lactoglobulin

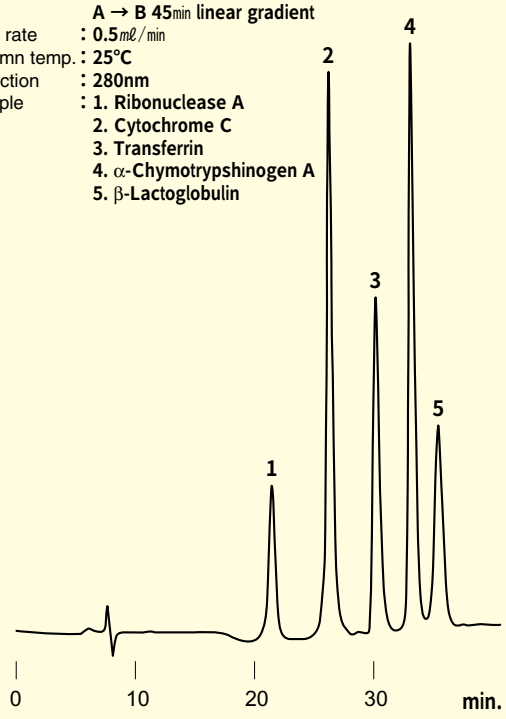
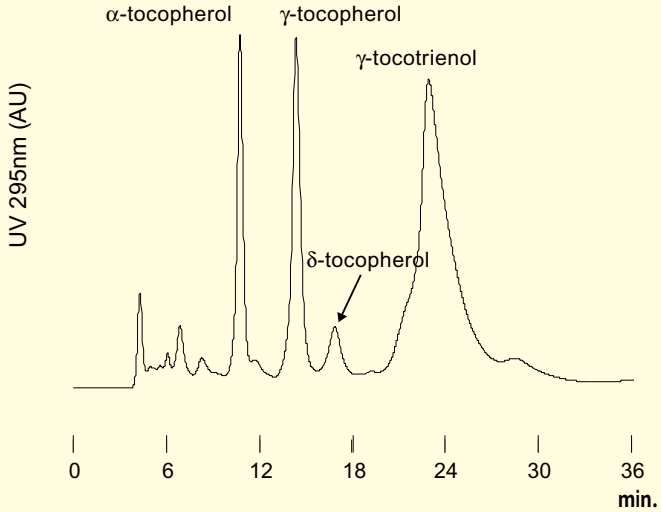


Fig. 5-21 Rice Bran Oil

Conditions
Column : MCI® GEL CHP2MG(10mm)
4.6A I.D.×150A
Eluent : Hexane-EtOH = 98/2 (vol.)
Flow rate : 0.5mℓ/min
Detection : 295nm
Sample : Rice Bran Oil, 50g/ml
Injection : 10μL

(A) CHP2MG (10μm)



Comparison between CHP207M and CHP10M

(Polypenon 60)

Fig. 5-22 Modified Styrene Divinylbenzene CHP207M

Conditions
Column : MCI®GEL CHP207M
4.6A I.D.×150mm
Eluent : CH3OH/10mM-Acetic acid=60/40
Flow rate : 0.46mℓ/min
Column temp. : 60°C
Detection : 280nm
Sample : Polyphenon 60(10mg/mℓ) each 10mL

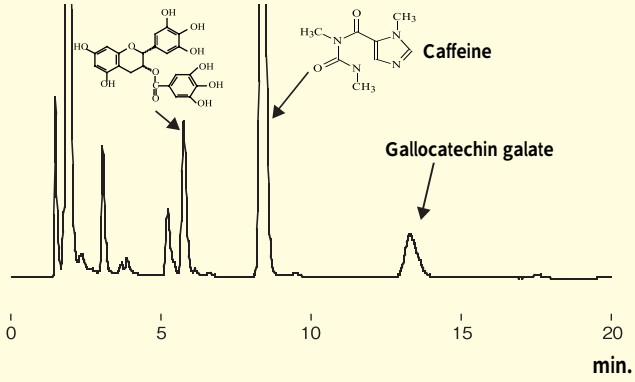
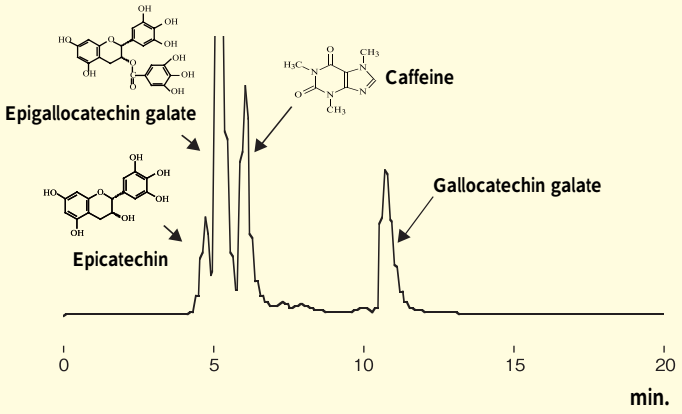


Fig. 5-23 Styrene Divinylbenzene CHP10M

Conditions
Column : MCI®GEL CHP10M
4.6mm I.D.×150mm
Eluent : CH3OH/10mM-Acetic acid=60/40
Flow rate : 0.46mℓ/min
Column temp. : 60°C
Detection : 280nm
Sample : Polyphenon 60(10mg/mℓ) each 10μL



Comparison with an ODS column

(TritonX-100)

Fig. 5-24 CHPOD1M

Conditions
Column : MCI®GEL CHP-OD1M
4.6mm I.D.×150mm
Eluent : 50vol%CH3CN
Flow rate : 0.50mℓ/min
Column temp. : 40°C
Detection : 254nm
Sample : Triton X-100
(polyoxyethylen Octylpheyl Ether)
1% each 10μL

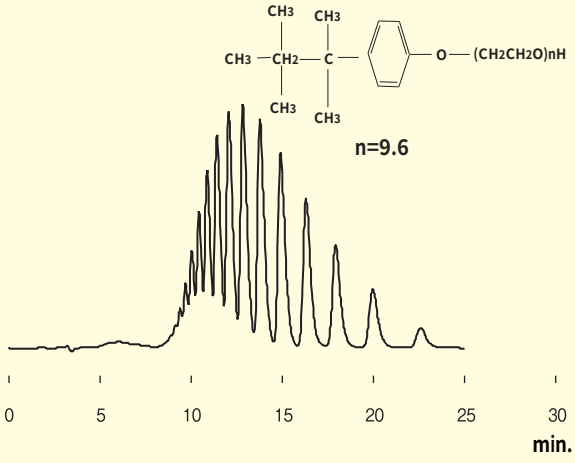
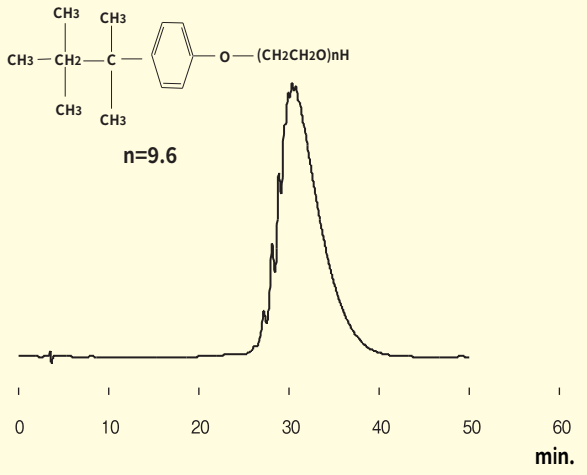


Fig. 5-25 ODS-1HU (ODS)

Conditions
Column : MCI®GEL ODS-1HU
4.6mm I.D.×250mm
Eluent : 50vol%CH3CN
Flow rate : 1.00mℓ/min
Column temp. : 40°C
Detection : 254nm
Sample : Triton X-100
(polyoxyethylen Octylpheyl Ether)
1% each 10μL



6 MCI® GEL Chiral separation columns

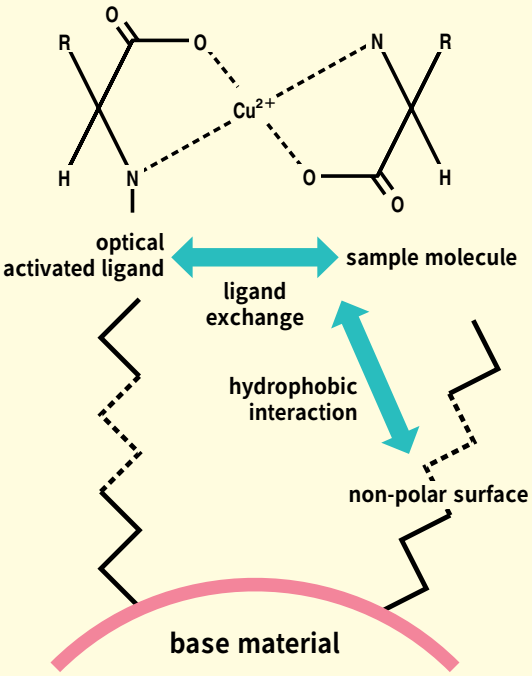
○MCI® GEL CRS10W（DLAA）4.6mmI.D×50mm
○MCI® GEL CRS15W（LDAA）4.6mmI.D×50mm

CRS10W 4.6×50

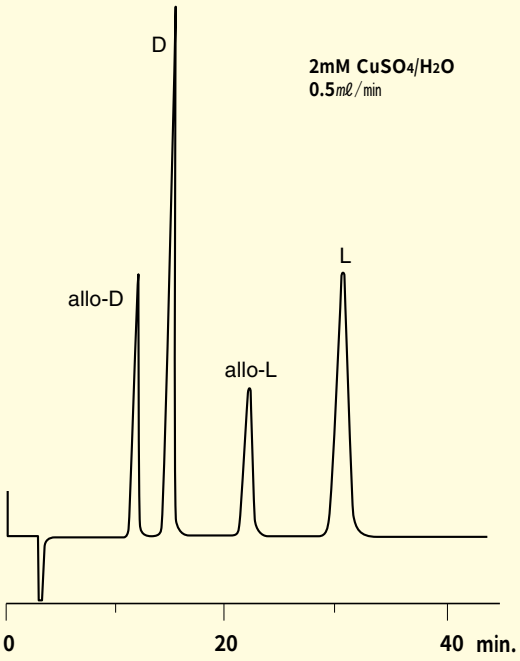
CRS15W 4.6×50

Separation mechanism and Characteristic of MCI® GEL CRS series

Separation mechanism



Application of CRS10W
Fig. 6-1 DL-Isoleucine



●Separation mechanism

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

●Strong points

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.

Application data of CRS10W

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

Fig. 6-2 Separation of amino acids mixture

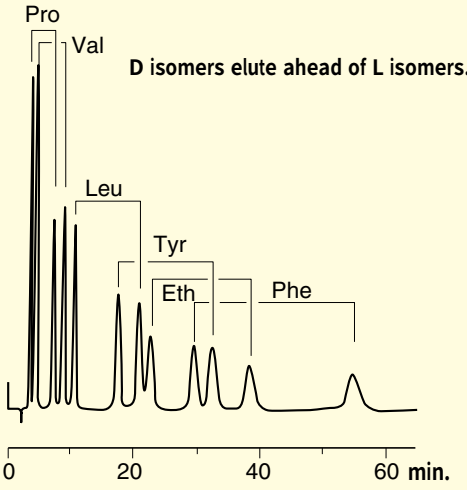


Fig. 6-3 Separation of amino acids mixture

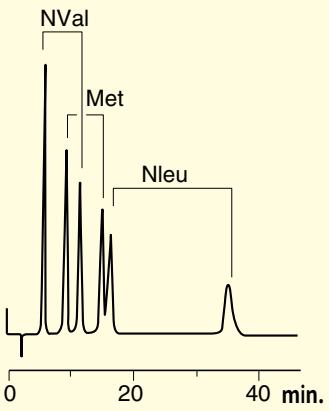


Fig. 6-4 Separation of DL-Ser.

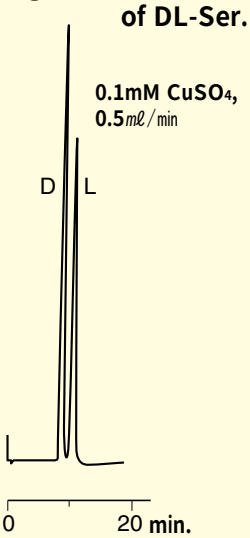


Fig. 6-5 Separation of DL-aspartic acid

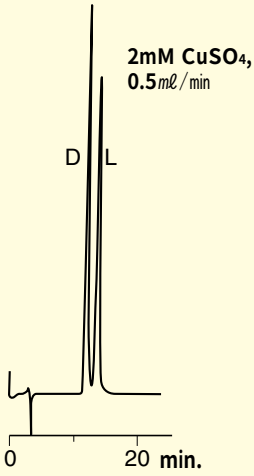


Fig. 6-6 Separation of DL-glutamic acid

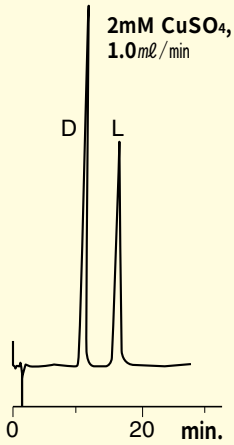


Fig. 6-7 Separation of DL-histidine

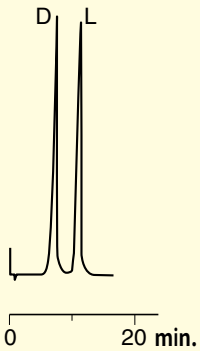


Fig. 6-8 Separation of DL-lysine

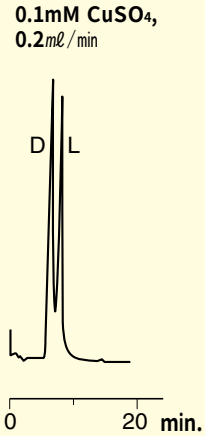


Fig. 6-9 Separation of DL-phenylalanine

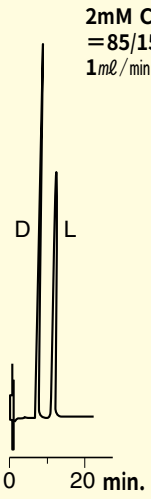


Fig. 6-10 Separation of DL-tryptophan

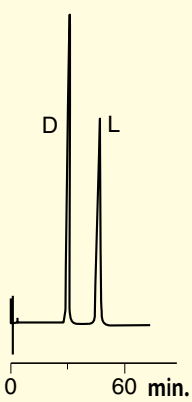


Fig. 6-11 Separation of DL-lactic acid

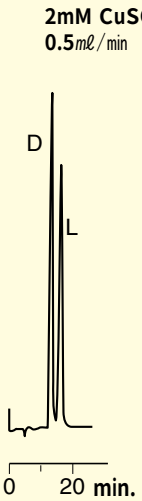
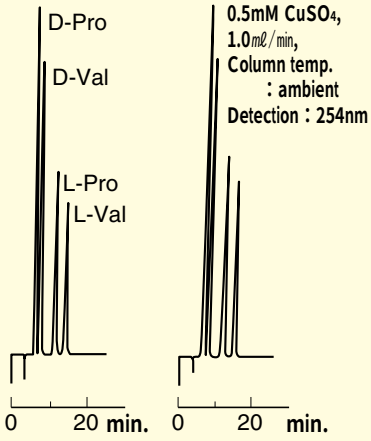


Fig. 6-12 Durability test

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



Application data of CRS10W

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

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

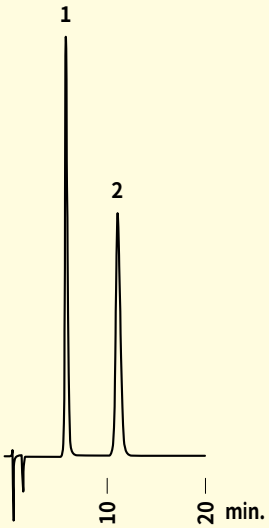


Fig. 6-14 Separation of methionine and acetylmethionine

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

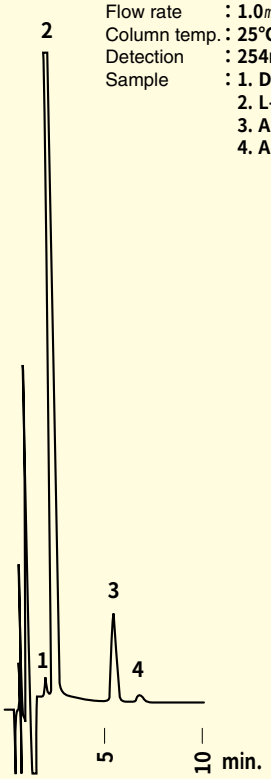
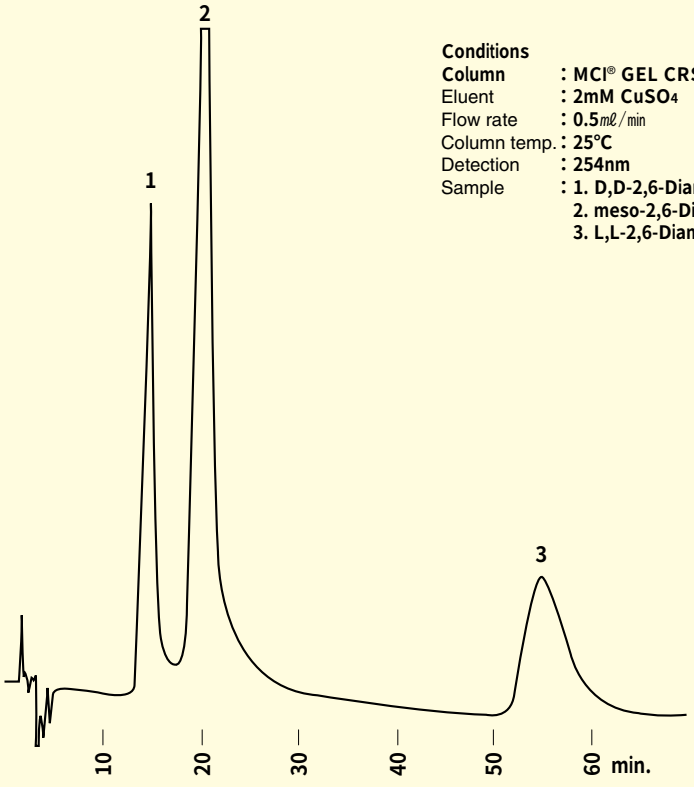
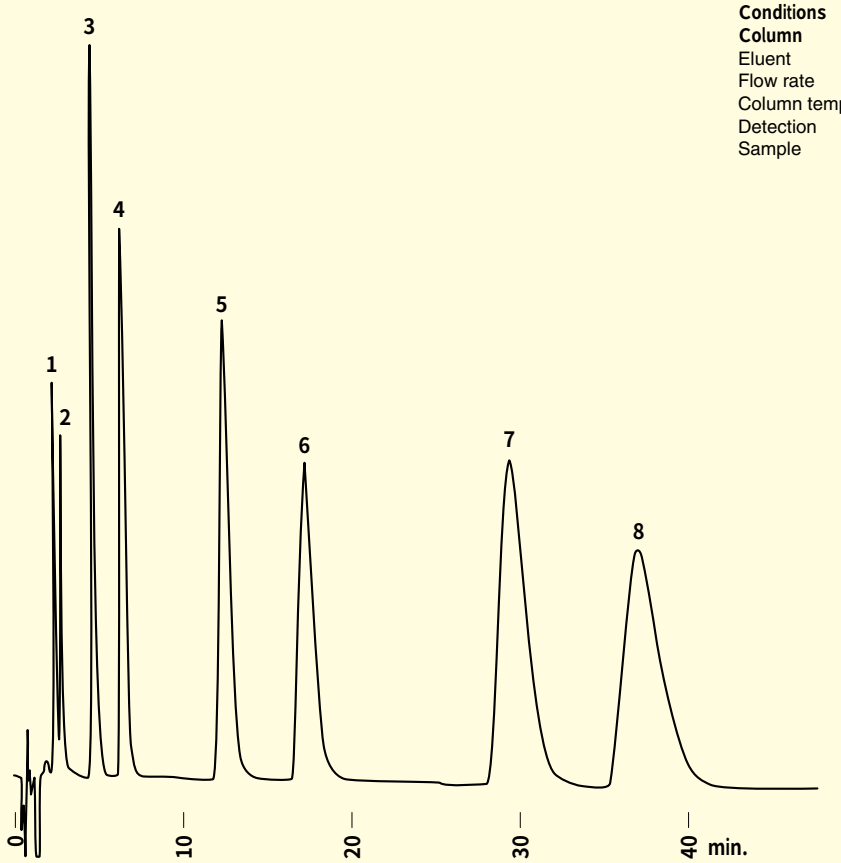


Fig. 6-15 Separation of diaminopimelic acid



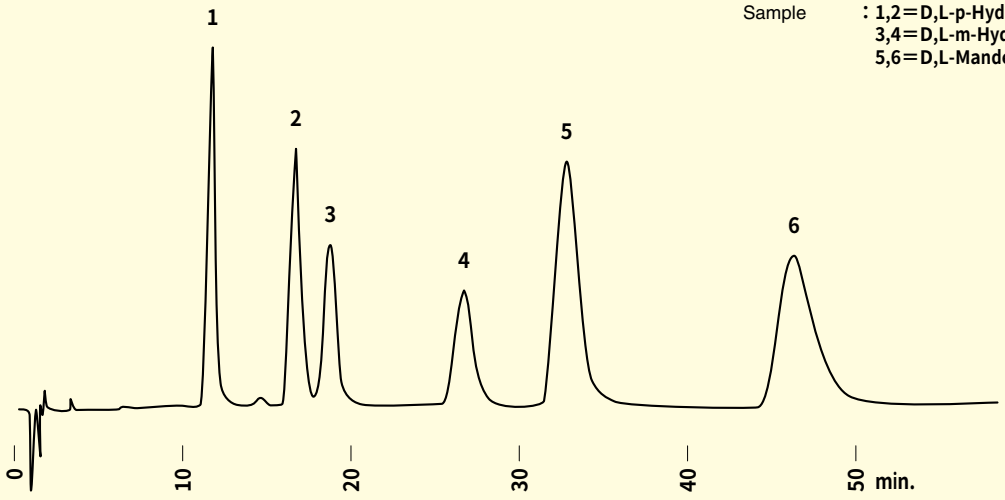
Conditions
Column : **MCI® GEL CRS10W 4.6mm I.D.×50mm**
Eluent : **2mM $CuSO_4$**
Flow rate : **0.5mℓ/min**
Column temp. : **25°C**
Detection : **254nm**
Sample : **1. D,D-2,6-Diaminopimelic acid**
2. meso-2,6-Diaminopimelic acid
3. L,L-2,6-Diaminopimelic acid

Fig. 6-16 Separation of 2-hydroxy carboxylic acids



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

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



Conditions
Column : MCI® GEL CRS10W 4.6mm I.D.×50mm
Eluent : 2mM $CuSO_4$/CH_3CN=90/10
Flow rate : 1.0mℓ/min
Column temp. : ambient
Detection : 254nm
Sample : 1,2=D,L-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

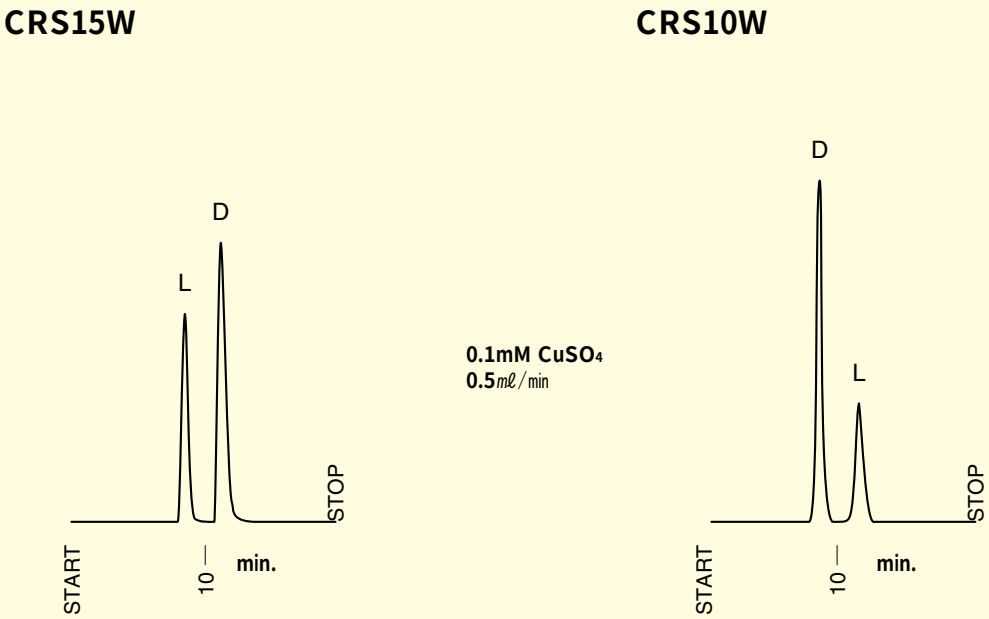
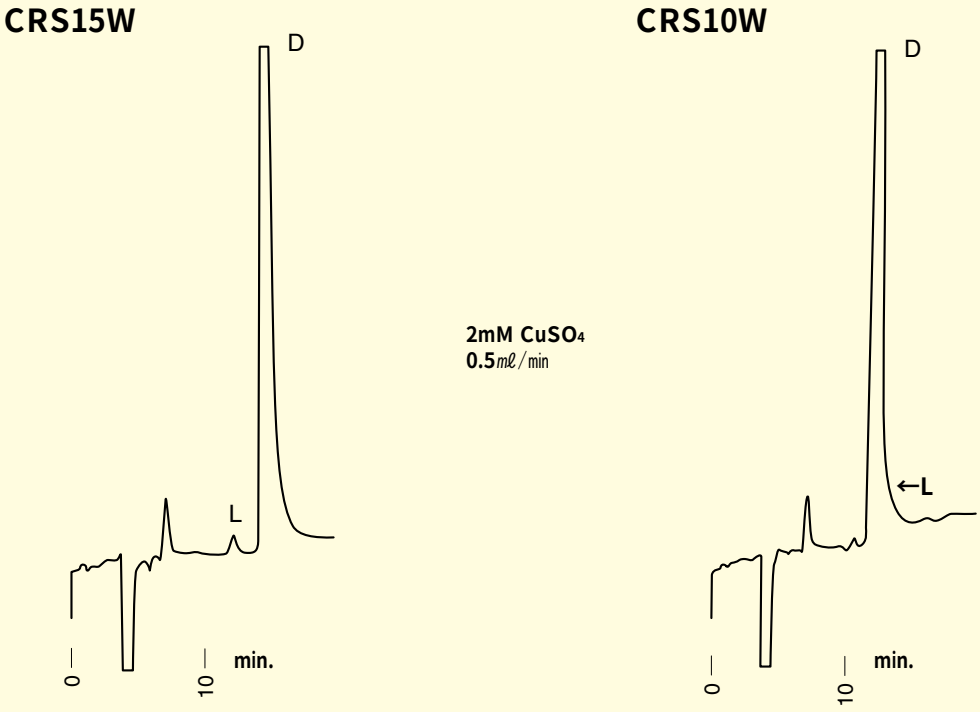


Fig. 6-19 Analysis of a trace of L-lactic acid in 50 ppm D-lactic acid

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 data

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

Notes

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

7 MCI® GEL
Chromatography media for preparative uses

○For ion exchange chromatography
MCI® GEL PrepEx series

○For hydrophobic interaction chromatography
MCI® GEL CQH_P series

○For reversed phase chromatography
MCI® GEL CHP series

MCI® GEL chromatography media for preparative use for application of various chromaography modes are available.

MCI® GEL offers analytical use and preparative use products both are the same in chromatographic characteristics. Experimental results such as separating conditions of HPLC columns can be applied to preparative chromatography because both packing media have almost the same chromatographic characteristics. Our proposal of the developing process will accelerate your R&D and reduce the time.

The chromatography media for preparative use are based on rigid polymers and their particle size distributions are narrow compare to conventional packing media. These characteristics provide some chromatographic merit. Rigid polymers are allowed to use at high flow rates and narrow particle size distribution can provide high separation chromatography. Productivity will be extrremely improved by using MCI® GEL chromatography media for preparative use.

●MCI® GEL chromatography media for preparative use

Separation mode	Name	Base polymer	Functional group	Particle size µm	Main application	Equivalent analytical packing media
Ion exchange	PrepEx-DEAE PrepEx-SP	HMA	DEAE SP	30	Biomolecules	ProtEx-DEAE ProtEx-SP
Hydrophobic interaction	CQH3BP CQH3PP	HMA	Butyl Phenyl	30	Biomolecules	CQH3BS CQH3PS
Reversed phase	CHP55A CHP55Y CHP20A CHP20Y CHP2MGY	ST/DVB ST/DVB ST/DVB ST/DVB MA	— — — — —	18 30 18 30 30	Organic compounds	CHP5C,CHP10M CHP5C,CHP10M CHP5C,CHP10M CHP5C,CHP10M CHP2MG,CHP2MGM

HMA ; polyhydroxymethacrylate ST/DVB ; styrene/divinylbenzene MA ; polymethacrylate

Separation mechanism and characteristics of PrepEx series

MCI® GEL PrepEx series is ion exchange chromatography media for preparative chromatography whose average particle size is 30μm.

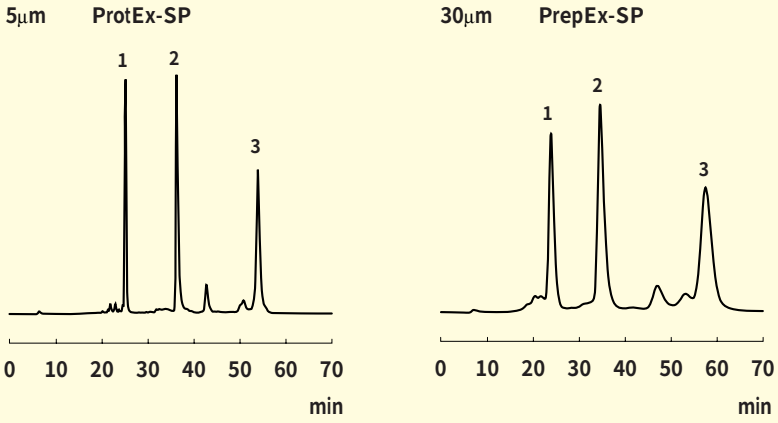
Surface characterisic of MCI® GEL PrepEx series packing media is the same as analytical use MCI® GEL PretEx seriese. Two types of ion exchanger, week anion exchanger PrepEx-DEAE and strong cation exchange PrepEx-SP are available.

Because ProtEx series and PrepEx series have the same chromatographic characteristics, experimental results of separating conditions of ProtEx series can be applied to PrepEx series.

High flow rates (over 300cm/hr.) are able to be applied to the chromatography media because they are based on rigid polymer. Productivity will be extremely improved.

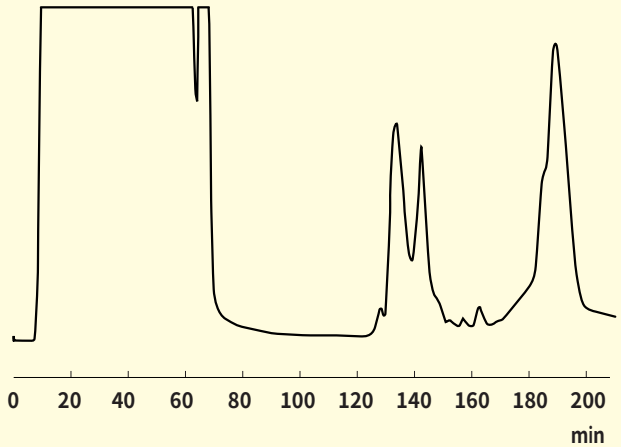
Application data of PrepEx series

Fig. 7-1 Proteins



Conditions
Column : ProtEx-SP,8.0mm I.D.×100mmL
PrepEx-SP,8.0mm I.D.×100mmL
Eluent : A : 20mM Phosphate buffer (pH7.0)
B : A+0.5M NaCl
Gradient : A→B,60min,linear
Flow rate : 0.5mℓ/min
Column temp. : 25℃
Detection : 280nm
Sample : 1.Ribnuclease A 150μg
2.Cytochrome C 60μg
3.Lysozyme 60μg

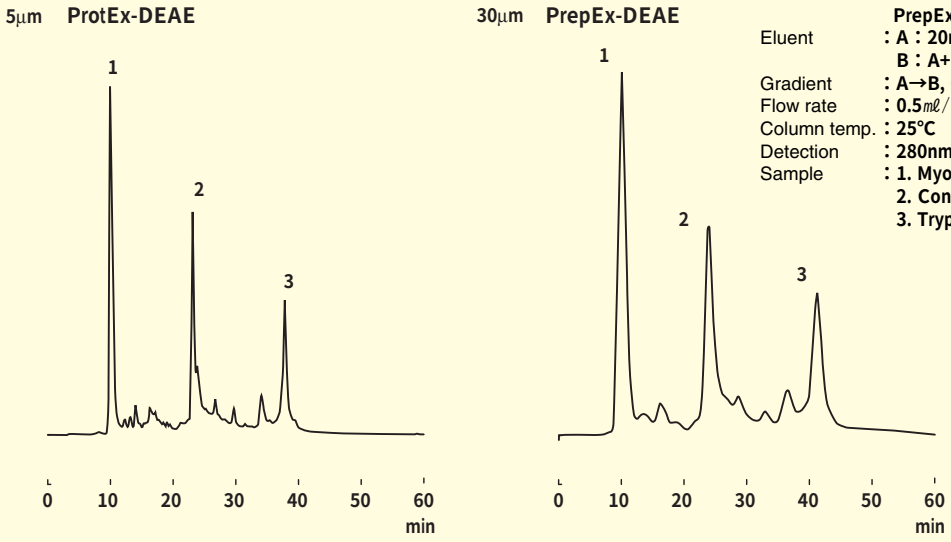
Fig. 7-2 Cow milk acid whey



Conditions
Column : PrepEx-SP,8.0mm I.D.×100mmL
Eluent : A : 20mM Phosphate buffer (pH7.11)
B : A+1.0M NaCl (pH7.03)
: 0-50min, Flow rate 1.0mℓ/min
50-110min, Eluent A, Flow rate 1.0mℓ/min
110-160min, linear gradient 0-50% B
Flow rate 0.5mℓ/min
160-190min, linear gradient 50-100% B
Flow rate 0.5mℓ/min
190-210min, Eluent B, Flow rate 0.5mℓ/min
Column temp. : 25℃
Detection : 280nm
Sample : Cow milk acid whey (pH4.7) 50mℓ

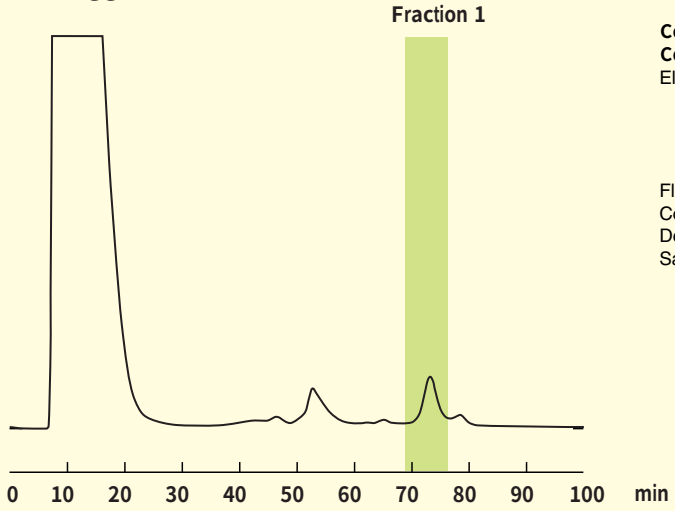
Application data of PrepEx series

Fig. 7-3 Proteins



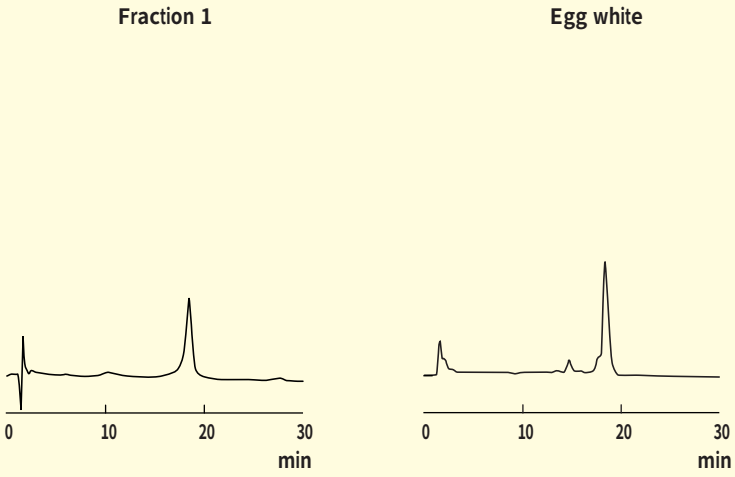
Conditions
Column : ProtEx-DEAE,8.0mm I.D.×100mmL
PrepEx-DEAE,8.0mm I.D.×100mmL
Eluent : A : 20mM Tris HCl (pH8.0)
B : A+0.5M NaCl (pH8.0)
Gradient : A→B, 60min, linear
Flow rate : 0.5mℓ/min
Column temp. : 25°C
Detection : 280nm
Sample : 1. Myoglobin 50μg
2. Conalbumin 50μg
3. Trypsin inhibitor 100μg

Fig. 7-4 Egg white



Conditions
Column : PrepEx-DEAE,8.0mm I.D.×100mm
Eluent : A : 100mM Phosphate buffer (pH6.5)
B : A+0.5M NaCl (pH6.5)
0-20min, Eluent A
20-80min, linear gradient 0-100%B
80-100min, Eluent B
Flow rate : 0.5mℓ/min
Column temp. : 25°C
Detection : 280nm,
Sample : Egg white (5times diluted) ,1000μl

Chromatograms of analytical column



Conditions
Column : ProtEx-DEAE,
4.6mm I.D.×50mm
Eluent : A : 100mM Phosphate buffer
(pH6.5)
B : A+0.5M NaCl
(pH6.5)
Gradient : A→B, 30min, linear
Flow rate : 0.5mℓ/min
Column temp. : 25°C
Detection : 280nm,
Sample : Fraction 1,100μl
Egg white (5 times diluted) ,100μl

CQH_P series

Hydrophobic interaction chromatography

Separation mechanism and characteristics of CQH_P series

MCI® GEL CQH_P series is preparative chromatography media for separating biomolecules in the basis of differnces of their hydrophobic properties. Average particle size is 30μm.

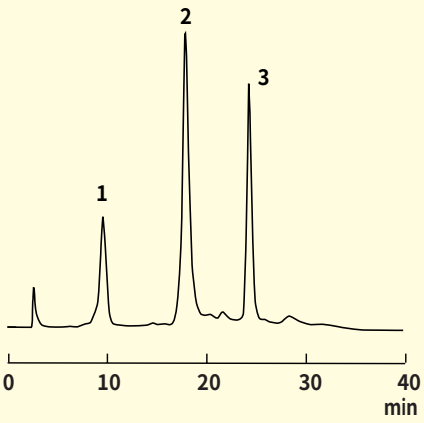
Two types of hydrophobic ligands, butyl type and phenyl type, these are defferences in hydrophobic properties, are available. An appropriate packing media can be selected in accordance with properties of injection samples.

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

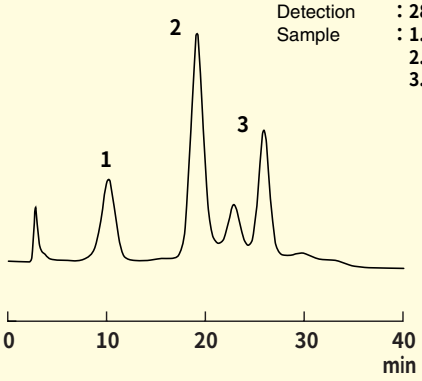
Application data of CQH_P series

Fig. 7-5 Proteins

10μm CQH 3BS



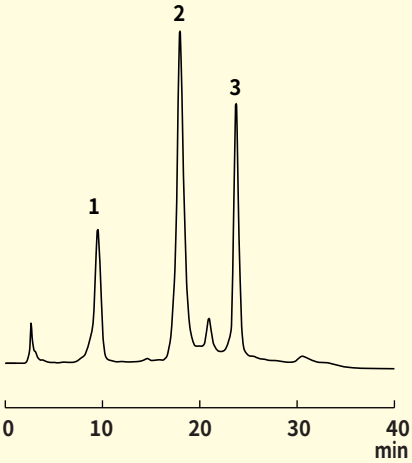
30μm CQH 3BP



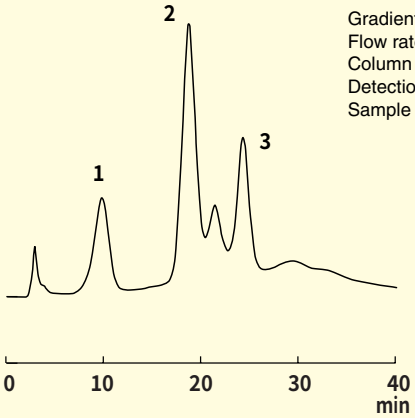
Conditions
Column : CQH3BS, 7.5mmI I.D.×75mmL
CQH3BP, 7.5mmI I.D.×75mmL
Eluent : A : B+1.7M $(NH_4)_2SO_4$
B : 0.1M Phosphate buffer (pH6.8)
Gradient : A→B, 30min, linear
Flow rate : 1.0mℓ/min
Column temp. : 25°C
Detection : 280nm,
Sample : 1. Ribonuclease A 112μg
2. Transferrin 154μg
3. α-Chymotrypsinogen A 60μg

Fig. 7-6 Proteins

10μm CQH 3PS



30μm CQH 3PP



Conditions
Column : CQH3PS, 7.5mm I.D.×75mmL
CQH3PP, 7.5mm I.D.×75mmL
Eluent : A : B+1.7M $(NH_4)_2SO_4$
B : 0.1M Phosphate buffer (pH6.8)
Gradient : A→B, 30min, linear
Flow rate : 1.0mℓ/min
Column temp. : 25°C
Detection : 280nm,
Sample : 1. Ribonuclease A 112μg
2. Transferrin 154μg
3. α-Chymotrypsinogen A 60μg

CHP series

Reversed phase chromatography

Separation mechanism and characteristics of CHP series

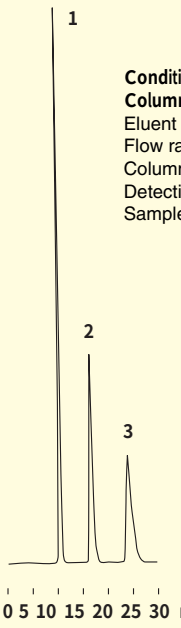
MCI® GEL CHP series is reversed phase chromatography media of porous type polymers.

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

MCI® GEL CHP55 series and CHP20 seriese are both ST/DVB polymers, but they differences in porosity. Pore size of CHP20 series is fairly larger than that of CHP55 series. Appropriate packing media can be selected in accordance with molecular size of injection samples.

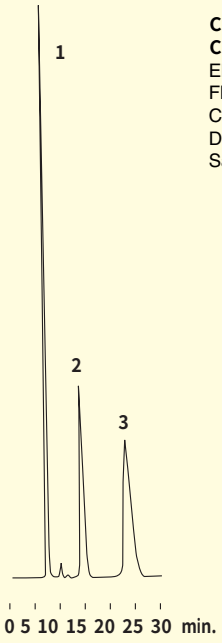
Application of CHP series

Fig. 7-7 Phthalic acid esters

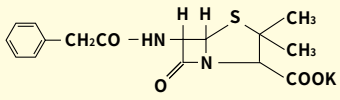


Conditions
Column : CHP55A, 10㎜I.D.×250㎜L
Eluent : H_2O/CH_3CN=20/80
Flow rate : 0.75㎖/min
Column temp. : 25℃
Detection : 254nm,
Sample : 1.Dimethyl phthalate 0.5%
2.Dipropyl phthalate 0.5%
3.Dibutyl phthalate 0.5%
100μl

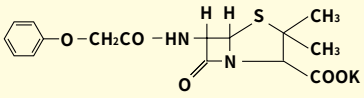
Fig. 7-8 Penicilin antibiotics



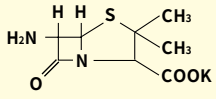
Conditions
Column : CHP55A, 10㎜I.D.×250㎜L
Eluent : CH_3OH/0.05M Phosphate buffer (pH8.0)=60/40
Flow rate : 2.18㎖/min
Column temp. : 25℃
Detection : 254nm,
Sample : 1.6-Aminopenicillanic acid 1000ppm
2.Penicillin G 1000ppm
3.Penicillin V 1000ppm
100μl



Penicllin G(Potassium Salt)

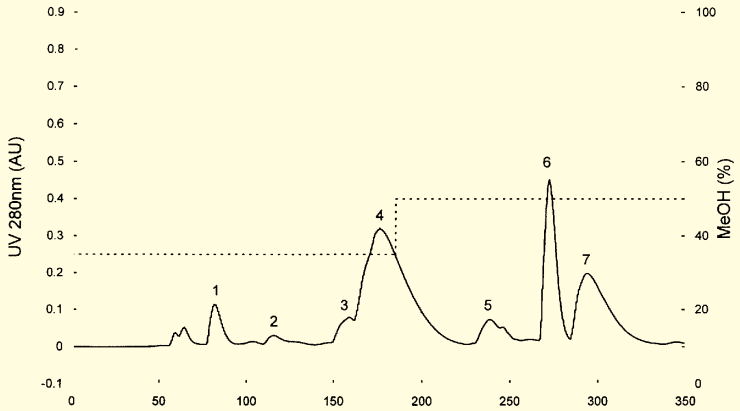


Penicllin V(Potassium Salt)



6-Aminopenioillanic acid

Fig. 7-9 Extract of green tea leaves



Conditions
Column : MCI® GEL CHP55A, 32mmI.D×465mm
Eluent : 0–185min, CH_3OH:0.01M Acetic acid(35:65)
185–350min, CH_3OH:0.01M Acetic acid(50:50)
Flow rate : 7.48㎖/min
Detection : 280nm
Sample : extract of green tea leaves, injection volumn 18.7㎖
1. epigallocatechin
2. catechin
3. epicatechin
4. epigallocatechin gallate
5. gallocatechin
6. epicatechin gallate
7. caffeine

Fig.7-10 Senna pulv. extract

Conditions

	Chromatogram A	Chromatogram B	Chromatogram C
Column	: MCI® GEL CHP5C 4.6mmI.D.×250mm	: MCI® GEL CHP20A 10.0mmI.D.×250mm	: MCI® GEL CHP20Y 10.0mmI.D.×250mm
Eluent	: *1	: *1	: *1
Flow rate	: 0.5mℓ/min.	: 2.4mℓ/min.	: 2.4mℓ/min.
Detection	: 270nm	: 270nm	: 270 nm
Sample	: *2 10μL	: *2 80μL	: *2 80 μL

*1: CH_3OH + 1% Acetic acid = 60 + 40 (vol.)
*2: Extract of senna pulv.

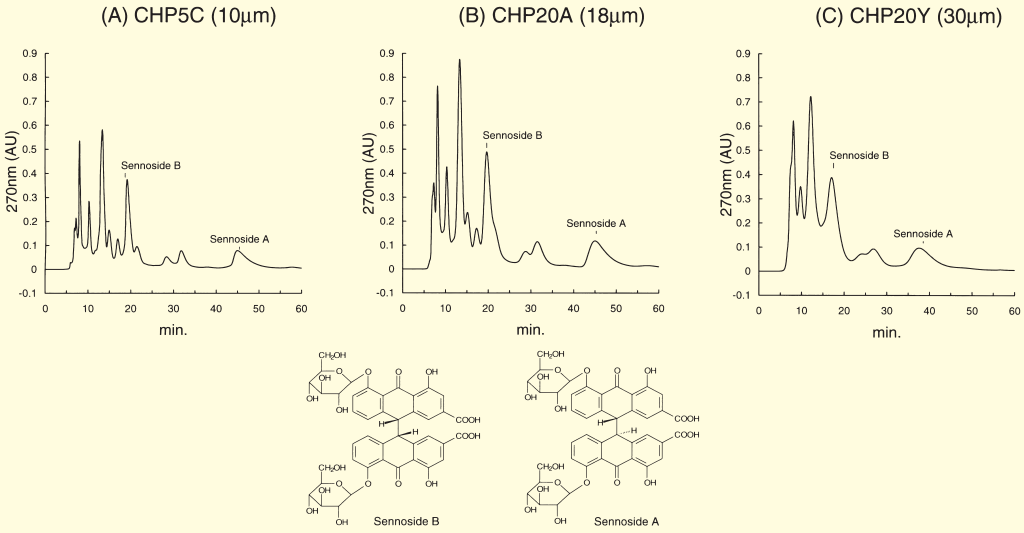


Fig. 7-11 Elution profile of senna pulv. extract separated on MCI GEL CHP20Y

Conditions

Column	: MCI® GEL CHP20Y 32mm I.D.×490mm
Eluent	: CH_3OH + 1% Acetic acid = 60 + 40 (vol.)
Flow rate	: 7.88mℓ/min.
Detection	: 270 nm
Sample	: Extract of senna pulv., partially purified by Diaion HP20 injected amount : 39.4 mℓ

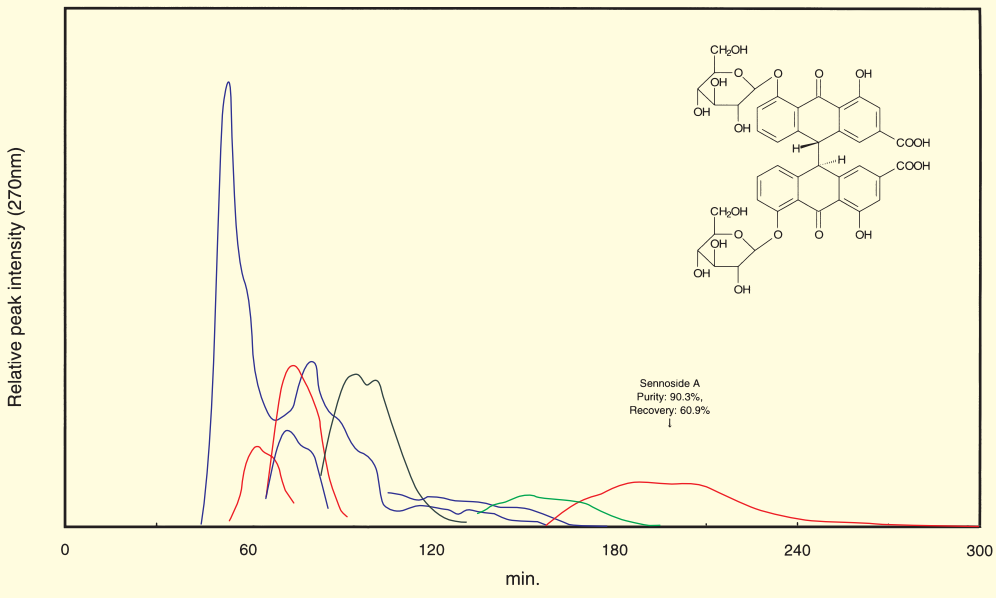


Fig. 7-12 Elution profile of gardenia fructus extract separated on MCI GEL CHP20Y

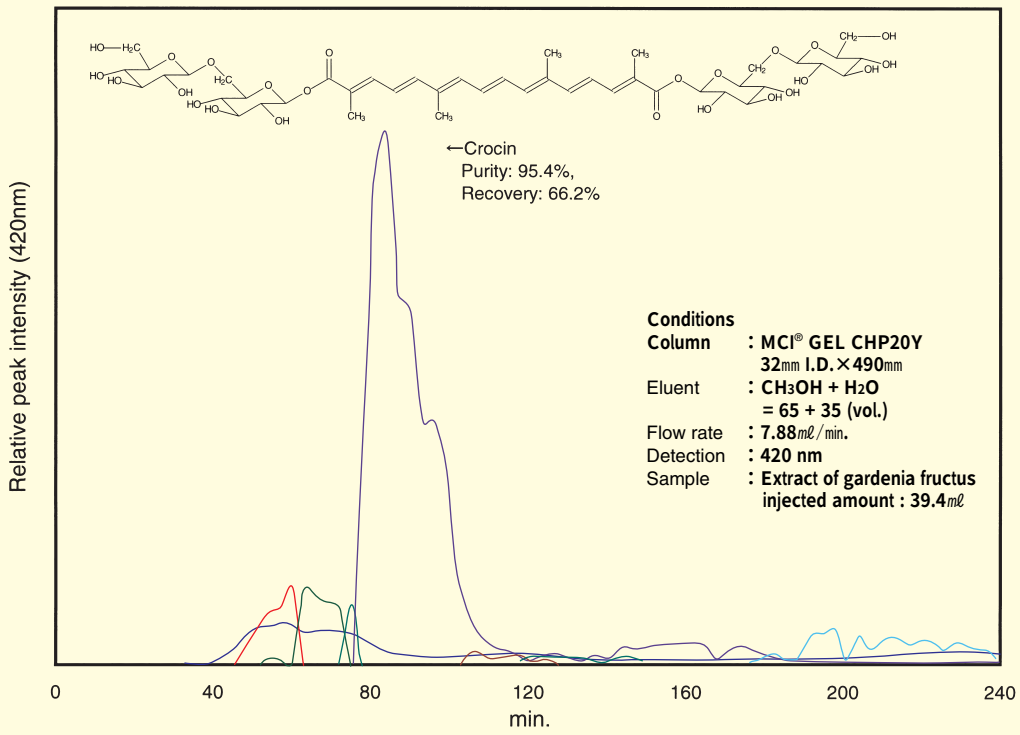
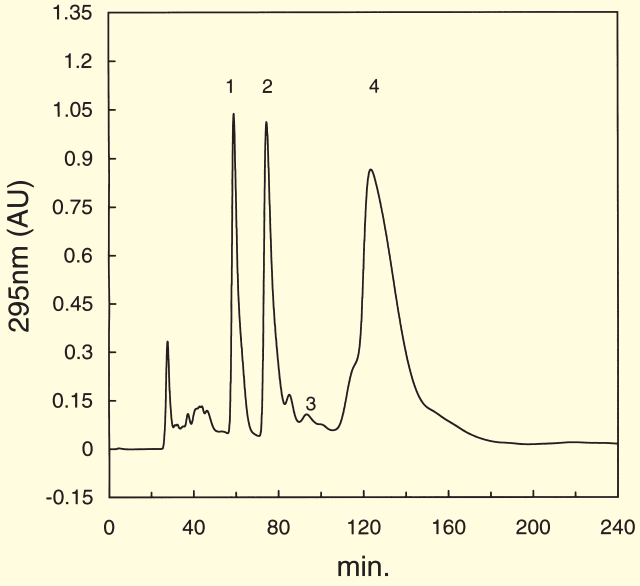
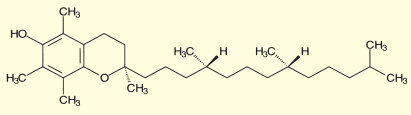
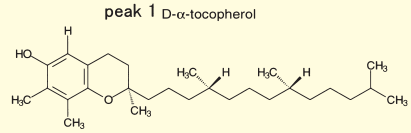


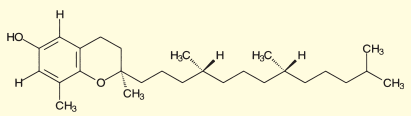
Fig. 7-13 Rice brain oil

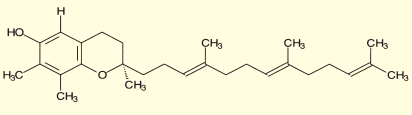
Conditions
Column : MCI® GEL CHP2MGY
20mm I.D.×500mm
Eluent : Hexane + C_2H_5OH = 98+2 (vol.)
Flow rate : 4.7mℓ/min.
Detection : 295 nm
Sample : Rice brain oil, 50mg/mℓ
injected amount : 1260 µL




peak 1 D-α-tocopherol


peak 2 D-γ-tocopherol


peak 3 D-δ-tocopherol


peak 4 D-γ-tocotrienol

8 MCI® GEL

MCI® GEL columns

main column			guard/pre-column		
Code No.	Name	Column dimensions (mm)	Code No.	Name	Column dimensions (mm)
Cation exchange resin	For amino acids				
001901	CK10U	6×120	003321	AFR2-PC	6×50
Cation exchange resin	For oligo saccharides				
000101	CK02A	20×250	000111	CK02AG	8×10
000102	CK02AS	20×250	000112	CK02ASG	8×10
000301	CK04S	10×200	001711 000311	CK10SG CK04SG	6×50 8×10
000302	CK04SS	10×200	001711 000312	CK10SG CK04SG	6×50 8×10
Cation exchange resin	For sugars				
000901	CK08S	8×500	000911	CK08SG	6×50
001001	CK08E	8×300	001011	CK08EG	6×50
001002	CK08EC	8×300	001012	CK08ECG	6×50
001003	CK08ES	8×300	001013	CK08ESG	6×50
Cation exchange resin	For carboxylic acids				
001005	CK08EH	8×300	001015	CK08EHG	6×50
Anion exchange resin	For carboxylic acids • sugars				
011101	CA08F	4.6×250	011111	CA08FG	4×10
011901	CDR10	4.6×250	011911	CDR10G	4×10
Ion chromatography	For cations				
003401	SCK01	6×50	001721	SCK-PC	6×50
003404	SCK01	4.6×150			
Ion chromatography	For anions				
013302	SCA04	4.6×150	013312	SCA-04G	4.6×30
			013021	SCA-PC	8×10
Bioseparation	For size exclusion	Hydrophilic polymer			
021301	CQP06	7.5×600	021311	CQP06G	4×50
021401	CQP10	7.5×600	021411	CQP10G	4×50
021501	CQP30	7.5×600	021511	CQP30G	4×50

main column			guard/pre-column		
Code No.	Name	Column dimensions (mm)	Code No.	Name	Column dimensions (mm)
Bioseparation	For anion exchange chromatography				
014603	ProtEx-DEAE	4.6×50			
014604	ProtEx-DEAE	7.5×100			
012601	CQA31S	7.5×75			
013001	CQA35S	7.5×75			
Bioseparation	For cation exchange chromatography				
003703	ProtEx-SP	4.6×50			
003704	ProtEx-SP	7.5×100			
003601	CQK30S	7.5×75			
003801	CQK31S	7.5×75			
Bioseparation	For hydrophobic interaction chromatography				
021601	CQH3BS	7.5×75			
021701	CQH3ES	7.5×75			
021801	CQH3PS	7.5×75			
Reversed phase columns					
040101	CHP10M	4.6×150			
020401	CHP5C	4.6×250			
040201	CHP2MGM	4.6×150			
020201	CHP2MG	4.6×250			
Chiral separation columns					
021901	CRS10W	4.6×50			
022001	CRS15W	4.6×50			

9 MCI® GEL
MCI® GEL chromatography media

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 bulk packings 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 40 years.

MCI® GEL bulk packings

For application of each packing material, please refer application data of the same packed column.

●For Ion chromatography [SCK series, SCA series]

Code No.	Name	Packing size (g)	Base material	Functional group	Counter ion	Mean particle size (μm)	Cross linkage (%)	Ion exchange capacity (μeq/g)	Remarks
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

●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)	Remarks
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	100mℓ	ST/DVB	RSO_3^-	H^+	75/150	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

●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)	Remarks
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	100mℓ	ST/DVB	QA	Cl^-	75／150	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 exchange resins for bioseparation [CQK series, CQA series]

Code No.	Name	Packing size (g)	Base material	Functional group	Counter ion	Mean particle size (μm)	Pore size (nm)	pH range	Remarks
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	100mℓ	HMA	SP	Na^+	30	60	1～13	
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	100mℓ	HMA	CM	Na^+	30	60	＞4	
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	100mℓ	HMA	DEAE	Cl^-	30	60	＜11	
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	100mℓ	HMA	QA	Cl^-	30	60	2～12	
1-501-01	PrepEx-DEAE	25mℓ	HMA	DEAE	Cl^-	30	100	＜11	Proteins
1-501-02	PrepEx-DEAE	100mℓ							
1-501-03	PrepEx-DEAE	1000mℓ							
1-502-01	PrepEx-SP	25mℓ	HMA	SP	Na^+	30	100	1～13	Proteins
1-502-02	PrepEx-SP	100mℓ							
1-502-03	PrepEx-SP	1000mℓ							

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

●Hydrophobic interaction chromatography resins for bioseparation [CQH series]

Code No.	Name	Packing size (g)	Base material	Functional group	Counter ion	Mean particle size (μm)	Pore size (nm)	Ion exchange capacity (meq／mℓ)	Remarks
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							

Abbreviation; HMA = Polyhydroxymethacrylate

●Size exclusion chromatography resins for bioseparation [CQP series]

Code No.	Name	Packing size (g)	Base material	Functional group	Counter ion	Mean particle size (μm)	Pore size (nm)	Exclusion limit	Remarks
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	100mℓ	HMA	—	—	30	60	1×10^6	

Abbreviation; HMA = Polyhydroxymethacrylate

●For reversed phase chromatography [CHP series]

Code No.	Name	Packing size (g)	Base material	Functional group	Counter ion	Mean particle size (μm)	Pore size (nm)	pH range	Remarks
1-202-01	CHP2MG	10	MA	—	—	10	25	2～12	Reversed phase chromatography
1-202-02	CHP2MG	1000mℓ							
1-204-01	CHP5C	10	ST/DVB	—	—	10	25	1～13	Reversed phase chromatography
1-201-01	CHP20P	100	ST/DVB	—	—	37／75	45	1～13	Reversed phase chromatography
1-302-01	CHP20P	100mℓ	ST/DVB	—	—	75／150	45	1～13	Reversed phase chromatography
1-302-02	CHP20P	500mℓ							
1-302-03	CHP20P	1000mℓ							
1-304-01	CHP55A	25mℓ	ST/DVB	—	—	18	25	1～13	Reversed phase chromatography
1-304-02	CHP55A	100mℓ							
1-304-03	CHP55A	1000mℓ							
1-303-01	CHP55Y	25mℓ	ST/DVB	—	—	30	25	1～13	Reversed phase chromatography
1-303-02	CHP55Y	100mℓ							
1-303-03	CHP55Y	1000mℓ							
1-307-01	CHP20A	25mℓ	ST/DVB	—	—	18	45	1～13	Reversed phase chromatography
1-307-02	CHP20A	100mℓ							
1-307-03	CHP20A	1000mℓ							
1-305-01	CHP20Y	25mℓ	ST/DVB	—	—	30	45	1～13	Reversed phase chromatography
1-305-02	CHP20Y	100mℓ							
1-305-03	CHP20Y	1000mℓ							
1-306-01	CHP2MGY	25mℓ	MA	—	—	30	25	2～12	Reversed phase chromatography
1-306-02	CHP2MGY	100mℓ							
1-306-03	CHP2MGY	1000mℓ							

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

●Synthetic adsorbents for enrichment organic compounds in environmental water

Code No.	Name	Packing size (mℓ)	Base material	Functional group	Counter ion	Mean particle size (μm)	Specific surface area (m²／g)	Ion exchange capacity (meq／mℓ)	Remarks
1-219-01	CSP800	50	ST/DVB	—	—	75／150	600	—	Synthetic adsorbents for non-ionic substances
1-132-01	CHPA25	20	ST/DVB	QA	Cl^-	150／300	20	＞2.0	Synthetic adsorbents for anionic substances

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

MCI® GEL CSP800 and MCI® GEL CHPA25 are used for enrichment traces of organic compounds in environmental water with high concentration ratio and high recovery, are recommended for sample preparation for mutagenicity study and GC-MS analysis. The CSP800 is for non-ionic substances such as trichloroethylene. The CHPA25 is for anionic substances such as humin. It is advised combined use these adsorbents.

●Cation exchange resin

Name	Packing size	Functional group	Mean particle size (μm)	Cross linkage (%)	Ion exchange capacity (meq／mℓ)	Remarks
CSP800	50g	RSO3-	25	8	＞1.9	Sugars, Carboxylic acids
CK08P	100mℓ	RSO3-	75/ 150	8	＞1.9	Sugars, Carboxylic acids

●Anion exchange resin

Name	Packing size	Functional group	Mean particle size (μm)	Cross linkage (%)	Ion exchange capacity (meq／mℓ)	Remarks
CA08Y	50g	QA	25	8	＞1.2	Sugars, Carboxylic acids
CA08P	100mℓ	QA	75/ 150	8	＞1.3	Sugars, Carboxylic acids

●Chelating resin for ion exchange chromatography

Name	Packing size	Functional group	Mean particle size (μm)	Cross linkage (%)	Ion exchange capacity (meq／mℓ)	Remarks
CHL10P	100g	Iminodiacetic acid	75/ 150	—	＞1.5	Metal
CHL 20P	100g	Polyamine	75/ 150	—	＞1.8	Metal
CLB10P	100g	Glucamine	75/ 150	—	＞1.0	Boron

●Reversed phase packing

Name	Packing size	Functional group	Mean particle size (μm)	Pore size (Å)	pH range	Remarks
CHP5C	10g	—	10	250	Whole range	Reversed phase
CHP2MG	10g	—	10	250	2～12	Reversed phase
CHP20P	100g	—	37/ 75	450	Whole range	Reversed phase
CHP20P	100mℓ	—	75/ 150	450	Whole range	Reversed phase
CSP207P	100mℓ	—	75/ 150	250	Whole range	Reversed phase
CHP2MGP	100mℓ	—	75/ 150	500	2～12	Reversed phase
CHPOD1Y	100mℓ	—	30	250	Whole range	Reversed phase
CHP50P			75/ 150	＜14000		Reversed phase
CHP75P			75/ 150	≪14000		Reversed phase

Protein exclusion limit MW

We have an assortment of MCI® GEL cation ion exchange resins, CK series, anion exchange resins, CA series, and chelating resins, CHL series, as solid phase adsorbents for the pretreatment in analyzing rare earth metals. We can also provide solid phase adsorbents with various micro-pore sizes and hydrophobicity, i.e. chemical structures, for R&D of new pharmaceuticals.
CHP50P and CHP75P with the controlled micro-pore size, in particular, have a distinctive advantage not to adsorb high molecular weight proteins but to adsorb only low molecular weight organic compounds.

10 MCI® GEL Compounds Index

	Compound	Classification	MCI® GEL Column	Figure	Page
1	Acetic acid	Carboxylic acid	CK08EH	2-12	11
2	Acetic acid	Carboxylic acid	CK08EH	2-17	12
3	Acetic acid	Carboxylic acid	CK08EH	2-18	12
4	Acetic acid	Carboxylic acid	CA08F	2-32	17
5	Acetic acid	Carboxylic acid	CA08F	2-33	18
6	Acetic acid	Carboxylic acid	CA08F	2-34	18
7	Acetylgalactosamine	Amino sugar	CK08EH	2-13	11
8	Acetylglucosamine	Amino sugar	CK08EH	2-13	11
9	Acetyl-D-Met.	Acetyl-D-amino acid	CRS10W	6-14	54
10	Acetyl-L-Met.	Acetyl-L-amino acid	CRS10W	6-14	54
11	5'-ADP	Nucleotide	CDR10	2-35	19
12	2'-AMP	Nucleotide	CDR10	2-35	19
13	2'-AMP	Nucleotide	CDR10	2-36	19
14	3'-AMP	Nucleotide	CDR10	2-36	19
15	5'-AMP	Nucleotide	CDR10	2-35	19
16	5'-AMP	Nucleotide	CDR10	2-36	19
17	5'-ATP	Nucleotide	CDR10	2-35	19
18	Adenine	Nucleic base	CDR10	2-35	19
19	Adenosine	Nuleoside	SCK01	3-6	22
20	Adonitol	Sugar alcohol	CK08EC	2-4	9
21	Alanine	Amino acid	CK10U	2-1	7
22	β-Alanine	Amino acid	CK10U	2-2	8
23	D-Alanine	D-Amino acid	CRS10W/CRS15W	6-18	56
24	L-Alanine	L-Amino acid	CRS10W/CRS15W	6-18	56
25	γ-Aminobutyric acid	Amino acid	CK10U	2-3	8
26	6-Aminopenicillanic acid	Penicillin antibiotic	CHP55A	7-8	62
27	Ammonia	Ammonia	SCK01	3-2	22
28	Ammonium ion	Cation	SCK01	3-1	22
29	Ammonium ion	Cation	SCK01	3-2	22
30	Ammonium ion	Ammonia	SCK01	3-3	22
31	Angiotensin II	Peptide	CHP2MGM	5-12	47
32	Antipyrine	Ingredients of medicine	CHP2MGM	5-10	46
33	Arginine	Amino acid	CK10U	2-1	7
34	Aspirin	Ingredients of medicine	CHP2MGM	5-10	46
35	Aspartic acid	Amino acid	CK10U	2-1	7
36	D-Aspartic acid	D-Amino acid	CRS10W	6-5	53
37	L-Aspartic acid	L-Amino acid	CRS10W	6-5	53
38	Bacitracin	Peptide	CQH3PS	4-26	38
39	Barbital	Anticonvulsant	CHP5C	5-17	49
40	Barium ion	Cation	SCK01	3-7	23
41	Benzoic acid	Aromatic carboxylic acids	CHP2MG	5-19	50
42	Bovine Serum Albumin	Protein	ProtEx-DEAE	4-9	32
43	Bromide	Anion	SCA04	3-12	24
44	Bromide	Anion	SCA04	3-13	24
45	n-Butyl alcohol	Alcohol	CK08EH	2-14	11
46	sec-Butyl alcohol	Alcohol	CK08EH	2-14	11
47	Cadmium ion	Cation	SCK01	3-8	23
48	Caffeine	Purine alkaloid	CHP10M	5-4	43
49	Caffeine	Ingredients of medicine	CHP2MGM	5-10	46
50	Caffeine	Purine alkaloid	CHP55A	7-9	62
51	Calcium ion	Cation	SCK01	3-7	23
52	Calcium ion	Cation	SCK01	3-8	23
53	Calcium ion	Cation	SCK01	3-9	23
54	Calcium ion	Cation	SCK01	3-10	23
55	Calcium ion	Cation	SCK01	3-11	23
56	Carbamazepine	Anticonvulsant	CHP5C	5-17	49
57	Carbonate	Anion	SCA04	3-15	25
58	4-Carboxybenzaldehyde	Aromatic carboxylic acids	CHP2MG	5-19	50
59	Catechin	Catechin	CHP55A	7-9	61
60	Cellobiose	Disaccharide	CA08F	2-31	17

	Compound	Classification	MCI® GEL Column	Figure	Page
61	Cellobiose	Disaccharide	CDR10	2-37	20
62	Cesium ion	Cation	SCK01	3-1	22
63	Chloride	Anion	SCA04	3-12	24
64	Chloride	Anion	SCA04	3-13	24
65	Chloride	Anion	SCA04	3-14	25
66	Chloride	Anion	SCA04	3-15	25
67	Chloride	Anion	SCA04	3-17	26
68	Chloroacetic acid	Carboxylic acid	CK08EH	2-17	12
69	Chloroacetic acid	Carboxylic acid	CK08EH	2-18	12
70	Cholic acid	Bile acid	CHP10M	5-7	44
71	α-Chymotrypsinogen A	Protein	ProtEx-SP	4-10	32
72	α-Chymotrypsinogen A	Protein	CQK31S	4-21	36
73	α-Chymotrypsinogen A	Protein	CQK30S	4-21	36
74	α-Chymotrypsinogen A	Protein	CHP2MGM	5-13	47
75	α-Chymotrypsinogen A	Protein	CHP2MG	5-20	50
76	α-Chymotrypsinogen A	Protein	CQH3BP	7-5	61
77	α-Chymotrypsinogen A	Protein	CQH3PP	7-6	61
78	2'-CMP	Nucleotide	CDR10	2-36	19
79	3'-CMP	Nucleotide	CDR10	2-36	19
80	5'-CMP	Nucleotide	CDR10	2-35	19
81	5'-CMP	Nucleotide	CDR10	2-36	19
82	Cinchonine	Cinchona alkaloid	CHP10M	5-5	43
83	Citric acid	Carboxylic acid	CK08EH	2-12	11
84	Citric acid	Carboxylic acid	CA08F	2-32	17
85	Citric acid	Carboxylic acid	CA08F	2-33	18
86	Cobalt ion	Cation	SCK01	3-8	23
87	Colibacillus extract	Protein	CQH3ES	4-24	38
88	Colibacillus extract	Protein	CQH3PS	4-25	38
89	Collagenase	Protein	ProtEx-DEAE	4-15	34
90	Conalbumin	Protein	ProtEx-DEAE	4-5	31
91	Conalbumin	Protein	PrepEx-DEAE	7-3	60
92	Cow milk acid whey	Cow milk acid whey	PrepEx-SP	7-2	59
93	Crocin	Crude drug	CHP20Y	7-12	64
94	Corticosterone	Adrenal cortex hormone	CHP10M	5-9	45
95	3',5'-Cyclic AMP	Nucleotide	CDR10	2-35	19
96	Cystine	Amino acid	CK10U	2-1	7
97	Cytidine	Nucleoside	SCK01	3-6	22
98	Cytochrome C	Protein	CQP30	4-3	29
99	Cytochrome C	Protein	ProtEx-SP	4-10	32
100	Cytochrome C	Protein	CQK30S	4-20	36
101	Cytochrome C	Protein	CQK31S	4-20	36
102	Cytochrome C	Protein	CHP2MGM	5-13	47
103	Cytochrome C	Protein	CHP2MG	5-20	50
104	Cytochrome C	Protein	PrepEx-SP	7-1	59
105	Cytosine	Nucleic base	CDR10	2-35	19
106	Deoxycholic acid	Bile acid	CHP10M	5-7	44
107	11-Deoxycortisol	Adrenal cortex hormone	CHP10M	5-9	45
108	Deoxyribose	Deoxysugar	CA08F	2-31	17
109	Deoxyribose	Deoxysugar	CDR10	2-37	20
110	D,D-2,6-Diaminopimelic acid	D,D-Diamino carboxylic acid	CRS10W	6-15	54
111	L,L-2,6-Diaminopimelic acid	L,L-Diamino carboxylic acid	CRS10W	6-15	54
112	meso-2,6-Diaminopimelic acid	meso-Diamino carboxylic acid	CRS10W	6-15	54
113	Diazepam	Anticonvulsant	CHP5C	5-17	49
114	Dibutyl phthalate	Phthalic acid ester	CHP10M	5-3	42
115	Dibutyl phthalate	Phthalic acid ester	CHP55A	7-7	62
116	Dichloroacetic acid	Carboxylic acid	CK08EH	2-17	12
117	Dichloroacetic acid	Carboxylic acid	CK08EH	2-18	12
118	Diethylene glycol	Polyalcohol	CK08EH	2-16	12
119	Dimethylamine	Amine	SCK01	3-2	22
120	4-Dimethylaminoantipyrine	Ingredients of medicine	CHP2MGM	5-10	46
121	Diethyl phthalate	Phthalic acid ester	CHP10M	5-3	42
122	Dimethyl phthalate	Phthalic acid ester	CHP55A	7-7	62
123	Dimethyl phthalate	Phthalic acid ester	CHP10M	5-3	42
124	Dimethyl phthalate	Phthalic acid ester	CHP55A	7-7	62
125	Dopamine	Catecholamine	CHP10M	5-2	42

	Compound	Classification	MCI ®GEL Column	Figure	Page
126	Egg white	Egg white	PrepEx-DEAE	7-4	60
127	Epicatechin	Catechin	CHP55A	7-9	62
128	Epicatechin gallate	Catechin	CHP55A	7-9	62
129	Epigallocatechin	Catechin	CHP55A	7-9	62
130	Epigallocatechin gallate	Catechin	CHP55A	7-9	62
131	Epinephrine	Catecholamine	CHP10M	5-2	42
132	4-Epitetracycline	Antibiotics	CHP5C	5-16	49
133	Erythritol	Sugar alcohol	CK08EC	2-4	9
134	Erythritol	Sugar alcohol	CK08EC	2-11	10
135	D-Ethionine	D-Amino acid	CRS10W	6-2	53
136	L-Ethionine	L-Amino acid	CRS10W	6-2	53
137	Ethyl alcohol	Alcohol	CK08EC	2-11	10
138	Ethyl alcohol	Alcohol	CK08EH	2-14	11
139	Ethyl alcohol	Alcohol	CK08EH	2-15	11
140	Ethylene glycol	Polyalcohol	CK08EH	2-15	11
141	Ethylene glycol	Polyalcohol	CK08EH	2-16	12
142	Extract of green tea leaves	Catechins	CHP55A	7-9	62
143	Ferritin	Protein	CQP30	4-3	29
144	Fluroride	Anion	SCA04	3-12	24
145	Fluroride	Anion	SCA04	3-13	24
146	Formic acid	Carboxylic acid	CK08EH	2-12	11
147	Formic acid	Carboxylic acid	CA08F	2-32	17
148	Fructose	Sugar	CK08EC	2-4	9
149	Fructose	Sugar	CK08EC	2-5	9
150	Fructose	Sugar	CK08EC	2-7	10
151	Fructose	Sugar	CK08EC	2-8	10
152	Fructose	Sugar	CK08EC	2-9	10
153	Fructose	Sugar	CK08EC	2-10	10
154	Fructose	Sugar	CK08EC	2-11	10
155	Fructose	Sugar	CK04S	2-28	16
156	Fructose	Sugar	CK04S	2-29	16
157	Fructose	Sugar	CK04S	2-30	16
158	Fructose	Sugar	CA08F	2-31	17
159	Fructose	Sugar	CDR10	2-37	20
160	Fructo-oligosaccharide	Fructo-oligosaccharide	CK04S	2-30	16
161	Fucose	Sugar	CA08F	2-31	17
162	Galactose	Sugar	CK08EC	2-6	9
163	Galactose	Sugar	CA08F	2-31	17
164	Galactose	Sugar	CDR10	2-37	20
165	Gallocatechin	Catechin	CHP55A	7-9	62
166	Gentiobiose	Disaccharide	CK08EC	2-4	9
167	Gluconic acid	Carboxylic acid	CA08F	2-33	18
168	Gluconic acid	Carboxylic acid	CA08F	2-34	18
169	Gluconic acid	Carboxylic acid	CQP06	4-4	29
170	Glucose	Sugar	CK08EC	2-4	9
171	Glucose	Sugar	CK08EC	2-5	9
172	Glucose	Sugar	CK08EC	2-7	10
173	Glucose	Sugar	CK08EC	2-8	10
174	Glucose	Sugar	CK08EC	2-9	10
175	Glucose	Sugar	CK08EC	2-10	10
176	Glucose	Sugar	CK08EC	2-11	10
177	Glucose	Sugar	CK08EH	2-13	11
178	Glucose	Sugar	CK04S	2-28	16
179	Glucose	Sugar	CK04S	2-29	16
180	Glucose	Sugar	CK04S	2-30	16
181	Glucose	Sugar	CA08F	2-31	17
182	Glucose	Sugar	CDR10	2-37	20
183	Glucose	Sugar	CQP06	4-4	29
184	Glutamic acid	Amino acid	CK10U	2-1	7
185	D-Glutamic acid	D-Amino acid	CRS10W	6-6	53
186	L-Glutamic acid	L-Amino acid	CRS10W	6-6	53
187	Glycerol	Polyalcohol	CK08EC	2-11	10
188	Glycerol	Polyalcohol	CK08EH	2-15	11
189	Glycine	Amino acid	CK10U	2-1	7
190	Glycohemoglobin	Protein	ProtEx-SP	4-11	32

	Compound	Classification	MCI® GEL Column	Figure	Page
191	Glycolic acid	Carboxylic acid	CK08EH	2-12	11
192	Glycolic acid	Carboxylic acid	CK08EH	2-18	12
193	Glycyrrhizic acid	Chinese medicinal drug	CHP10M	5-8	45
194	Gly-Tyr	Peptide	CHP2MGM	5-12	47
195	3'-GMP	Nucleotide	CDR10	2-36	19
196	5'-GMP	Nucleotide	CDR10	2-36	19
197	5'-GTP	Nucleotide	CDR10	2-35	19
198	Guanosine	Nucleoside	SCK01	3-6	22
199	Hemoglobin A0	Protein	ProtEx-DEAE	4-6	31
200	Hemoglobin A2	Protein	ProtEx-DEAE	4-6	31
201	Hemoglobin S	Protein	ProtEx-DEAE	4-6	31
202	Histidine	Amino acid	CK10U	2-1	7
203	D-Histidine	D-Amino acid	CRS10W	6-7	53
204	L-Histidine	L-Amino acid	CRS10W	6-7	53
205	Human growth hormone	Hormone	ProtEx-DEAE	4-7	31
206	Human serum	Serum	CQH3ES	4-23	38
207	Human serum	Serum	CQH3PS	4-23	38
208	Hydrocortisone	Adrenal cortex hormone	CHP10M	5-9	45
209	5-Hydroxytryptophan	Amino acid	CHP10M	5-2	42
210	D-2-Hydroxy-n-butyric acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	55
211	L-2-Hydroxy-n-butyric acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	55
212	D-α-Hydroxy isocaproic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	55
213	L-α-Hydroxy isocaproic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	55
214	D-α-Hydroxy-n-valeric acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	55
215	L-α-Hydroxy-n-valeric acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	55
216	D-m-Hydroxymandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	55
217	L-m-Hydroxymandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	55
218	D-p-Hydroxymandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	55
219	L-p-Hydroxymandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	55
220	Hypoxanthine	Uric acid related compound	CHP10M	5-6	44
221	IgG1 MOPC21(mouse)	monoclonal antibody	ProtEx-DEAE	4-16	34
222	IgG2b, κ (mouse)	monoclonal antibody	ProtEx-DEAE	4-14	33
223	5'-IMP	Nucleotide	CDR10	2-36	19
224	Interleukin 2	Protein	ProtEx-DEAE	4-9	32
225	Isoleucine	Amino acid	CK10U	2-1	7
226	allo-D-Isoleucine	D-Amino acid	CRS10W	6-1	52
227	allo-L-Isoleucine	L-Amino acid	CRS10W	6-1	52
228	D-Isoleucine	D-Amino acid	CRS10W	6-1	52
229	L-Isoleucine	L-Amino acid	CRS10W	6-1	52
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	β-Lactoglobulin	Protein	CQA31S	4-19	35
236	β-Lactoglobulin	Protein	CQA35S	4-19	35
237	β-Lactoglobulin	Protein	CHP2MG	5-20	50
238	Lactose	Disaccharide	CK08EC	2-4	9
239	Lactose	Disaccharide	CK08EC	2-6	9
240	Lactose	Disaccharide	CA08F	2-31	17
241	Lactose	Disaccharide	CDR10	2-37	20
242	Lactulose	Disaccharide	CK08EC	2-6	9
243	D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-11	53
244	L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-11	53
245	D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-16	55
246	L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-16	55
247	D-Lactic acid	D-α-Hydroxycarboxylic acid	CRS10W/CRS15W	6-19	56
248	L-Lactic acid	L-α-Hydroxycarboxylic acid	CRS10W/CRS15W	6-19	56
249	Leucine	Amino acid	CK10U	2-1	7
250	D-Leucine	D-Amino acid	CRS10W	6-2	53
251	L-Leucine	L-Amino acid	CRS10W	6-2	53
252	Leu Enkephalin	Peptide	CQH3PS	4-26	38
253	Leu Enkephalin	Peptide	CHP2MGM	5-12	47
254	Lipoxidase	Enzyme	CQA31S	4-22	36
255	Lithium ion	Cation	SCK01	3-1	22

	Compound	Classification	MCI® GEL Column	Figure	Page
256	Lysine	Amino acid	CK10U	2-1	7
257	D-Lysine	D-Amino acid	CRS10W	6-8	53
258	L-Lysine	L-Amino acid	CRS10W	6-8	53
259	Lysozyme	Protein	PrepEx-SP	7-1	59
260	Lysozyme	Protein	CQK30S	4-20	36
261	Lysozyme	Protein	CQK31S	4-20	36
262	Magnesium ion	Cation	SCK01	3-7	23
263	Magnesium ion	Cation	SCK01	3-9	23
264	Magnesium ion	Cation	SCK01	3-10	23
265	Magnesium ion	Cation	SCK01	3-11	23
266	Malic acid	Carboxylic acid	CK08EH	2-12	11
267	Malic acid	Carboxylic acid	CA08F	2-32	17
268	Malonic acid	Carboxylic acid	CK08EH	2-12	11
269	Malonic acid	Carboxylic acid	CA08F	2-32	17
270	Maltose	Disaccharide	CA08F	2-31	17
271	Maltose	Disaccharide	CDR10	2-37	20
272	D-Mandelic acid	D-α-Hydroxycarboxylic acid	CRS10W	6-17	55
273	L-Mandelic acid	L-α-Hydroxycarboxylic acid	CRS10W	6-17	55
274	Manganese ion	Cation	SCK01	3-8	23
275	Mannitol	Sugar alcohol	CK08EC	2-4	9
276	Mannitol	Sugar alcohol	CK08EC	2-11	10
277	Mannose	Sugar	CK08EC	2-4	9
278	Mannose	Sugar	CA08F	2-31	17
279	Mannose	Sugar	CDR10	2-37	20
280	D-Methionine	D-Amino acid	CRS10W	6-3	53
281	L-Methionine	L-Amino acid	CRS10W	6-3	53
282	D-Methionine	D-Amino acid	CRS10W	6-14	54
283	L-Methionine	L-Amino acid	CRS10W	6-14	54
284	Melibiose	Disaccharide	CA08F	2-31	17
285	Melibiose	Disaccharide	CDR10	2-37	20
286	Met Enkephalin	Peptide	CHP2MGM	5-12	47
287	Methionine	Amino acid	CK10U	2-1	7
288	Methyl alcohol	Alcohol	CK08EH	2-15	11
289	Methylamine	Amine	SCK01	3-2	22
290	Met-Leu-Tyr	Peptide	CQH3PS	4-26	38
291	Mouse brain sap	Mouse brain sap	ProtEx-DEAE	4-12	33
292	Myoglobin	Protein	CQP30	4-3	29
293	Myoglobin	Protein	ProtEx-DEAE	4-5	31
294	Myoglobin	Protein	CQA31S	4-18	35
295	Myoglobin	Protein	CQA35S	4-18	35
296	Myoglobin	Protein	CQA31S	4-19	35
297	Myoglobin	Protein	CQA35S	4-19	35
298	Myoglobin	Protein	CQK30S	4-20	36
299	Myoglobin	Protein	CQK31S	4-20	36
300	Myoglobin	Protein	PrepEx-DEAE	7-3	60
301	Nitrate	Anion	SCA04	3-12	24
302	Nitrate	Anion	SCA04	3-13	24
303	Nitrate	Anion	SCA04	3-14	25
304	Nitrate	Anion	SCA04	3-15	25
305	Nitrate	Anion	SCA04	3-17	26
306	Nitrite	Anion	SCA04	3-12	24
307	Nitrite	Anion	SCA04	3-13	24
308	D-Norleucine	D-Amino acid	CRS10W	6-3	53
309	L-Norleucine	L-Amino acid	CRS10W	6-3	53
310	D-Norvaline	D-Amino acid	CRS10W	6-3	53
311	L-Norvaline	L-Amino acid	CRS10W	6-3	53
312	Oligosaccharide	Dp1-Dp9	CK04S	2-21,25	15,16
313	Oligosaccharide	Dp1-Dp13	CK04SS	2-22,26	15,16
314	Oligosaccharide	Dp1-Dp15	CK02A	2-23	15
315	Oligosaccharide	Dp1-Dp23	CK02AS	2-24,27	15,16
316	Orotic acid	Uric acid related compound	CHP10M	5-6	44
317	Ovalbumin	Protein	CQP30	4-3	29
318	Ovalbumin	Protein	CQA31S	4-18	35
319	Ovalbumin	Protein	CQA35S	4-18	35
320	Oxalic acid	Carboxylic acid	CK08EH	2-12	11

	Compound	Classification	MCI® GEL Column	Figure	Page
321	Oxine copper	Agricultural chemical	CHP2MG	5-18	50
322	Pancreatin	Digestive enzyme	ProtEx-DEAE	4-17	34
323	Penicillin G	Penicillin antibiotic	CHP55A	7-8	62
324	Penicillin V	Penicillin antibiotic	CHP55A	7-8	62
325	Phenacetin	Ingredients of medicine	CHP2MGM	5-10	46
326	D-Phenylalanine	D-Amino acid	CRS10W	6-2	53
327	L-Phenylalanine	L-Amino acid	CRS10W	6-2	53
328	D-Phenylalanine	D-Amino acid	CRS10W	6-9	53
329	L-Phenylalanine	L-Amino acid	CRS10W	6-9	53
330	D-α-Phenylglycine	D-Amino acid	CRS10W	6-13	54
331	L-α-Phenylglycine	L-Amino acid	CRS10W	6-13	54
332	Phenobarbital	Anticonvulsant	CHP5C	5-17	49
333	Phosphate	Anion	SCA04	3-12	24
334	Polyethyleneglycol	Water soluble polymer	CQP30	4-2	29
335	Potassium ion	Cation	SCK01	3-1	22
336	Potassium ion	Cation	SCK01	3-3	22
337	Potassium ion	Cation	SCK01	3-4	22
338	Potassium ion	Cation	SCK01	3-5	22
339	Procainamide	Procainamide	CHP2MGM	5-14	48
340	Procaine	Procaine	CHP2MGM	5-14	48
341	Proline	Amino acid	CK10U	2-1	7
342	D-Proline	D-Amino acid	CRS10W	6-2	53
343	L-Proline	L-Amino acid	CRS10W	6-2	53
344	n-Propyl alcohol	Alcohol	CK08EH	2-14	11
345	Propyleneglycol	Polyalcohol	CK08EH	2-15	11
346	Quinine	Cinchona alkaloid	CHP10M	5-5	43
347	Rhamnose	Sugar	CA08F	2-31	17
348	Rhamnose	Sugar	CDR10	2-37	20
349	Ribonuclease A	Protein	ProtEx-SP	4-10	32
350	Ribonuclease A	Protein	CQK30S	4-20	36
351	Ribonuclease A	Protein	CQK31S	4-20	36
352	Ribonuclease A	Protein	CQK31S	4-21	36
353	Ribonuclease A	Protein	CQK30S	4-21	36
354	Ribonuclease A	Protein	CHP2MGM	5-13	47
355	Ribonuclease A	Protein	CHP2MG	5-20	50
356	Ribonuclease A	Protein	PrepEx-SP	7-1	59
357	Ribonuclease A	Protein	CQH3BP	7-5	61
358	Ribonuclease A	Protein	CQH3PP	7-6	61
359	Ribose	Sugar	CK08EC	2-4	9
360	Ribose	Sugar	CA08F	2-31	17
361	Ribose	Sugar	CDR10	2-37	20
362	RNA type III from bakers yeast	RNA	ProtEx-DEAE	4-13	33
363	Rubidium ion	Cation	SCK01	3-1	22
364	Salicin	Phenol glycoside	CK08EC	2-4	9
365	Sennoside A	Crude drug	CHP5C	7-10	63
366	Sennoside A	Crude drug	CHP20A	7-10	63
367	Sennoside A	Crude drug	CHP20Y	7-10	63
368	Sennoside A	Crude drug	CHP20Y	7-11	63
369	Sennoside B	Crude drug	CHP5C	7-10	63
370	Sennoside B	Crude drug	CHP20A	7-10	63
371	Sennoside B	Crude drug	CHP20Y	7-10	63
372	Serine	Amino acid	CK10U	2-1	7
373	D-Serine	D-Amino acid	CRS10W	6-4	53
374	L-Serine	L-Amino acid	CRS10W	6-4	53
375	Serotonin	Catecholamine	CHP10M	5-2	42
376	Sodium ion	Cation	SCK01	3-1	22
377	Sodium ion	Cation	SCK01	3-3	22
378	Sodium ion	Cation	SCK01	3-4	22
379	Sodium ion	Cation	SCK01	3-5	22
380	Sorbitol	Sugar alcohol	CK08EC	2-5	9
381	Sorbitol	Sugar alcohol	CK08EH	2-15	11
382	Stachyose	Tetrasaccharide	CK08EC	2-4	9
383	Strontium ion	Cation	SCK01	3-7	23
384	Strontium ion	Cation	SCK01	3-8	23
385	Succinylsulfathiazole	Sulfa drugs	CHP2MGM	5-11	46

	Compound	Classification	MCI® GEL Column	Figure	Page
386	Sucrose	Disaccharide	CK08EC	2-5	9
387	Sucrose	Disaccharide	CK08EC	2-7	10
388	Sucrose	Disaccharide	CK08EC	2-8	10
389	Sucrose	Disaccharide	CK04S	2-30	16
390	Sulfamerazine	Sulfa drugs	CHP2MGM	5-11	46
391	Sulfanilamide	Sulfa drugs	CHP2MGM	5-11	46
392	Sulfate	Anion	SCA04	3-12	24
393	Sulfate	Anion	SCA04	3-13	24
394	Sulfate	Anion	SCA04	3-14	25
395	Sulfate	Anion	SCA04	3-15	25
396	Sulfate	Anion	SCA04	3-16	26
397	Sufathiazole	Sulfa drugs	CHP2MGM	5-11	46
398	Tartalic acid	Carboxylic acid	CK08EH	2-12	11
399	Tartalic acid	Carboxylic acid	CA08F	2-32	17
400	Tetracycline	Antibiotics	CHP5C	5-16	49
401	Terephthalic acid	Aromatic carboxylic acid	CHP2MG	5-19	50
402	Theobromine	Purine alkaloid	CHP10M	5-4	43
403	Theophylline	Purine alkaloid	CHP10M	5-4	43
404	Theophylline	Purine alkaloid	CHP10M	5-6	44
405	Thiocyanic ion	Anion	SCA04	3-16	26
406	Thiosulfuric ion	Anion	SCA04	3-16	26
407	Thiuram	Agricultural chemical	CHP2MG	5-18	50
408	Threonine	Amino acid	CK10U	2-1	7
409	Thymine	Nucleic base	CDR10	2-35	19
410	α-Tocopherol	Vitamin	CHP2MGY	7-13	64
411	δ-Tocopherol	Vitamin	CHP2MGY	7-13	64
412	γ-Tocopherol	Vitamin	CHP2MGY	7-13	64
413	γ-Tocotrienol	Vitamin	CHP2MGY	7-13	64
414	p-Toluic acid	Aromatic carboxylic acid	CHP2MG	5-19	50
415	TPN	Nucleotide	CDR10	2-35	19
416	Transferrin	Protein	CQA35S	4-19	35
417	Transferrin	Protein	CQA31S	4-19	35
418	Transferrin	Protein	CHP2MG	5-20	50
419	Transferrin	Protein	CQH3BP	7-5	61
420	Transferrin	Protein	CQH3PP	7-6	61
421	Trichloroacetic acid	Carboxylic acid	CK08EH	2-17	12
422	Triethyleneglycol	Polyalcohol	CK08EH	2-16	12
423	Trimethylamine	Amine	SCK01	3-2	22
424	Tyrosine	Amino acid	CK10U	2-1	7
425	D-Tyrosine	D-Amino acid	CRS10W	6-2	53
426	L-Tyrosine	L-Amino acid	CRS10W	6-2	53
427	Trypsin Inhibitor	Enzyme	ProtEx-DEAE	4-5	31
428	Trypsin Inhibitor	Enzyme	CQA31S	4-18	35
429	Trypsin Inhibitor	Enzyme	CQA35S	4-18	35
430	Trypsin inhibitor	Enzyme	PrepEx-DEAE	7-3	60
431	Trypsinogen	Enzyme	CQK31S	4-21	36
432	Trypsinogen	Enzyme	CQK30S	4-21	36
433	Tryptophan	Amino acid	CHP10M	5-2	42
434	D-Tryptophan	D-Amino acid	CRS10W	6-10	53
435	L-Tryptophan	L-Amino acid	CRS10W	6-10	53
436	3'-UMP	Nucleotide	CDR10	2-36	19
437	5'-UMP	Nucleotide	CDR10	2-36	19
438	Uracil	Nucleic base	CDR10	2-35	19
439	Uric acid	Uric acid	CHP10M	5-6	44
440	Uridine	Nucleoside	SCK01	3-6	22
441	Urine	Urine	CDR10	2-38	20
442	Ursodeoxycholic acid	Bile acid	CHP10M	5-7	44
443	Valine	Amino acid	CK10U	2-1	7
444	Valine	Amino acid	CK10U	2-2	8
445	D-Valine	D-Amino acid	CRS10W	6-2	53
446	L-Valine	L-Amino acid	CRS10W	6-2	53
447	Vitamin B3	Water soluble vitamin	CHP2MGM	5-15	48
448	Vitamin B6	Water soluble vitamin	CHP2MGM	5-15	48
449	Vitamin B12	Water soluble vitamin	CHP2MGM	5-15	48
450	Vitamin C	Water soluble vitamin	CHP2MGM	5-15	48

	Compound	Classification	MCI® GEL Column	Figure	Page
451	Xanthine	Uric acid related compound	CHP10M	5-6	44
452	Xylitol	Sugar alcohol	CK08EH	2-4	9
453	Xylitol	Sugar alcohol	CK08EC	2-15	11
454	Xylose	Sugar	CA08F	2-31	17
455	Xylose	Sugar	CDR10	2-37	20
456	Zinc ion	Cation	SCK01	3-8	23

Limited warranty

Mitsubishi Chemical Corporation warrants that its pre-packed columns (including separation media products) shall meet published specifications at the time of shipment from Mitsubishi Chemical Corporation. Because of the susceptibility of these products to deterioration, all warranty claims must be made within the stipulated in the listed sales office. All claims shall be deemed waived in the event the purchaser fails to notify the company within the period.

Conditions

A. The products in this brochure are for laboratory or manufacturing use. They are not intended for drug, medicinal, food additive or household use. Compliance with local and government regulations concerning their use is the responsibility of the purchaser.

B.Voiding of warranty :
This warranty is null and void if any product has been (1) altered or modified such that its stability or reliability is any way affected ; (2) misused ; or (3) damaged by abuse, negligence or accident. The term "misuse" includes, but is not limited to, use not in compliance with the "Column Handling Instructions".

C.Limitations and Exclusions :
All recommendations, information and descriptions supplied by Mitsubishi Chemical Corporation with respect to any product in this brochure are believed to be accurate and reliable, but do not constitute warranties. The sole liability of Mitsubishi Chemical Corporation for any breach of warranty is limited to replacement, or at the sole option of Mitsubishi Chemical Corporation a refound of the purchase price.

Changes

All specifications, quantities, designs and prices are subject to change without notice.

General

Neither this publication, nor any products in this brochure shall be construed as recommending the infringement of any patent, nor extending any license, express or implied, nor assuming any liability under any issued or pendinng patent. The data presented herein have been carefully compiled from our records which we believe to be accurate and reliable. We make, however, no warranties or representations with respect hereto, nor is freedom from any patent to be inferred.

MITSUBISHI CHEMICAL

please visit

http://www.diaion.com

Sales Office

Mitsubishi Chemical Corporation
Environmental Solution Division
Separation Materials Department
14-1, Shiba 4-chome, Minato-ku, Tokyo 108-0014 Japan
Phone: +81-3-6414-3390 Fax: +81-3-6414-3407

1768-5CC0-018
0803MA1000