

**HPLC Column / Packing Material with
Polysaccharide Derivatives Chiral Selector**

CHIRAL ART

- Applicable to various chiral compounds
- Excellent resolution/durability
- Extremely low initial cost on analysis and purification



CHIRAL ART

Features

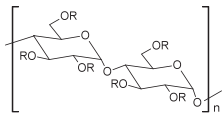
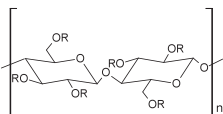
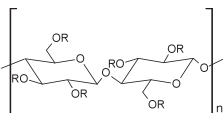
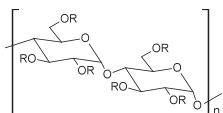
- Applicable to various chiral compounds
- Excellent resolution/durability
- Extremely low initial cost on analysis and purification
- High durability column that is suitable for SFC



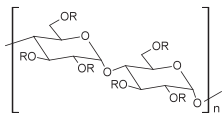
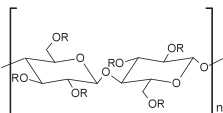
Bulk packing material is also available.

Specifications

Immobilized type

Column/Packing material	Particle size (μm)	Chiral selector	USP Classification
CHIRAL ART Amylose-SA	3	 Amylose tris(3,5-dimethylphenylcarbamate)	—
CHIRAL ART Cellulose-SB	5 10 20	 Cellulose tris(3,5-dimethylphenylcarbamate)	—
NEW CHIRAL ART Cellulose-SC	5	 Cellulose tris(3,5-dichlorophenylcarbamate)	—
NEW CHIRAL ART Amylose-SE	10 20	 Amylose tris(3,5-dichlorophenylcarbamate)	—
Usable mobile phase	Normal phase	<i>n</i> -hexane, <i>n</i> -heptane, methanol, ethanol, 2-propanol, acetonitrile, ethyl acetate, tetrahydrofuran, chloroform, <i>t</i> -butyl methyl ether, etc.	
	Reversed phase	acetonitrile, methanol, ethanol, 2-propanol, tetrahydrofuran, water, aqueous buffer, etc.	

Coated type

Column/Packing material	Particle size (μm)	Chiral selector	USP Classification
CHIRAL ART Amylose-C	5	 Amylose tris(3,5-dimethylphenylcarbamate)	L51
CHIRAL ART Cellulose-C	10 20	 Cellulose tris(3,5-dimethylphenylcarbamate)	L40
Usable mobile phase		<i>n</i> -hexane, <i>n</i> -heptane, ethanol, 2-propanol, acetonitrile, etc.	

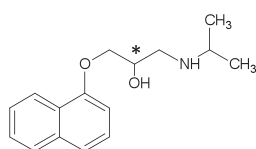
Useful for Chiral Separation of Wide Range of Compounds

Compound	Mobile phase	Separation factor (α)							
		Immobilized type				Coated type			
		Amylose-SA	Competitor's product	Cellulose-SB	Competitor's product	Amylose-C	Competitor's product	Cellulose-C	Competitor's product
<i>trans</i> -Stilbene oxide	Hex/IPA (90/10)	2.7	2.8	1.6	1.9	2.9	3.0	2.3	2.2
Benzoin	Hex/IPA (90/10)	1.2	1.2	1.4	1.4	1.3	1.3	1.6	1.6
<i>N</i> -CBZ-DL-Alanine	Hex/IPA/TFA (80/20/0.1)	1.7	1.7	1.7	1.8	2.0	2.2	3.0	2.9
Ibuprofen	Hex/IPA/TFA (99/1/0.1)	1.1	1.1	1.1	1.1	1.1	1.1	1.3	1.2
Propranolol	Hex/IPA/DEA (80/20/0.1)	×	×	1.6	1.4	×	×	2.0	1.8
Verapamil	Hex/IPA/DEA (90/10/0.1)	1.2	1.2	×	×	1.3	1.3	×	×

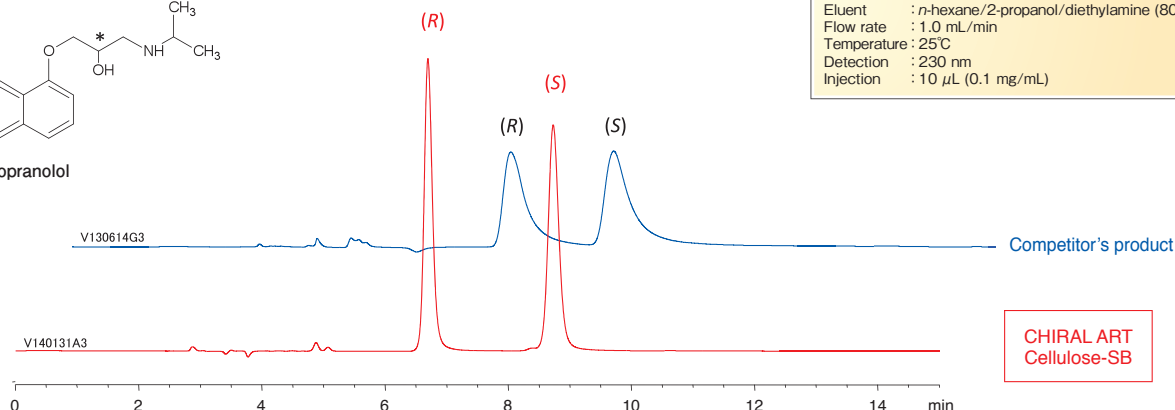
Hex: *n*-hexane, IPA: 2-propanol, TFA: trifluoroacetic acid, DEA: diethylamine, ×: Not separated

CHIRAL ART provide results comparable to other polysaccharide columns.

Excellent Peak Shape

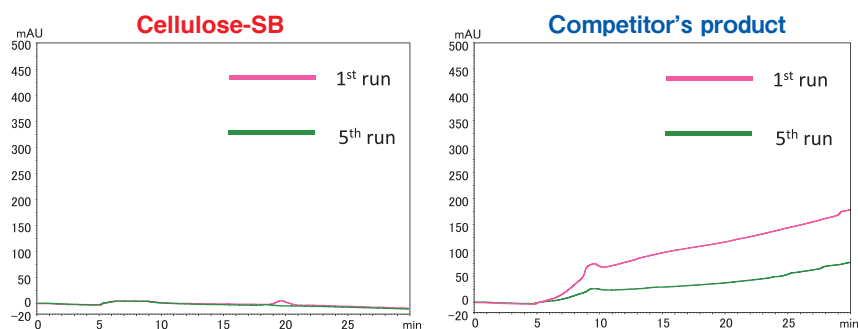


Propranolol



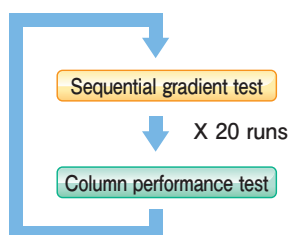
CHIRAL ART provide good peak shapes on ionic and metal coordination compounds.

Low Column Bleeding



CHIRAL ART Immobilized type show remarkably reduced background signal under the typical gradient condition. This low column bleeding of those columns provides high sensitivity on LC/MS analysis due to the very low ion suppression as well as stable baseline. CHIRAL ART Immobilized type offer excellent robustness on gradient analysis and highly sensitive analysis on LC/MS.

Extended Packing Durability

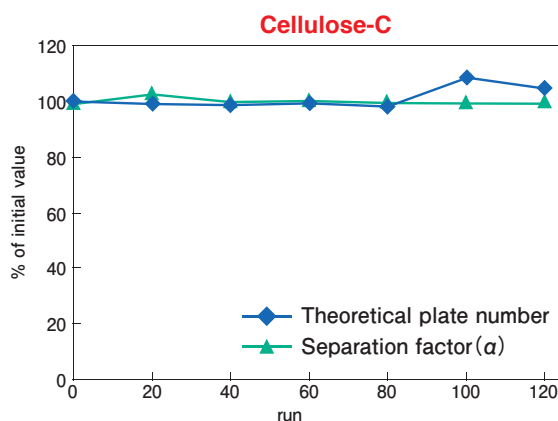
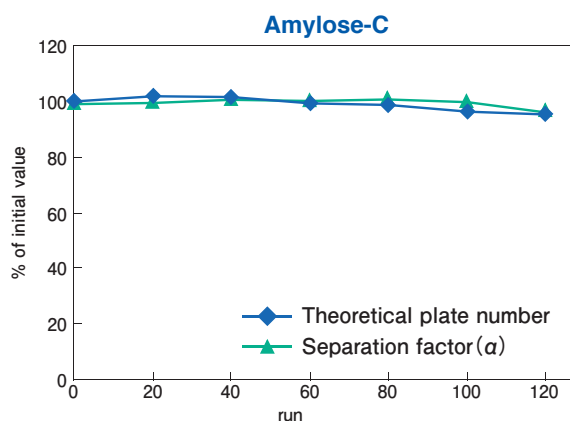


Sequential gradient test

Column : 5 μ m, 250 X 4.6 mmI.D.
 Eluent : A) *n*-hexane, B) ethanol
 0-100%B (0-15 min)
 Flow rate : 3.0 mL/min
 Pressure : 10-30 MPa/run
 Temperature : 37°C

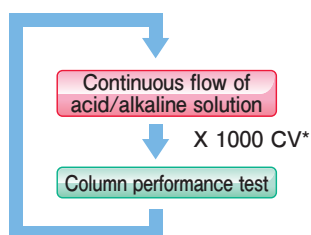
Column performance test

Column : 5 μ m, 250 X 4.6 mmI.D.
 Eluent : *n*-hexane/ethanol (90/10)
 Flow rate : 1.0 mL/min
 Temperature : 37°C
 Detection : UV at 230 nm
 Sample : *trans*-Stilbene oxide



CHIRAL ART have outstanding packed bed stability provided by the use of high-strength super wide pore silica and innovative packing technology. The column efficiency and selectivity are maintained even after the sequential gradient tests at a high flow rate (three times higher than normal flow rate) and a high pressure (rapid pressure change). CHIRAL ART are suitable for the case where one intends to shorten an analysis time, (re-)equilibration time and/or column cleaning time by increasing the flow rate. This feature is also effective when highly viscous solvent is needed to be used as a mobile phase on immobilized type columns.

Wide Usable pH Range



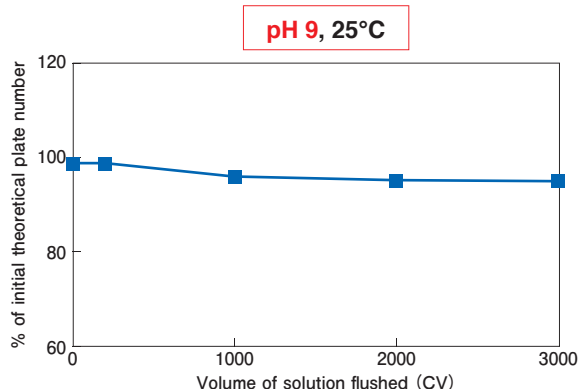
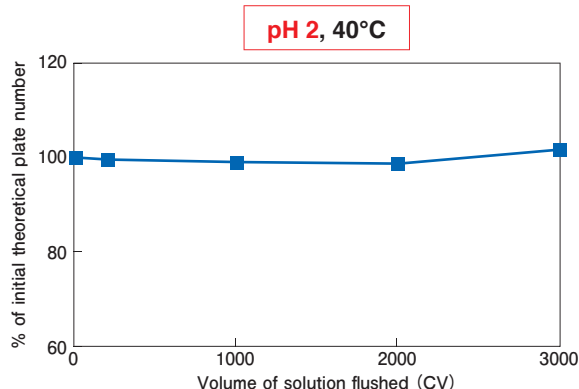
*CV=Column Volume

Continuous flow of acid/alkaline solution

Column : CHIRAL ART Cellulose-SB
 5 μ m, 50 X 4.6 mmI.D.
 Eluent : Buffer/methanol (90/10)
 Flow rate : 1.0 mL/min
 [Acidic condition]
 Buffer : 0.1% H₃PO₄ (pH 2)
 Temperature : 40°C
 [Basic condition]
 Buffer : 20 mM NH₄HCO₃-DEA (pH 9)
 Temperature : 25°C

Column performance test

Column : CHIRAL ART Cellulose-SB
 5 μ m, 50 X 4.6 mmI.D.
 Eluent : acetonitrile/water (30/70)
 Flow rate : 1.0 mL/min
 Temperature : 25°C
 Detection : UV at 254 nm
 Sample : Benzoin



CHIRAL ART Immobilized type have excellent chemical stability and can be used across a wide pH range. Addition of acid/amine in a mobile phase or use of buffer solution is an effective tool for improving peak shape and/or resolution.

High Solvent Versatility (Immobilized Type)

High Solvent Resistance

Amylose-SA

Initial

$\alpha = 1.19$
 $k'(2) = 6.60$

SA20_B001

After flushing with
1,000 CV of
ethyl acetate

$\alpha = 1.20$
 $k'(2) = 6.68$

SA20_B10

0 1 2 3 4 5 6 7 8

Cellulose-SB

Initial

$\alpha = 1.39$
 $k'(2) = 4.20$

SB01_01B2

After flushing with
1,000 CV of
tetrahydrofuran

$\alpha = 1.38$
 $k'(2) = 4.12$

SB01_10B2

0 1 2 3 4 min

Retention rate of initial column performance

(after flushing with 1,000CV of each solvent at 40°C)

*CV=Column Volume

	Amylose-SA		Cellulose-SB	
	α	$k'(2)$	α	$k'(2)$
Ethyl acetate	100.3%	101.2%	100.0%	99.1%
Tetrahydrofuran	100.0%	100.0%	99.3%	98.0%
Dichloromethane	100.3%	100.6%	101.3%	99.6%

Column : 5 μ m, 50 X 4.6 mm I.D.
Eluent : *n*-hexane/2-propanol (95/5)
Flow rate : 1.0 mL/min
Temperature : 25°C
Sample : Benzoin

On CHIRAL ART Amylose-SA and Cellulose-SB, the change in column performance after flushing with each solvent was less than 2%. They have high resistance to various solvents.

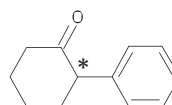
Method Screening

Solvent Range on Coated Type

Solvent Range on Immobilized Type

n-hexane/ethyl acetate or
MTBE/R-OH is also effective.

Solvent B		2-propanol (IPA)	ethanol (EtOH)	tetrahydrofuran (THF)	methyl <i>tert</i> -butyl ether (MTBE)
<i>n</i> -hexane	Ratio (A/B) 95/5	$\alpha = 1.22$ $R_s = 3.33$			
	90/10	$\alpha = 1.21$ $R_s = 2.78$	$\alpha = 1.19$ $R_s = 2.51$	$\alpha = 1.16$ $R_s = 2.31$	Good Separation $\alpha = 1.34$ $R_s = 4.52$
	80/20	$\alpha = 1.19$ $R_s = 2.11$	$\alpha = 1.21$ $R_s = 2.07$		$\alpha = 1.30$ $R_s = 4.54$
					10 min



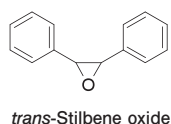
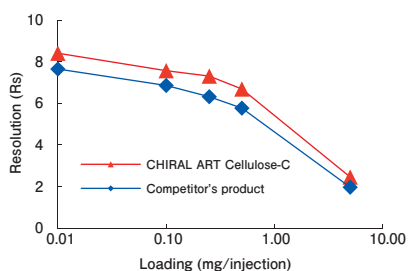
2-Phenylcyclohexanone

Column : CHIRAL ART Cellulose-SB
5 μ m, 150 X 3.0 mm I.D.
Flow rate : 0.425 mL/min
Detection : UV at 220 nm
Temperature : 25°C

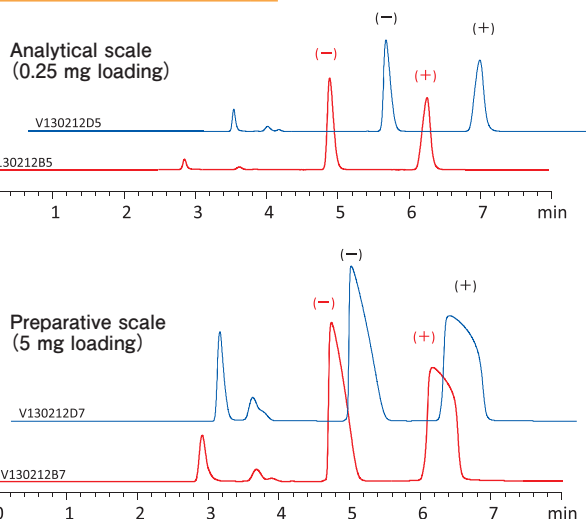
The chiral method screening of 2-Phenylcyclohexanone on CHIRAL ART Cellulose-SB is shown above. A mobile phase containing MTBE gave good separation. On CHIRAL ART Immobilized type with high solvent versatility, chromatographers can freely choose the most suitable mobile phase by considering the solubility, resolution and loadability of target compound based on the purpose of separation (e.g. analytical or preparative).

Effective for Preparative Separation of Enantiomers

Suitable for High-Loading Preparation



Increasing
loading
X 20



Competitor's product

CHIRAL ART
Cellulose-C

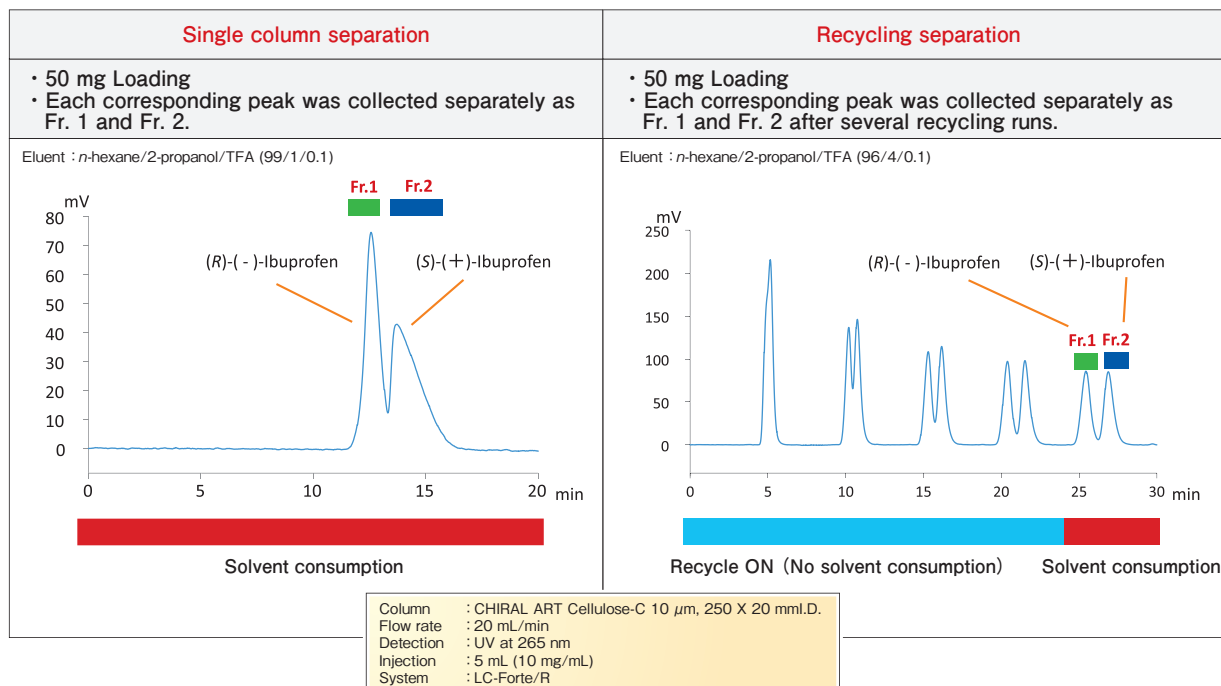
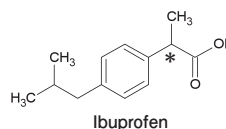
Competitor's product

CHIRAL ART
Cellulose-C

On both analytical and preparative separation, separation behavior of CHIRAL ART is equivalent to that of the competitor's product.

Column : 5 μ m, 250 X 4.6 mm.I.D.
Eluent : *n*-hexane/ethanol (90/10)
Flow rate : 1.0 mL/min

High Purity Purification Utilizing Recycling Preparation



	Single Column	Recycling
Enantiomeric purity (%ee)		
Fr.1 (R)-(-)-Ibuprofen	95.0	98.4
Fr.2 (S)-(+)-Ibuprofen	96.8	99.2
Yield (%)	84	95
Solvent consumption (mL solvent/g product)	9,523	1,276

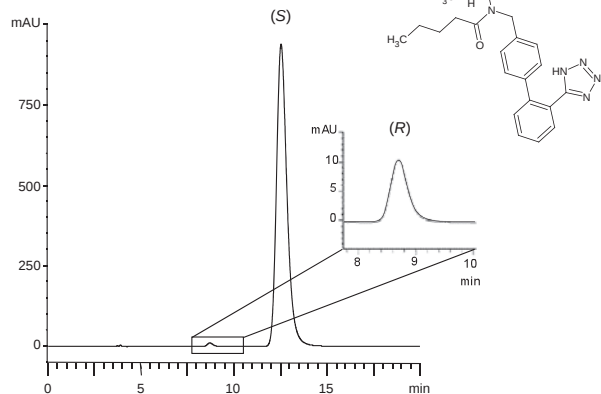
Ibuprofen enantiomers were purified by utilizing recycling mode of multi preparative HPLC system, LC-Forte/R. Recycling chromatography is effective when method optimization of chiral isolation is difficult on single column separation. Recycling method offers high purity and high recovery purification. Furthermore, no solvent is consumed during recycling mode. It greatly contributes reduction of solvent consumption on purification.



LC-Forte/R

Applications

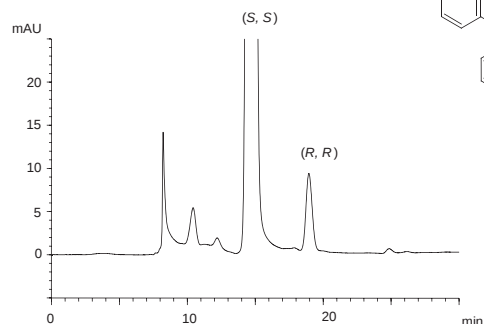
Valsartan (USP method)



Column : CHIRAL ART Cellulose-C 5 μ m, 250 X 4.6 mmI.D.
Eluent : *n*-hexane/2-propanol/TFA (85/15/0.1)
Flow rate : 0.8 mL/min
Temperature : 25°C
Detection : UV at 230 nm

E130620B

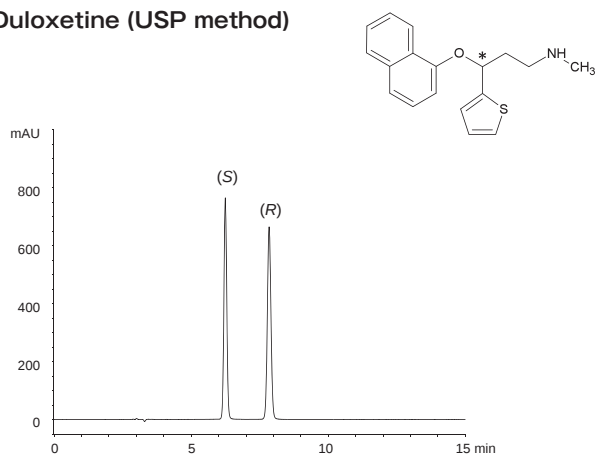
Sertraline (EP method)



Column : CHIRAL ART Amylose-C 5 μ m, 250 X 4.6 mmI.D.
Eluent : mixture*/*n*-hexane (70/30)
 **n*-hexane/2-propanol/diethylamine (975/25/1)
Flow rate : 0.4 mL/min
Temperature : 25°C
Detection : UV at 275 nm

E131205C

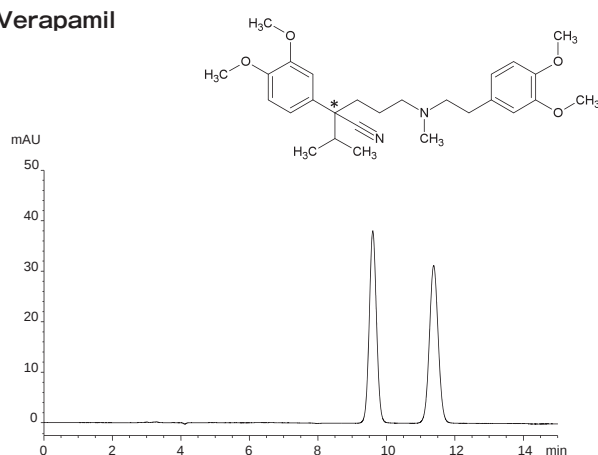
Duloxetine (USP method)



Column : CHIRAL ART Cellulose-C 5 μ m, 250 X 4.6 mmI.D.
Eluent : *n*-hexane/2-propanol/diethylamine (83/17/0.2)
Flow rate : 1.0 mL/min
Temperature : 40°C
Detection : UV at 230 nm

F130930A

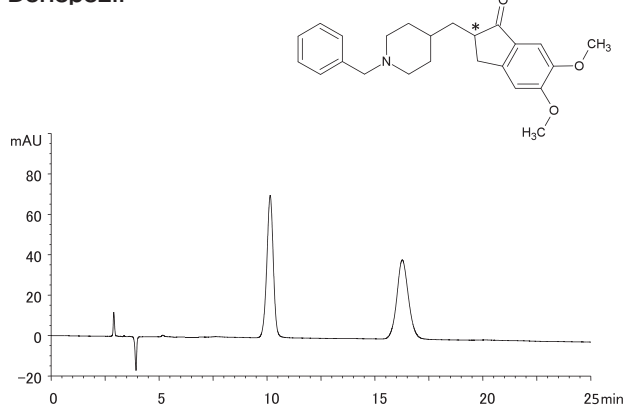
Verapamil



Column : CHIRAL ART Amylose-C 5 μ m, 250 X 4.6 mmI.D.
Eluent : *n*-hexane/2-propanol/diethylamine (90/10/0.1)
Flow rate : 1.0 mL/min
Temperature : 25°C
Detection : UV at 254 nm

V130905D

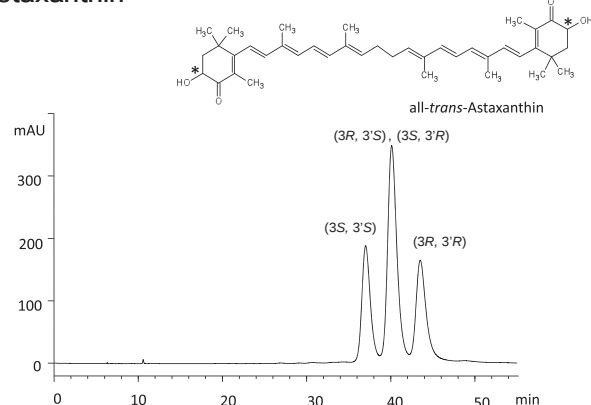
Donepezil



Column : CHIRAL ART Amylose-SA 5 μ m, 250 X 4.6 mmI.D.
Eluent : *n*-hexane/2-propanol/diethylamine (80/20/0.1)
Flow rate : 1.0 mL/min
Temperature : 25°C
Detection : UV at 230 nm

V140422B2

Astaxanthin



Courtesy of Fuji Chemical Industry Co., Ltd.

Column : CHIRAL ART Cellulose-SB 5 μ m, 250 X 4.6 mmI.D.
Eluent : *n*-hexane/THF (85/15)
Flow rate : 0.5 mL/min
Temperature : 25°C
Detection : UV at 476 nm

E140417B

Contract Purification of Chiral Compounds is Now Available

Features

- **Highly productive**
 - ← Highly efficient preparative separation methods (recycling chromatography, SFC, SMB)
- **Highly reliable**
 - ← Extensive expertise and excellent performance in scaling-up of chromatography purification
- **Cost competitive**
 - ← Low-cost chiral packing materials
- **Applicable to various scales**
 - ← Equipped with dynamic axial compression columns with a maximum inner diameter of 1000 mm and a HPLC system with pumps at a maximum flow rate of 50 L/min
- **GMP compliant purification service (to be started in September 2015)**

Scale	several mg ~ tens of g			tens of g ~ several tons		
Location	Chiral Technologies Laboratory			Komatsu Works		
	Devices	Column inner diameter	Purpose	Devices	Column inner diameter	Purpose
Equipments	Preparative HPLC LC-Forte/R	20, 30 mm	Purification of trace impurity, Recycling purification of enantiomers	Dynamic Axial Compression Columns + K-Prep system	100~1000 mm max. flow rate 0.5~50 L/min	Production-scale purification of enantiomers
	K-Prep LAB	50 mm	Single column purification with stacking injection	Explosion proof recycling system	up to 1000 mm max. flow rate 50 L/min	Efficient purification of enantiomers
	Preparative SFC	20, 30 mm	Preparative SFC of enantiomers	Large SMB (Planning)	100~600 mm	Production-scale purification of API
	SMB	20, 30 mm	Continuous purification, Simulation for scaling up SMB	GMP purification facility (September 2015)	600 mm	GMP compliant purification of pharmaceutical intermediate
						

Worldwide Availability

YMC America, Inc.
www.ymcamerica.com

YMC Europe GmbH
www.ymc-europe.com

YMC India Pvt. Ltd.
www.ymcindia.com

YMC Korea Co., Ltd.
www.ymckorea.com

YMC Shanghai Rep. Office
www.ymchina.com

YMC Singapore Tradelinks Pte. Ltd.
www.ymc.sg

YMC Taiwan Co., Ltd.
www.ymctaiwan.com



YMC CO., LTD.

YMC Karasuma-Gojo Bldg., 284 Daigo-cho
Karasuma Nishiiru Gojo-dori, Shimogyo-ku
Kyoto, 600-8106, Japan
TEL:+81-75-342-4515 FAX:+81-75-342-4550
www.ymc.co.jp sales@ymc.co.jp

Distributor

CHIRAL ART

Ordering Information



► Columns

Immobilized type

Particle size (μm)	Column size inner diameter X length (mm)			Product number			
				Amylose-SA	Cellulose-SB	Cellulose-SC	Amylose-SE
3	2.0	X	75	KSA99S03-L502WT	KSB99S03-L502WT	-	-
	2.0	X	100	KSA99S03-1002WT	KSB99S03-1002WT	-	-
	2.0	X	150	KSA99S03-1502WT	KSB99S03-1502WT	-	-
	2.0	X	250	KSA99S03-2502WT	KSB99S03-2502WT	-	-
	3.0	X	75	KSA99S03-L503WT	KSB99S03-L503WT	-	-
	3.0	X	100	KSA99S03-1003WT	KSB99S03-1003WT	-	-
	3.0	X	150	KSA99S03-1503WT	KSB99S03-1503WT	-	-
	3.0	X	250	KSA99S03-2503WT	KSB99S03-2503WT	-	-
	4.6	X	50	KSA99S03-0546WT	KSB99S03-0546WT	-	-
	4.6	X	75	KSA99S03-L546WT	KSB99S03-L546WT	-	-
	4.6	X	100	KSA99S03-1046WT	KSB99S03-1046WT	-	-
	4.6	X	150	KSA99S03-1546WT	KSB99S03-1546WT	-	-
5	4.6	X	250	KSA99S03-2546WT	KSB99S03-2546WT	-	-
	4.6	X	150	KSA99S05-1546WT	KSB99S05-1546WT	KSC99S05-1546WT	KSE99S05-1546WT
	4.6	X	250	KSA99S05-2546WT	KSB99S05-2546WT	KSC99S05-2546WT	KSE99S05-2546WT
	10	X	250	KSA99S05-2510WT	KSB99S05-2510WT	KSC99S05-2510WT	KSE99S05-2510WT
	20	X	250	KSA99S05-2520WX	KSB99S05-2520WX	KSC99S05-2520WX	KSE99S05-2520WX
	30	X	250	KSA99S05-2530WX	KSB99S05-2530WX	KSC99S05-2530WX	KSE99S05-2530WX

Coated type

Particle size (μm)	Column size inner diameter X length (mm)			Product number	
				Amylose-C	Cellulose-C
5	4.6	X	150	KAN99S05-1546WT	KCN99S05-1546WT
	4.6	X	250	KAN99S05-2546WT	KCN99S05-2546WT
	10	X	250	KAN99S05-2510WT	KCN99S05-2510WT
	20	X	250	KAN99S05-2520WX	KCN99S05-2520WX
	30	X	250	KAN99S05-2530WX	KCN99S05-2530WX

► Packing Materials

Immobilized type

Particle size (μm)	Product number			
	Amylose-SA	Cellulose-SB	Cellulose-SC	Amylose-SE
5	KSA99S05	KSB99S05	KSC99S05	KSE99S05
10	KSA99S11	KSB99S11	-	-
20	KSA99S21	KSB99S21	-	-

Coated type

Particle size (μm)	Product number	
	Amylose-C	Cellulose-C
5	KAN99S05	KCN99S05
10	KAN99S11	KCN99S11
20	KAN99S21	KCN99S21

* Please inquire us other than those listed above.