YMC PB-0054E

YMC-Triart
UHPLC & HPLC Columns

Versatile Hybrid Silica Based HPLC Column

Particle size
1.9 μm
3 μm
5 μm

- 5 chemistries for different selectivity
- Great chemical and thermal durability
- UHPLC (up to 100 MPa) and HPLC columns
- Available in high durability semi-preparative columns

Suitable as a first choice column with excellent durability
YMC-Triart C18

Effective for fast analysis of compounds with low polarity or for separation of isomers
YMC-Triart C8

Effective for separation of compounds with long conjugated system by utilizing π-π interaction
YMC-Triart Phenyl

Effective for separation of polar compounds or isomers by polar interaction
YMC-Triart PFP

Effective for separation of highly polar compounds
YMC-Triart Diol-HILIC

YMC CO., LTD.
http://www.ymc.co.jp

Versatile Hybrid Silica Based HPLC Column

YMC-Triart Series

Various product lineup enables wide range of separation from UHPLC to HPLC analysis and even to preparative separation.

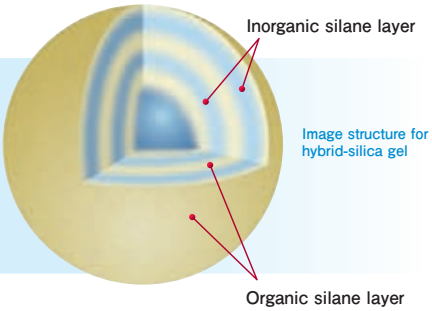
YMC-Triart series are next-generation organic hybrid silica based columns, emphasizing versatility. The main features are superior durability, peak shape across all kind of compounds and reproducibility.
Having the same selectivity across different particle sizes, smooth method transfer between UHPLC and HPLC can be performed. Moreover, various bonded phases supplement performance of C18 phase, and allow separations which C18 columns cannot achieve.

Features

- **Effective for method screening with various chemistries**
- **Great chemical durability provided by hybrid particles**
- **Superior peak shapes for a wide range of compounds and in various conditions**
- **UHPLC compatible column with operating pressure up to 100 MPa packed with 1.9 μm particle**
- **Available in highly-durable semi-preparative column**
- **Smooth method transfer from UHPLC to HPLC analysis and even to HPLC purification**

Versatile hybrid base material

YMC-Triart C18 is based on novel organic/inorganic hybrid particles. The granulation process utilizing microreactor technology enables continuous and highly controlled production of multi-layered hybrid particles. This layered structure contributes to Triart's excellent chemical durability as well as physical durability.



Contents

Triart series products lineup

【Product lineup and specifications】

Product	Triart C18	Triart C8	Triart Phenyl	Triart PFP	Triart Diol-HILIC
Separation mode	Reversed phase				HILIC
Base	Organic/inorganic hybrid silica				
Particle size (μm)	1.9, 3, 5				
Pore size (nm)	12				
Bonding	Polymeric				
Carbon content (%)※	20	17	17	15	12
Endcapping	Yes			No	
pH range	1-12	1-12	1-10	1-8	2-10
100% aqueous compatibility	YES	NO	YES	YES	-
USP Classification	L1	L7	L11	L43	L20

※ Containing 8% for hybrid silica base material.

【Characteristics of YMC-Triart series】

-$C_{18}H_{37}$

YMC-Triart C18

Suitable as a first choice column with excellent durability

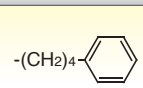
- Superior peak shape
- Usable over wide range of pH and temperature
- Usable with 100% aqueous mobile phase

-C_8H_{17}

YMC-Triart C8

Effective for fast analysis of compounds with low polarity or for separation of isomers

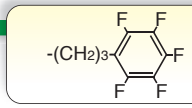
- Compete with the versatility of C18
- Usable over wide range of pH and temperature
- Ideal for separations of isomers or structural analogs



YMC-Triart Phenyl

Effective for separation of compounds with long conjugated system by utilizing π-π interaction

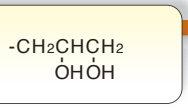
- Unique selectivity due to π-π interaction
- Ideal for separations of aromatic compounds or compounds having long conjugated system
- Excellent resolution without adsorption and tailing



YMC-Triart PFP

Effective for separation for polar compounds or separation of isomers

- Alternative selectivity to C18/C8 due to unique polar interaction
- Superior planar cognitive ability / steric selectivity
- Ideal for separations of polar compounds or isomers



YMC-Triart Diol-HILIC

Effective for separation of highly polar compounds

- Ideal for separation of highly polar compounds, which are hardly retained on a reversed phase column
- Superior durability and usable under wide range of mobile phase conditions
- Excellent reproducibility with less ionic adsorption

YMC-Triart series 1.9μm

UHPLC column for ultra-fast separation and high resolution analysis

- 1.9 μm column for UHPLC with operating pressure up to 100 MPa
- Same separation selectivity as 3 μm and 5 μm
- Simple method transfer between conventional HPLC and UHPLC

YMC-Actus Triart series

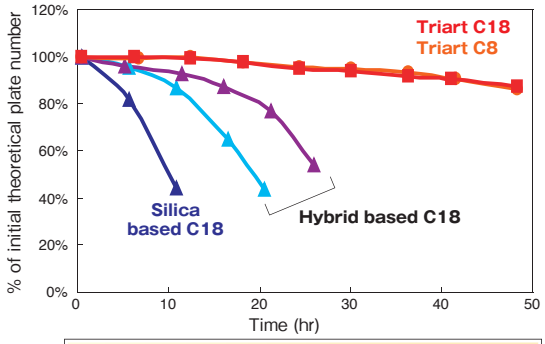
Semi-preparative HPLC columns with outstanding column durability

- Enhanced durability by applying axial compression technology
- Packed columns for milligram scale preparative HPLC
- Usable under wide range of mobile phase conditions

Excellent durability

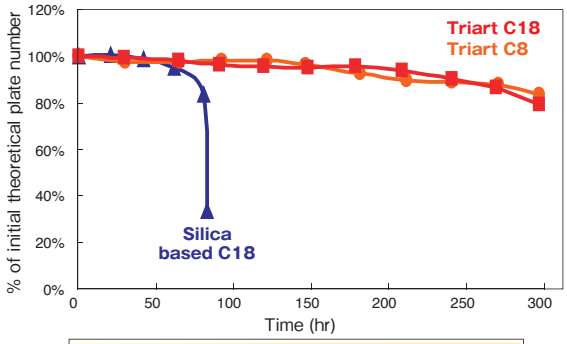
【Durability in high pH】

Phosphate buffer (pH 11.5), 40℃



Column	: 5 μm, 150 X 4.6 mmI.D.
Eluent	: 50 mM K_2HPO_4-K_3PO_4 (pH 11.5)/methanol (90/10)
Flow rate	: 1.0 mL/min
Temperature	: 40℃
Sample	: benzyl alcohol

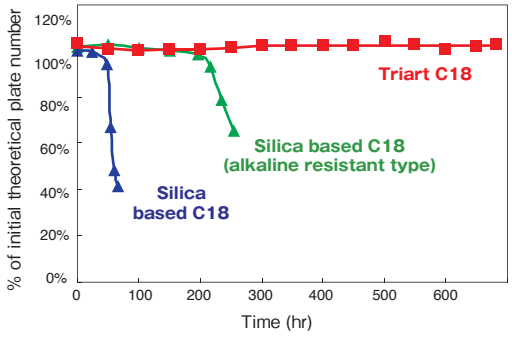
Triethylamine (pH 11.5), 40℃



Column	: 5 μm, 150 X 4.6 mmI.D.
Eluent	: 50 mM triethylamine (pH 11.5)/methanol (90/10)
Flow rate	: 1.0 mL/min
Temperature	: 40℃
Sample	: benzyl alcohol

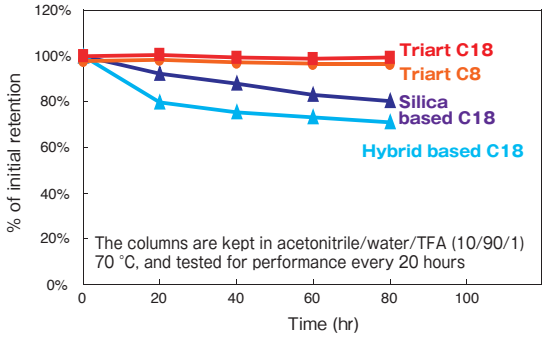
【Durability in high temperature】

pH 6.9, 70℃



Column	: 5 μm, 50 X 2.0 mmI.D.
Eluent	: 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)/acetonitrile (90/10)
Flow rate	: 0.2 mL/min
Temperature	: 70℃
Sample	: phenol

pH 1, 70℃

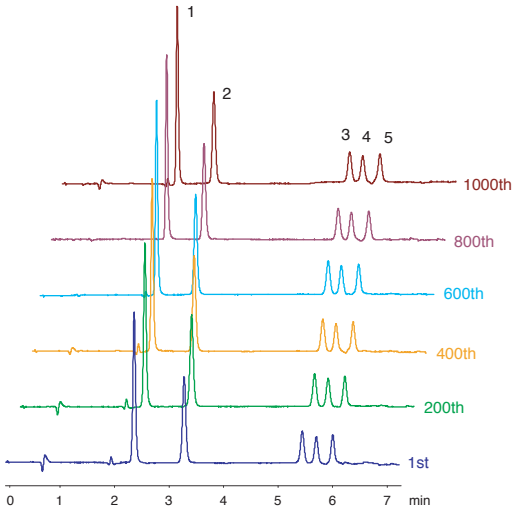


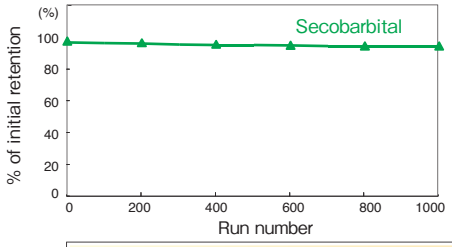
Test conditions	Column	: 5 μm, 50 X 2.0 mmI.D.
	Eluent	: acetonitrile/water (60/40)
	Flow rate	: 0.2 mL/min
	Temperature	: 37℃
	Sample	: butyl benzoate

With innovative surface modification on organic hybrid silica, YMC-Triart columns show great chemical durability and they can be used over a wide pH range. Even at high-pH or high-temperature conditions, the lifetime of YMC-Triart C18 and C8 is more than 10 times greater than that of conventional C18 columns and a few times greater than commercially available high alkaline-resistant C18 columns. When using under alkaline condition, organic buffers such as triethylamine make the column life longer than phosphate buffer. In addition, YMC-Triart is ideally suited for preparative purifications of various compounds or peptide analysis in the cases where trifluoroacetic acid (TFA) is frequently used, because it has high resistance to acids.

【Long column lifetime under chemically harsh conditions】

Continuous analysis with alkaline mobile phase (pH 9.5) -Barbiturates-



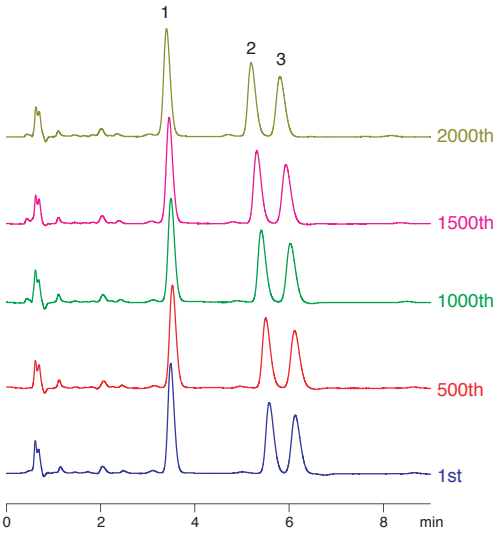


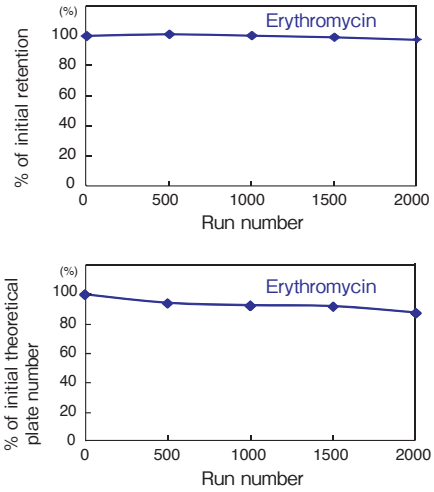
1. Barbital
2. Phenobarbital
3. Hexobarbital
4. Pentobarbital
5. Secobarbital

Column	: YMC-Triart C18 5 μm, 50 X 2.0 mmI.D.
Eluent	: A) 20 mM $HCOONH_4$-NH_3 (pH 9.5)
	B) methanol
	0-90%B (0-7 min)
Flow rate	: 0.2 mL/min
Temperature	: 25℃
Detection	: UV at 240 nm
Injection	: 1 μL

YMC-Triart shows great durability under alkaline mobile phase conditions, which is difficult for conventional silica columns. This assures stable analysis over a long period of time.

Continuous analysis at pH 7.9, 70℃ -Erythromycin antibiotics-



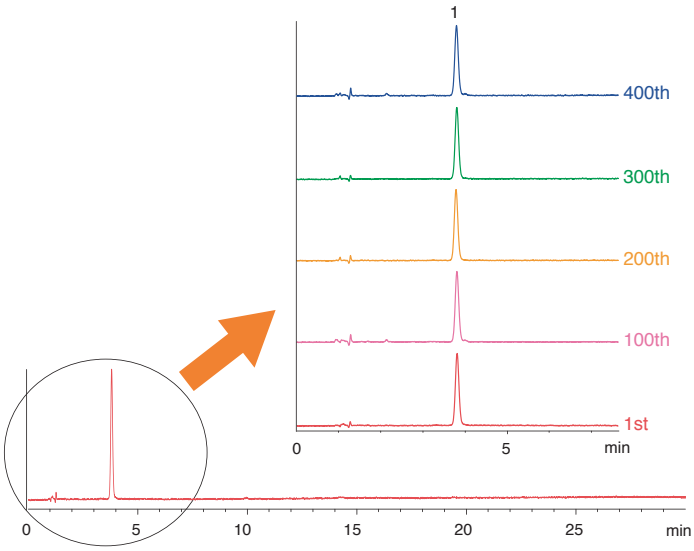


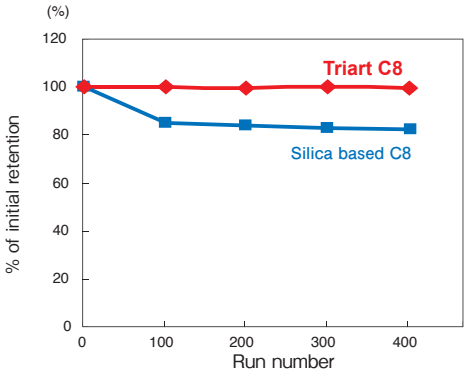
1. Erythromycin
2. Erythromycin ethylsuccinate
3. Erythromycin estolate

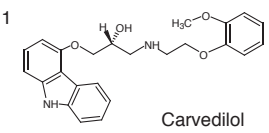
Erythromycins are shown to be easily degraded under acidic (< pH 6.5) condition. Higher pH is preferable. In addition, higher temperature tends to show better peak shape. Enhanced chemical durability of Triart C18 enables highly reproducible analysis under high pH and high temperature.

Column	: YMC-Triart C18 3 μm 50 X 2.0 mmI.D.
Eluent	: 20 mM KH_2PO_4-K_2HPO_4 (pH 7.9)/acetonitrile/methanol (40/45/15)
Flow rate	: 0.2 mL/min
Temperature	: 70℃
Detection	: UV at 210 nm
Injection	: 1 μL

Continuous analysis at pH 2.0, 55℃ -Carvedilol-





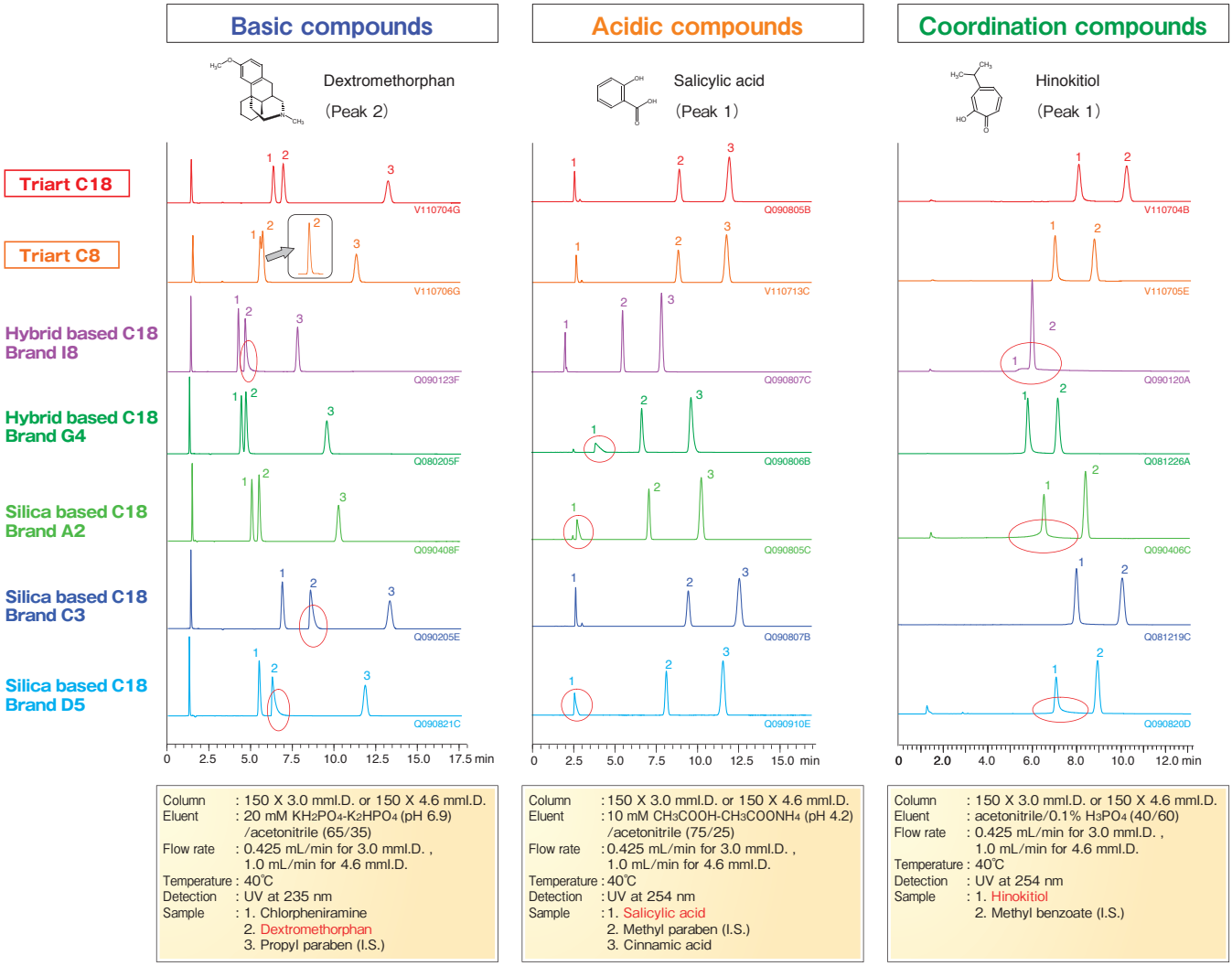


Carvedilol

Analyses of carvedilol are performed continuously, referring the Japanese Pharmacopoeia 16th Edition which specifies to use a C8 column. Under severe condition of pH 2 for mobile phase and 55°C for column temperature, the retention time is decreased over analyses on a conventional silica based monomeric C8 column. On the other hand, no change is observed in retention time of YMC-Triart C8 even after 400 injections (200 hours). YMC-Triart C8 provides stable analysis under harsh conditions just as same as YMC-Triart C18.

Column	: YMC-Triart C8 5 μm 150 X 2.0 mmI.D.
Eluent	: phosphate buffer (pH 2.0)* /acetonitrile (65/35) ** Dissolve 2.72 g of KH_2PO_4 in 900 mL water, adjust pH 2.0 with H_3PO_4, and add water to make 1000 mL*
Flow rate	: 0.28 mL/min *(adjust the flow rate so that the retention time of carvedilol is about 4 min)*
Temperature	: 55℃
Detection	: UV at 240 nm
Injection	: 4 μL
(The Japanese Pharmacopoeia 16th; Related substances)	

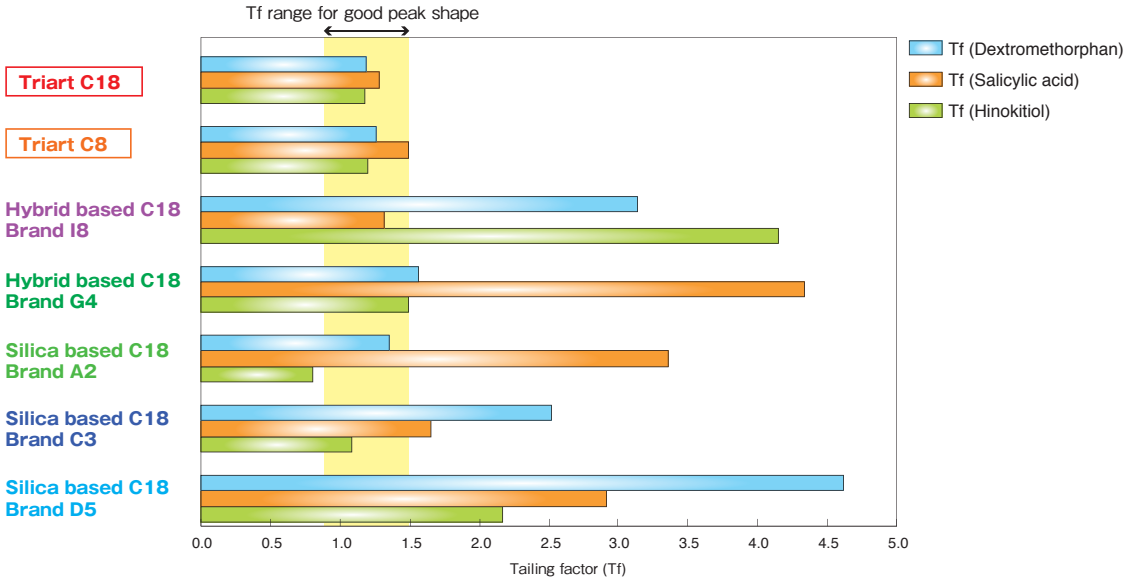
Great peak shapes without adsorption/peak tailing



Column : 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.
Eluent : 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9) /acetonitrile (65/35)
Flow rate : 0.425 mL/min for 3.0 mmI.D. , 1.0 mL/min for 4.6 mmI.D.
Temperature : 40℃
Detection : UV at 235 nm
Sample : 1. Chlorpheniramine
2. Dextromethorphan
3. Propyl paraben (I.S.)

Column : 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.
Eluent : 10 mM CH_3COOH-CH_3COONH_4 (pH 4.2) /acetonitrile (75/25)
Flow rate : 0.425 mL/min for 3.0 mmI.D. , 1.0 mL/min for 4.6 mmI.D.
Temperature : 40℃
Detection : UV at 254 nm
Sample : 1. Salicylic acid
2. Methyl paraben (I.S.)
3. Cinnamic acid

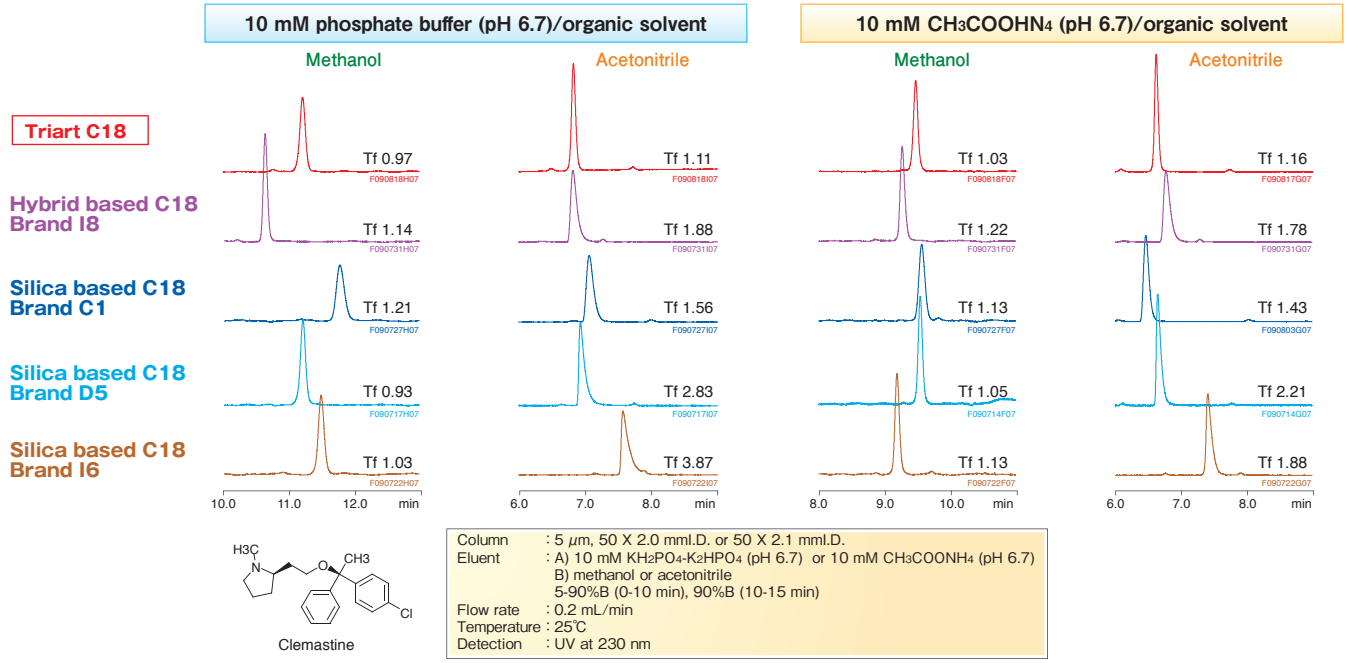
Column : 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.
Eluent : acetonitrile/0.1% H_3PO_4 (40/60)
Flow rate : 0.425 mL/min for 3.0 mmI.D. , 1.0 mL/min for 4.6 mmI.D.
Temperature : 40℃
Detection : UV at 254 nm
Sample : 1. Hinokitiol
2. Methyl benzoate (I.S.)



The peak tailing or fronting of ionic compounds are often caused by adsorption to residual silanol groups and/or surface impurities resulting from base materials or manufacturing process. Triart, based on hybrid silica material with little metal impurities and rigorously endcapped, provides symmetrical peak shapes for all types of compounds.

Superior peak shapes across various mobile phases

【Peak shape comparison of basic compound】

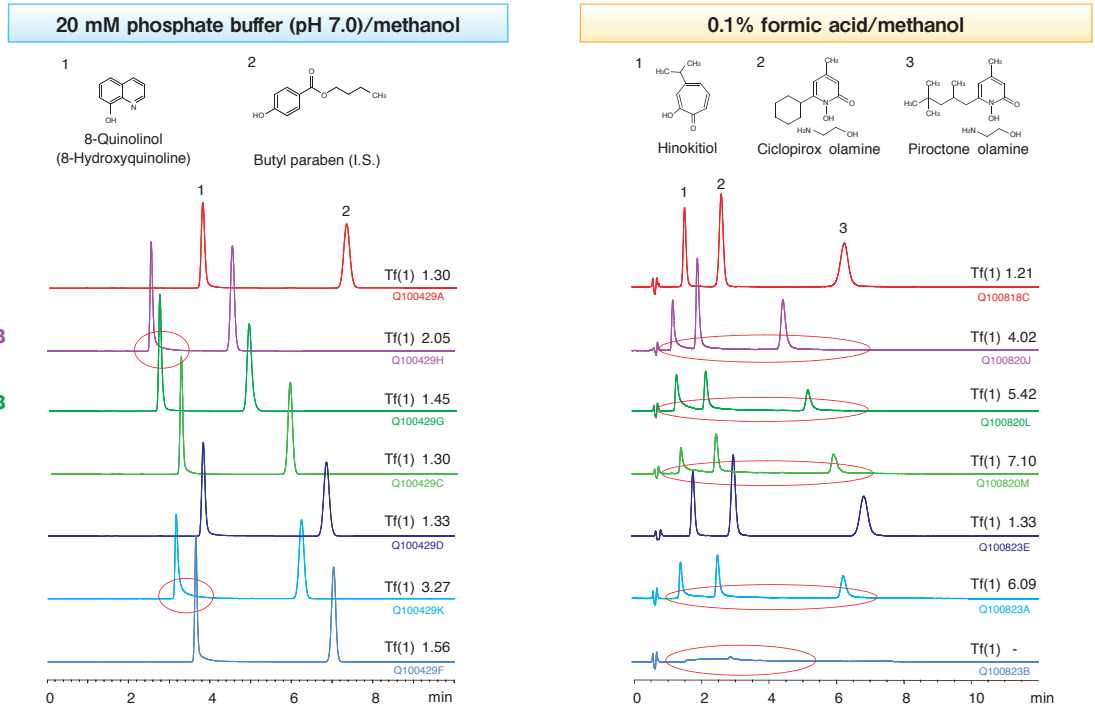


Clemastine

Column	: 5 μm, 50 X 2.0 mmI.D. or 50 X 2.1 mmI.D.
Eluent	: A) 10 mM KH_2PO_4-K_2HPO_4 (pH 6.7) or 10 mM CH_3COONH_4 (pH 6.7) B) methanol or acetonitrile 5-90%B (0-10 min), 90%B (10-15 min)
Flow rate	: 0.2 mL/min
Temperature	: 25℃
Detection	: UV at 230 nm

Clemastine is a well known basic compound which can easily tail on conventional ODS columns. YMC-Triart C18 can analyze clemastine without any peak deterioration with any kinds of buffer/solvent combinations.

【Peak shape comparison of coordination compounds】



Column	: 5 μm or 3 μm, 150 X 4.6 mmI.D
Eluent	: 20 mM KH_2PO_4-K_2HPO_4 (pH 7.0)/methanol (35/65)
Flow rate	: 1.0 mL/min
Temperature	: 40℃
Detection	: UV at 254 nm
Injection	: 10 μL

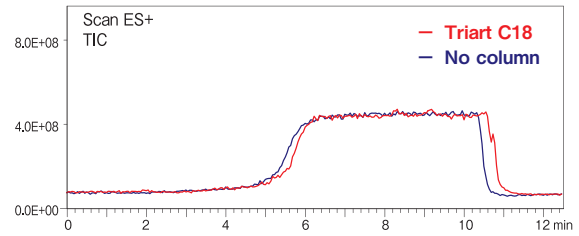
Column	: 5 μm or 3 μm, 50 X 2.0 mmI.D. or 50 X 2.1 mmI.D
Eluent	: methanol/water/formic acid (65/35/0.1)
Flow rate	: 0.2 mL/min
Temperature	: 40℃
Detection	: UV at 310 nm
Injection	: 1 μL

YMC-Triart C18 is able to provide excellent peak shapes for coordination compounds which are often absorbed to a column, resulting from a strong interaction with impurities such as metal ion.

Effective for high-sensitive analysis using LC/MS

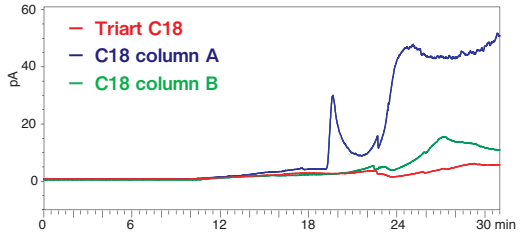
【Low bleeding】

LC/MS



Column	: 5 μm, 50 X 2.0 mmI.D.
Eluent	: A) water/formic acid (100/0.1) B) acetonitrile/formic acid (100/0.1) 5%B (0-1 min), 5-100%B (1-5 min), 100%B (5-10 min), 100-5%B (10-10.1 min), 5%B (10.1-12.5 min)
Flow rate	: 0.4 mL/min
Temperature	: 40℃
Detection	: ESI positive, TIC (Mass Range: 50-1000)

Corona* CAD*



Column	: 5 μm, 250 X 4.6 mmI.D.
Eluent	: A) water/formic acid (100/0.1) B) acetonitrile/formic acid (100/0.1) 5%B (0-5 min), 5-100%B (5-20 min),100%B (20-30 min)
Flow rate	: 1.0 mL/min
Temperature	: 40℃
Detection	: Corona CAD

On Triart column, very low level of bleeding (leaching) is achieved thanks to the improvement of production procedure and of durability. Background noise of Triart C18 on LC/MS (TIC) is almost the same as blank run with no column. Also, baseline is almost stable on Corona CAD (Charged Aerosol Detector). These results prove that there is little bleeding from Triart C18 column. Very low background noise and high S/N ratio even with high-sensitive detectors are expected on Triart columns.

*Corona and CAD is a registered trademark of Thermo Fisher Scientific.

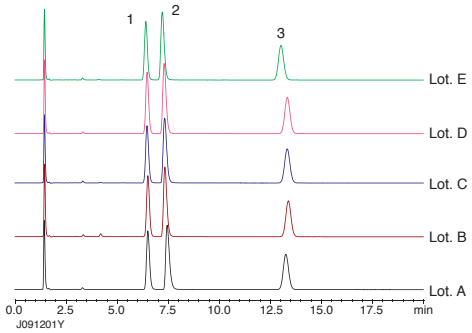
Quality control

【Excellent reproducibility】

Packing material

YMC-Triart C18 exhibits excellent lot-to-lot reproducibility for all types of compounds including basic and coordination compounds that often exhibits peak tailing or adsorption onto packing material.

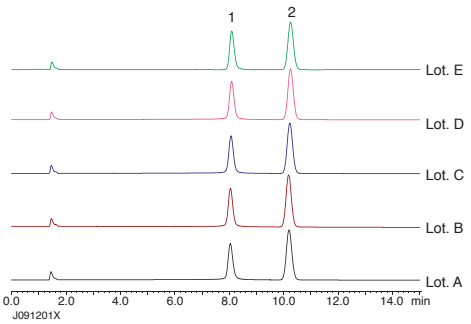
Basic compounds



1. Chlorpheniramine　　2. Dextromethorphan
3. Propyl paraben (I.S.)

Column	: 5 μm, 150 X 3.0 mmI.D.
Eluent	: 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)/acetonitrile (65/35)
Flow rate	: 0.425 mL/min
Temperature	: 40℃
Detection	: UV at 235 nm

Coordination compound

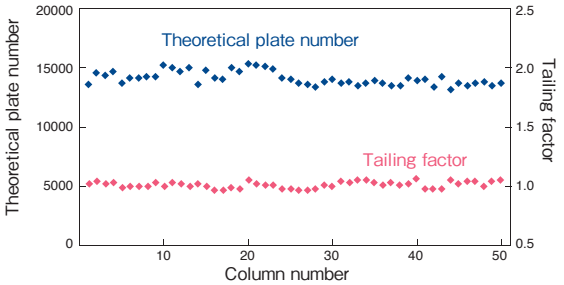


1. Hinokitiol
2. Methyl benzoate (I.S.)

Column	: 5 μm, 150 X 3.0 mmI.D.
Eluent	: acetonitrile/0.1% H_3PO_4 (40/60)
Flow rate	: 0.425 mL/min
Temperature	: 40℃
Detection	: UV at 254 nm

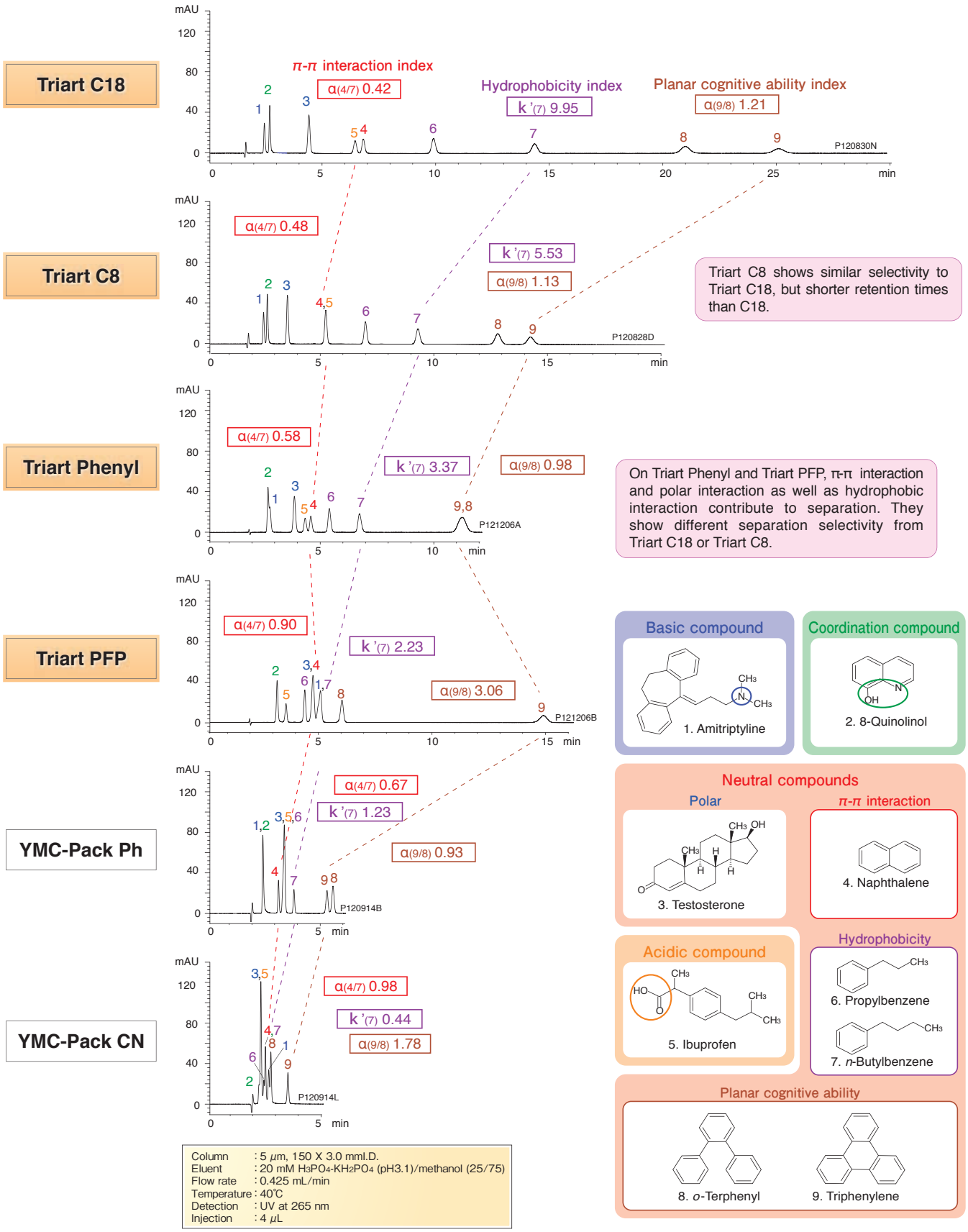
Packed column

Rigorous control of theoretical plate number (N) and tailing factor (Tf) is performed on Triart C18 packed column.



Column	: 5 μm, 150 X 4.6 mmI.D.
Eluent	: acetonitrile/water (60/40)
Flow rate	: 1.0 mL/min
Temperature	: ambient
Sample	: butyl benzoate

Comparison of separation selectivity among YMC-Triart series



Column	: 5 μm, 150 X 3.0 mmI.D.
Eluent	: 20 mM H_3PO_4-KH_2PO_4 (pH3.1)/methanol (25/75)
Flow rate	: 0.425 mL/min
Temperature	: 40℃
Detection	: UV at 265 nm
Injection	: 4 μL

A mixture that consists of compounds with various characteristics is analyzed with reversed phase Triart columns. In addition to hydrophobic interaction, secondary interactions such as π-π interaction and polar interaction are different from column to column. Those parameters have great impact on retention capacity (k') and separation factor (α). By utilizing the difference in separation characteristics, wide range of compounds can be well-separated with Triart series.

YMC-Triart C18

- Carbon content : 20%
- 100% aqueous compatibility : YES
- USP Classification : L1

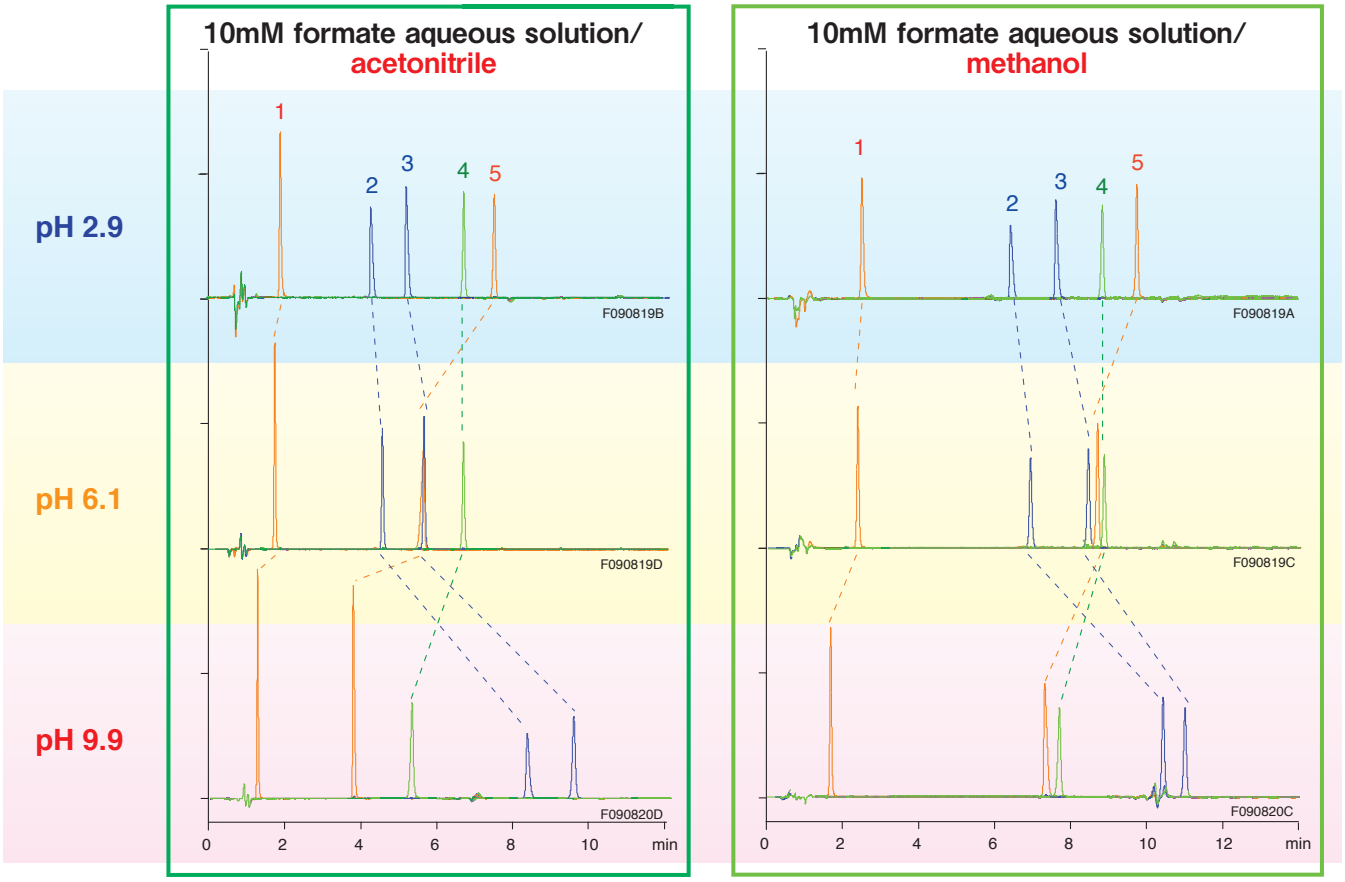
Highly durable column suitable as a first choice

Features

One of the main features of YMC-Triart C18 is great chemical durability and outstanding peak shape. YMC-Triart C18 can be used under conditions of wide range of pH or high temperature. Preferable balance of surface hydrophobicity and hydrogen bonding capacity are achieved by the optimization of density of C18 bonded phase. This feature enables YMC-Triart C18 a first-choice column suitable for various separations. YMC-Triart C18 also performs well with 100% aqueous mobile phase and superior retention and reproducibility can be obtained.

Flexibility in method development

【Efficient mobile phase screening for ionic compounds】



1 Saccharin (Acidic compound) pka=2.2

2 Dextromethorphan (Basic compound) pka=8.3

3 Amitriptyline (Basic compound) pka=9.4

4 *n*-Butylparaben (Weakly acidic compound) pka=8.3

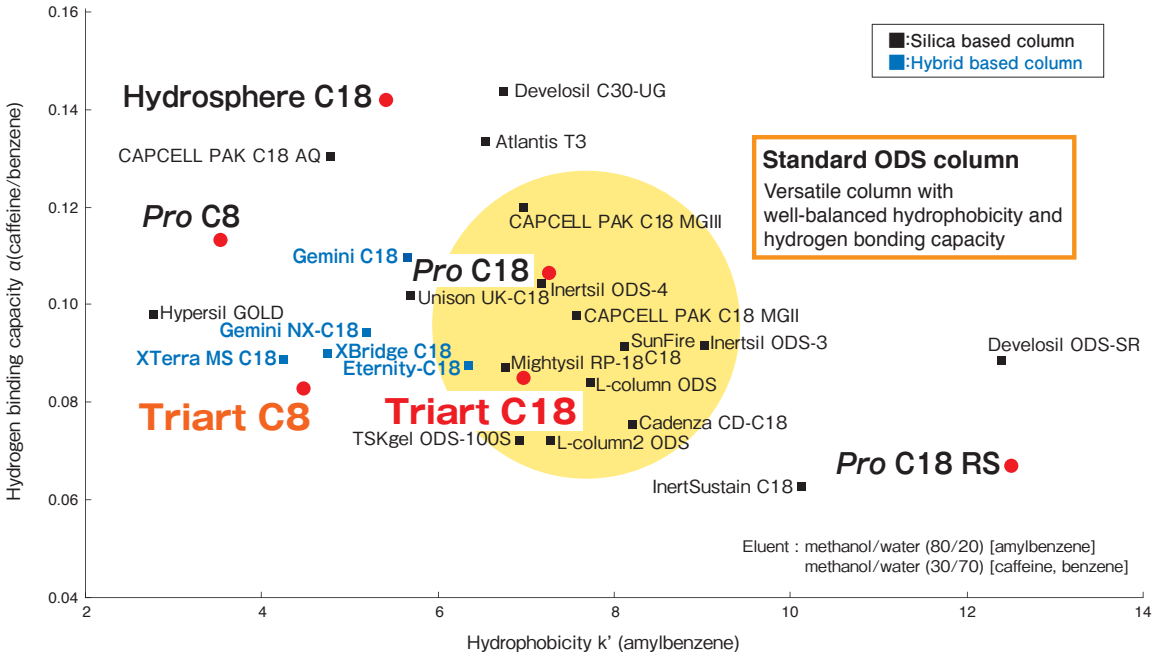
5 Ibuprofen (Acidic compound) pka=4.4

Column	: YMC-Triart C18 5 μm 50 X 2.0 mmI.D.
Eluent	: A) 10 mM HCOOH for pH 2.9 10 mM $HCOONH_4$ for pH 6.1 10 mM $HCOONH_4$-NH_3 for pH 9.9 B) organic solvent 5-90%B (0-10 min), 90%B (10-15 min)
Flow rate	: 0.2 mL/min
Temperature	: 25℃
Detection	: UV at 230 nm

On reversed-phase HPLC, pH and organic solvent are the most important factors to control retention and selectivity. Triart C18 with wide usable pH range offers significant advantage in selection of mobile phase condition. Triart C18 delivers symmetrical peak shapes for all types of compounds. Moreover, this feature is independent from mobile phase pH and mobile phase condition. Chromatographers can choose the most optimal condition by combining various mobile phase conditions such as mobile phase pH, and types of organic solvent / buffer system.

Suitable as a first choice column

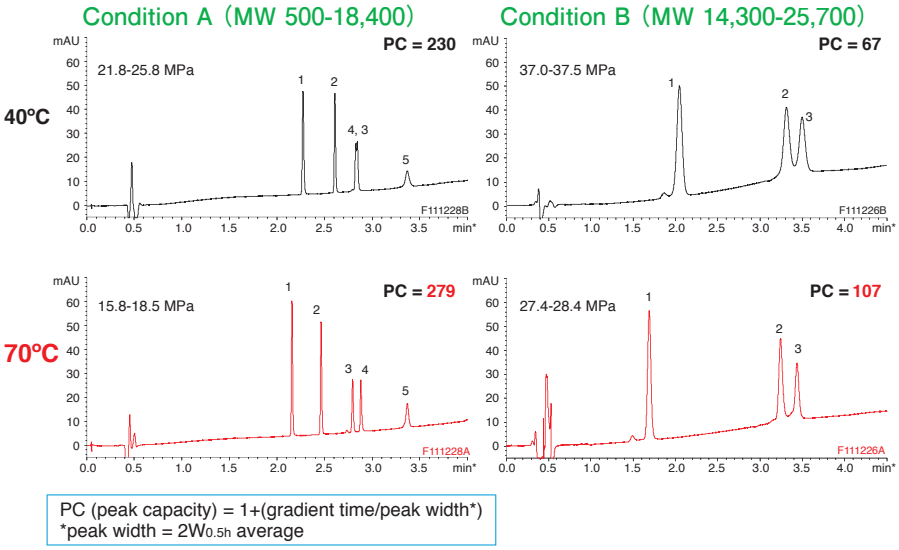
【Selectivity chart】



YMC-Triart C18 has a favorable balance of hydrophobicity and hydrogen bonding capacity, and is used as a versatile first-choice column for method development. In contrast, conventional hybrid silica based ODS columns tend to have low hydrophobicity than conventional silica based columns.

Highly efficient RP-HPLC separation of proteins and peptides using high temperature

【Comparison of separation of peptides and proteins at between 40°C and 70°C】



PC (peak capacity) = 1+(gradient time/peak width*)
*peak width = $2W_{0.5h}$ average

Analytes	MW	Peak width$_{0.5h}$ (min)	
		40°C	70°C
Condition A			
1. Oxytocin	1,007	0.017	0.014
2. Leu-Enkephalin	556	0.015	0.015
3. β-Endorphin	3,465	-	0.016
4. Insulin	5,733	-	0.015
5. β-Lactoglobulin A	18,400	0.043	0.030
Condition B			
1. Lysozyme	14,300	0.069	0.044
2. α-Chymotrypsinogen	25,700	0.080	0.049
3. β-Lactoglobulin A	18,400	0.080	0.048

Column : YMC-Triart C18 1.9 μm
50 X 2.0 mmI.D.
Eluent : A) water/TFA (100/0.1)
B) acetonitrile/TFA (100/0.1) - condition A
B) acetonitrile/IPA/TFA (50/50/0.1) - condition B
Gradient : 10-80%B (0-5 min) - condition A
30-60%B (0-5 min) - condition B
Flow rate : 0.4 mL/min
Detection : UV at 220 nm
Injection : 1 μL
System : Agilent 1200SL

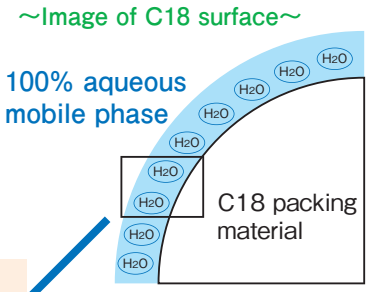
The impact temperature on separation of peptides and proteins with a variety of molecular weight (MW) is estimated. The separations at 40°C and 70°C are compared.
By increasing column temperature to 70°C, selectivity change is observed, and peaks become sharper. Thus, improved resolution especially for larger molecules is obtained. Generally, larger molecules diffuse very slowly compared to small molecules. An elevated temperature can improve efficiency and peak shape by lowering mobile phase viscosity and improving mass transfer.
Temperature is a simple and effective tool to increase resolution in separation of proteins and peptides. Triart C18 with wide temperature range is ideal for proteins and peptides separation.

Effective for an analysis of highly polar compounds using 100% aqueous condition

【Retention stability under 100% aqueous mobile phase】

Nucleic bases

1 Cytosine 2 Uracil 3 Guanine 4 Thymine 5 Adenine



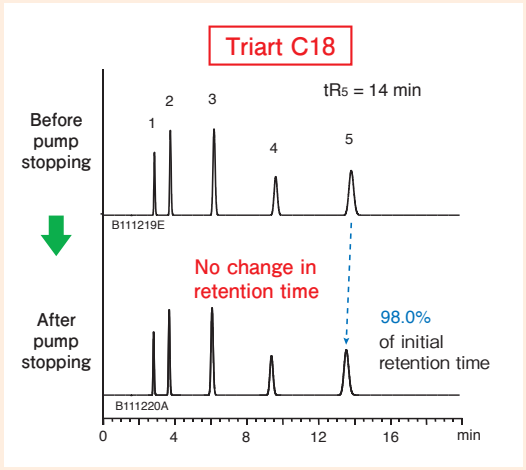
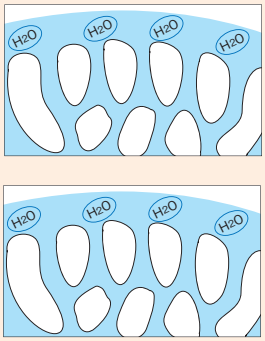


Image of C18 surface hydration



Column	: 5 μm, 150 X 4.6 mmI.D.
Eluent	: 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)
Flow rate	: 1.0 mL/min
Temperature	: 37°C
Detection	: UV at 254 nm

The surface of YMC-Triart C18 is well-hydrated even after stopping pump.
This provides longer and stable retention time of polar nucleic bases.

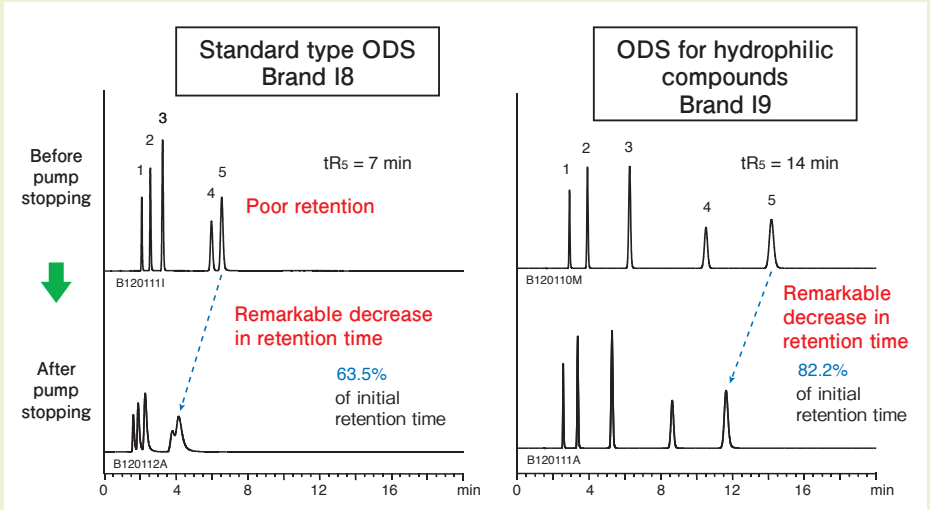
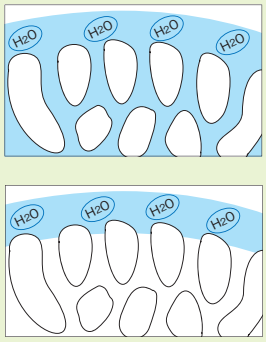


Image of C18 surface hydration



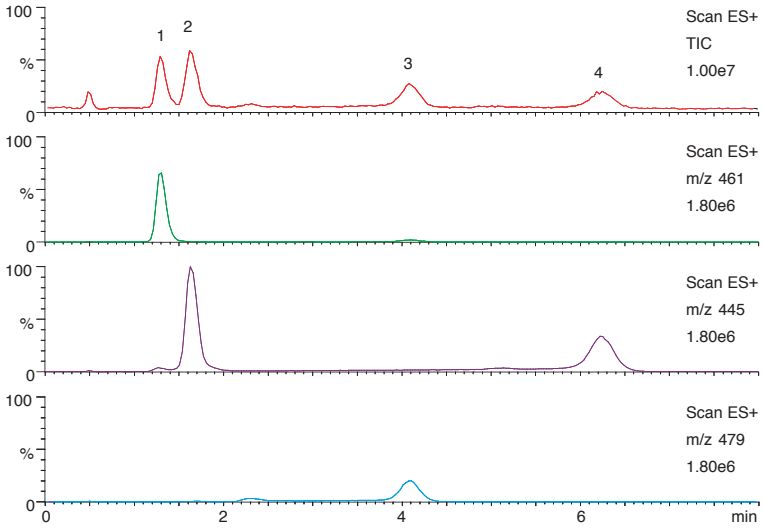
The surface of packing material is not fully hydrated. Compounds are not partitioned between mobile phase and stationary phase, and therefore its retention becomes shorter.

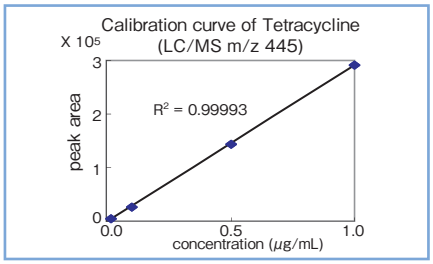
Under the 100% aqueous mobile phase, conventional C18 columns generally show poorer performance (retention and peak shape) due to low surface hydration caused by repulsion between aqueous mobile phase and hydrophobic bonded phase. Several columns that are compatible with 100% aqueous mobile phase in the market. Such columns exhibit excellent reproducibility and good retention ability of polar compounds achieved by sufficient surface hydration. On the other hand, classical silica base resin and bonded phase are easily degraded under such highly aqueous condition. Those aqueous compatible columns tend to have short lifetime.

To overcome the shortcomings of classical silica-based columns designed for highly aqueous compatibility, YMC-Triart C18 is a highly durable C18 column with polymerically bonded C18 phase on the organic/inorganic hybrid silica. YMC-Triart C18 is designed to retain both moderate hydrogen bonding capacity and hydrophobicity on the surface by optimizing bonded density of C18 phase. Its versatility is ideal for the first choice ODS column, and also applicable to analyses of polar compounds with 100% aqueous mobile phase condition.

Suitable for high sensitive LC/MS analysis

【Analysis of Tetracycline antibiotics using LC/MS】





Column	: YMC-Triart C18 5 μm 50 X 2.0 mmI.D.
Eluent	: acetonitrile/water/formic acid (15/85/0.1)
Flow rate	: 0.4 mL/min
Temperature	: 40℃
Detection	: ESI positive mode
Injection	: 10 μL

Triart C18 with its low bleeding characteristics is ideal for high sensitivity analysis using LC/MS. In addition, Triart C18's surface inertness to basic compounds and coordination compounds offers excellent and reproducible peak shape for quantitating difficult to chromatograph compounds.

1 Oxytetracycline (MW 460.4)

2 Tetracycline (MW 444.4)

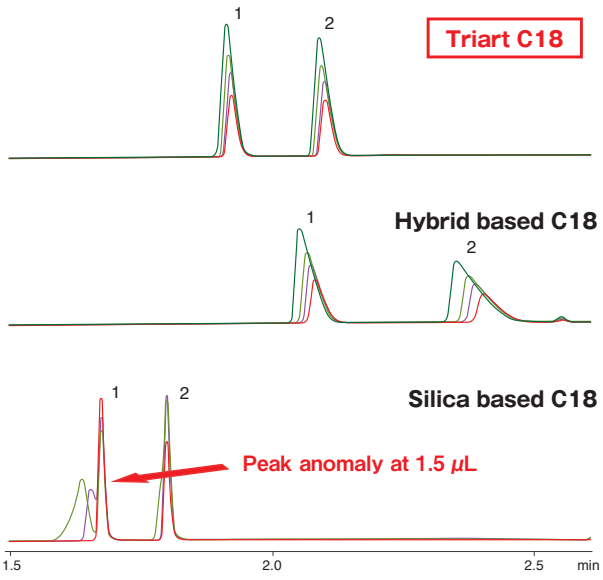
3 Chlortetracycline (MW 478.8)

4 Doxycycline (MW 444.4)

Minimizing strong solvent/ sample loading effects

【Improvement of loadability】

Influence of injection volume on peak shape



Sample dissolving solvent
acetonitrile

Injection volume
1.0 μL
1.5 μL
2.0 μL
3.0 μL

Column	: 5 μm, 50 X 2.0 mmI.D. or 2.1 mmI.D.
Eluent	: A) water/formic acid (100/0.1) B) acetonitrile/formic acid (100/0.1) 5%B (0-0.5 min), 5-100%B (0.5-2.5 min)
Flow rate	: 0.4 mL/min
Temperature	: 40℃
Detection	: UV at 275 nm

1 Propranolol (50 μg/mL)

2 Verapamil (50 μg/mL)

YMC-Triart C18 can tolerate larger injection volumes of samples containing solvents that have strong eluting ability (e.g., acetonitrile) while allowing for better peak shape than conventional columns. This can be important for a sample pretreated with higher concentrations of organic solvent, crude reaction samples and poorly soluble samples.

YMC-Triart C8

- Carbon content : 17%
- 100% aqueous compatibility : NO
- USP Classification : L7

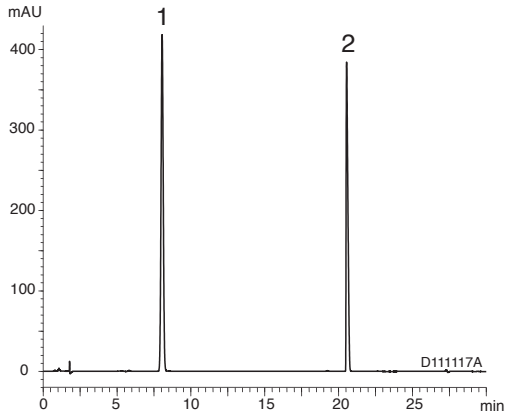
Effective for fast analysis of compounds with low polarity or for separation of isomers

Features

YMC-Triart C8 is a versatile column with excellent chemical durability that is equivalent to YMC-Triart C18. YMC-Triart C8 is suitable for fast analysis of samples containing hydrophobic compounds that are strongly retained on C18 columns or samples containing compounds with large difference in hydrophobicity.
In addition, its high bonded density provides high cognitive ability to separate compounds with structural differences. Triart C8 is also ideal for the separation of isomers and structural analogs.

Comparable versatility to C18

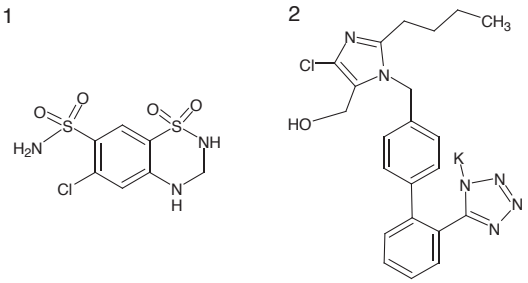
【Analysis of drugs】



Column	: YMC-Triart C8 5 μm 150 X 4.0 mmI.D.
Eluent	: A) phosphate buffer (pH 6.7)*/acetonitrile (93/7) B) acetonitrile 0-8%B (0-12 min), 8-62%B (12-28 min) *Dissolve 1.25 g of KH_2PO_4 and 2.01 g of $Na_2HPO_4 \cdot 12H_2O$ in 1000 mL of water
Flow rate	: 1.0 mL/min
Temperature	: 35℃
Detection	: UV at 280 nm
Injection	: 20 μL

(The United States Pharmacopeia 34th; Assay)

Losartan potassium / hydrochlorothiazide

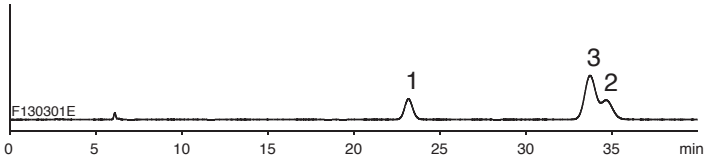


YMC-Triart C8 has good chemical durability and peak shapes as good as YMC-Triart C18. It is useful in various fields including pharmaceutical products, food and natural products.

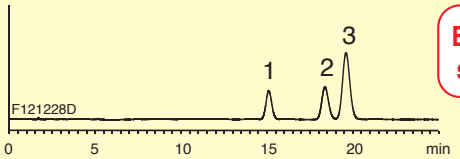
Ideal for separations of isomers or structural analogs

【Separation of positional isomers】

Triart C18



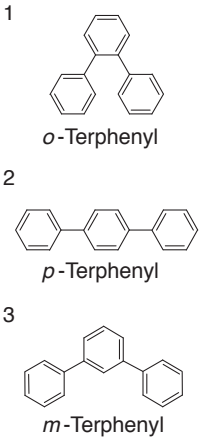
Triart C8



Baseline resolution in shorter analysis time

Column	: 5 μm, 150 X 3.0 mmI.D.
Eluent	: methanol/water (75/25)
Flow rate	: 0.425 mL/min
Temperature	: 30℃
Detection	: UV at 254 nm

Terphenyl isomers



Triart C8 provides superior resolution of Terphenyl isomers to Triart C18. The higher bonded density of C8 contributes to recognition of small difference in structure though the elution profile is similar between C18 and C8. Additionally, C8 phase offers shorter retention time than C18 phase thanks to the low hydrophobicity. These unique characteristics are effective for fast analysis of isomers and compounds with low polarity.

YMC-Triart Phenyl

- Carbon content : 17%
- 100% aqueous compatibility : YES
- USP Classification : L11

Effective for separation of compounds having long conjugated system by utilizing π-πinteraction

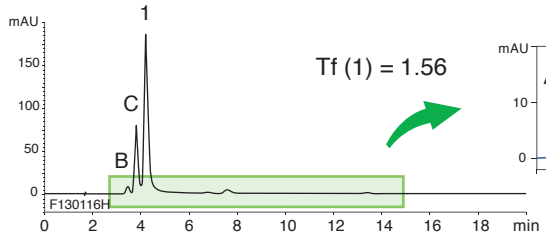
Features

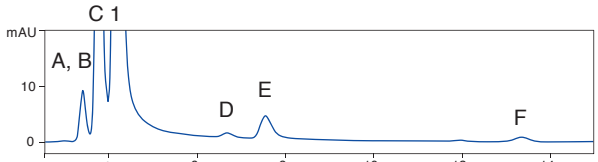
YMC-Triart Phenyl is a phenylbutyl group bonded phase. Well balanced hydrophobic interaction and π-π interaction that is unique to phenyl group has been achieved by optimization of bonded density and spacer chain length (C4). Especially, compounds with aromatic ring or long conjugated system tend to have strong retention. YMC-Triart Phenyl is ideal for separations of such isomers or structural analogs. The surface modification common among YMC-Triart series provides high durability and excellent peak shape without absorption.

Unique selectivity due to π-π interaction and superior peak shape without adsorption

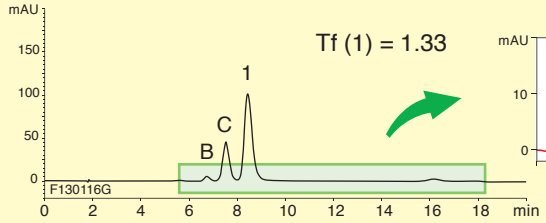
【Ideal for aromatic compounds and compounds having long conjugated system】

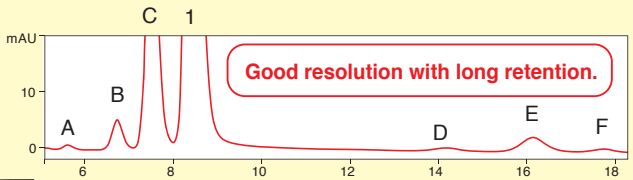
Triart C18



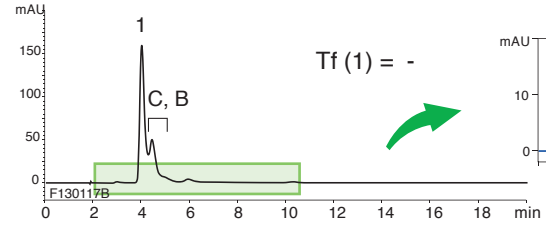


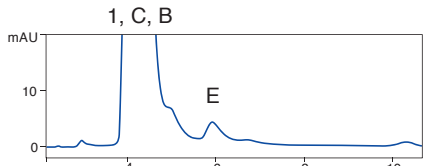
Triart Phenyl



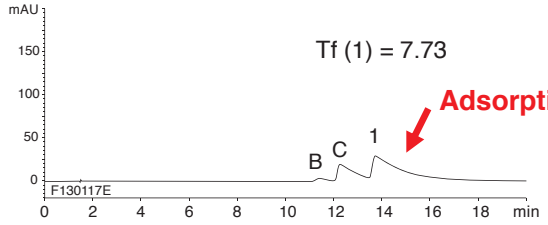


Triart PFP

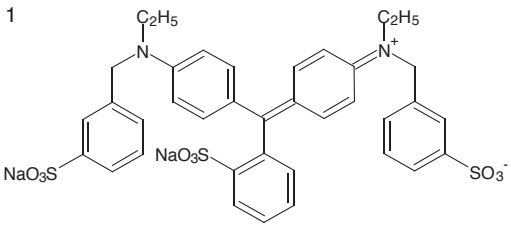




Silica based Phenyl-Hexyl



Brilliant Blue FCF and its impurities



Brilliant blue FCF

A - F : Structural analogs in Brilliant Blue FCF reagent

Column	: 5 μm, 150 X 3.0 or 4.6 mmI.D.
Eluent	: methanol/0.1% H_3PO_4 (45/55)
Flow rate	: 0.425 mL/min for 3.0 mmI.D. 1.0 mL/min for 4.6 mmI.D.
Temperature	: 40℃
Detection	: UV at 630 nm

Brilliant blue FCF of acidic triphenylmethane dye and its impurities (presumed to be by-products having similar structure) can not be separated well with YMC-Triart C18. On the other hand, they are retained well on YMC-Triart Phenyl, and excellent separation and peak shape are obtained. Strong adsorption and poor resolution is observed on a commercially available phenylhexyl column. When it comes to separations of aromatic compounds or compounds with long conjugated system, YMC-Triart Phenyl is more suitable than C18 due to strong retention by π-π interaction.

YMC-Triart PFP

- Carbon content : 15%
- 100% aqueous compatibility : YES
- USP Classification : L43

Effective for separation of polar compounds or isomers provided by unique polar interaction

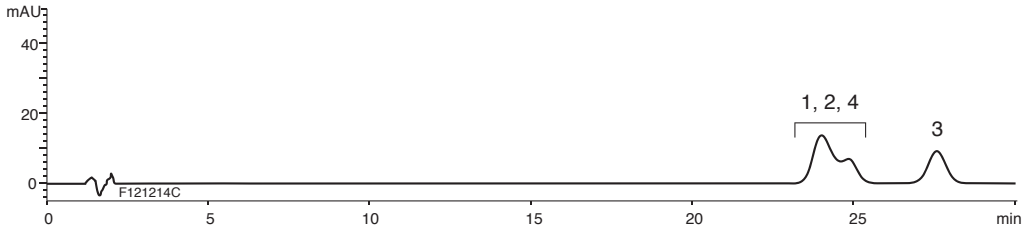
Features

YMC-Triart PFP is a pentafluorophenyl group bonded phase. The selectivity is unique due to various interactions such as hydrophobic, π-π, and dipole-dipole. YMC-Triart PFP is effective especially for improving separation of aromatic compounds, nitro compounds, and compounds with halogen because the selectivity is very different from other columns.

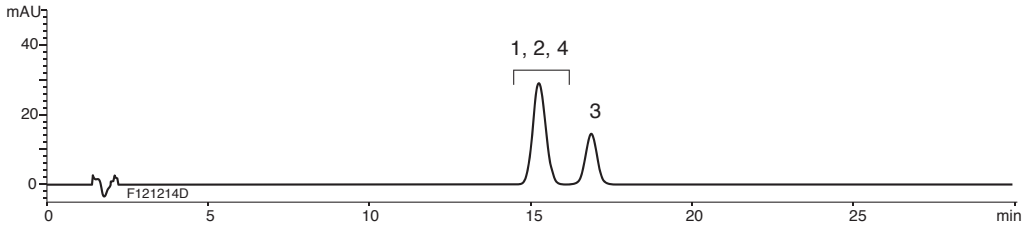
Effective for separation of polar compounds or isomers

【Unique separation provided by various interactions】

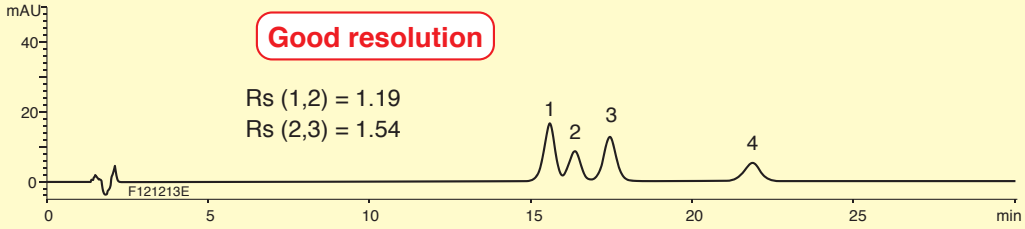
Triart C18



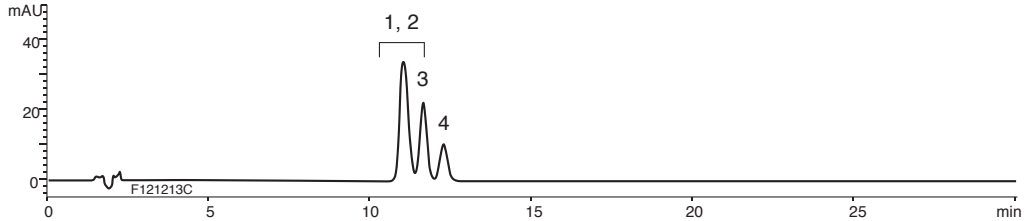
Triart Phenyl



Triart PFP

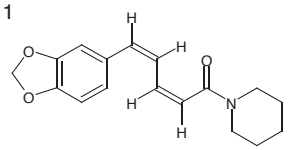


Silica based PFP



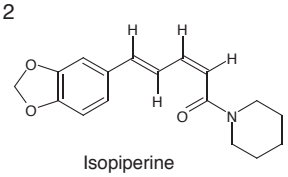
Piperine *cis-trans* isomers

1



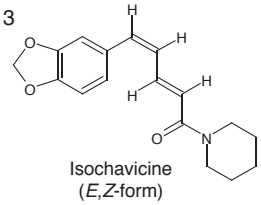
Chavicine
(*Z*,*Z*-form)

2



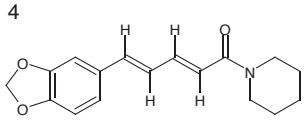
Isopiperine
(*Z*,*E*-form)

3



Isochavicine
(*E*,*Z*-form)

4



Piperine
(*E*,*E*-form)

Column	: 5 μm, 150 X 3.0 or 4.6 mmI.D.
Eluent	: acetonitrile/0.1% formic acid (40/60)
Flow rate	: 0.425 mL/min for 3.0 mmI.D. 1.0 mL/min for 4.6 mmI.D.
Temperature	: 25℃
Detection	: UV at 280 nm

Since the differences in hydrophobicity of *cis-trans* isomers of piperine, which is a pungent component contained in pepper, are small, commonly used reversed phase columns are not able to separate them. However YMC-Triart PFP can work well because YMC-Triart PFP can recognize minor charge localization in a molecule due to various interactions such as π-π and dipole-dipole. It shows high selectivity for compounds with small structural difference.

■ Carbon content : 12%
■ USP Classification : L20

YMC-Triart Diol-HILIC

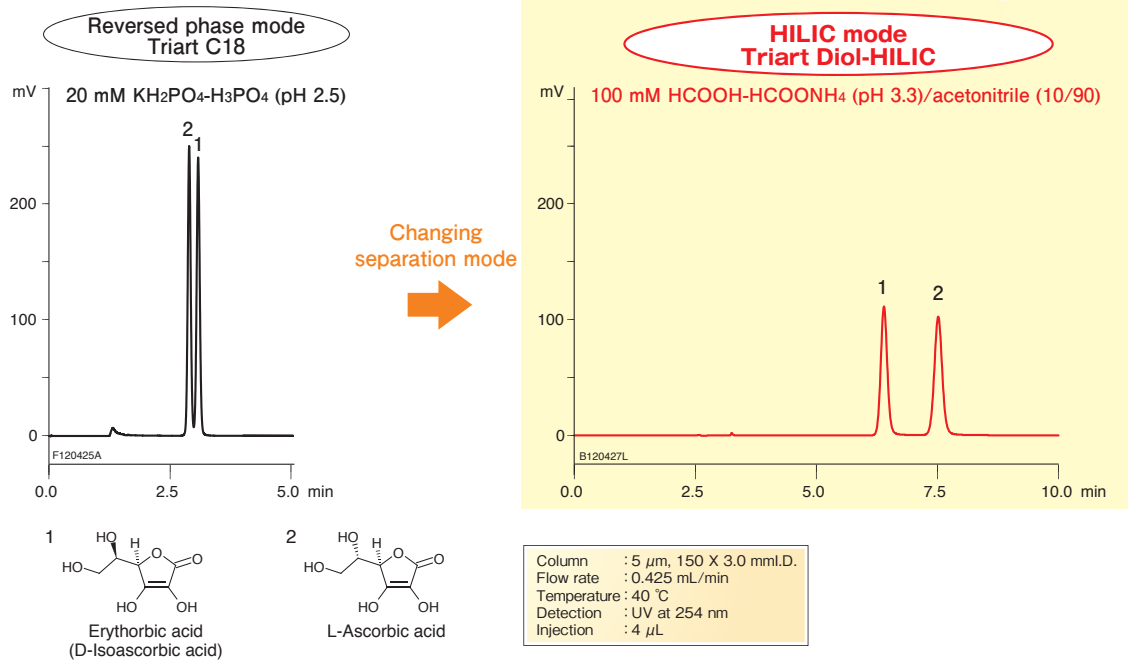
Effective for separation of highly polar compounds

Features

YMC-Triart Diol-HILIC is a HILIC (hydrophilic interaction chromatography) column based on an organic/inorganic hybrid particle synthesized with dihydroxypropyl group. Triart Diol-HILIC is ideal for a separation of polar and hydrophilic compounds which are not retained on reversed phase (C18, C8, and others) chromatography. Triart Diol-HILIC based on organic/inorganic hybrid particle provides excellent durability and is usable across a wide pH range. Low nonspecific adsorption provided by ionically neutral dihydroxypropyl group offers quantitative analysis with high reproducibility.

Ideal for separation of highly polar compounds which are hardly retained on a reversed phase column

【Comparison of reversed phase and HILIC separations】

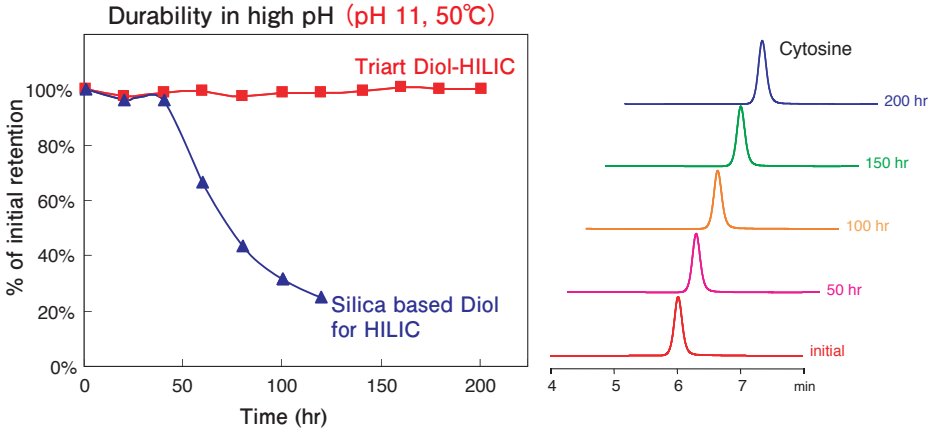


Column	: 5 μm, 150 X 3.0 mmI.D.
Flow rate	: 0.425 mL/min
Temperature	: 40 ℃
Detection	: UV at 254 nm
Injection	: 4 μL

Triart C18 (reversed phase) shows very weak retention and poor resolution of L-ascorbic acid and its stereoisomer (erythorbic acid) even with a 100% aqueous mobile phase. On the other hand, Triart Diol-HILIC shows strong retention and better resolution of these compounds with a mobile phase containing 90% organic solvent.

Excellent durability and reproducibility in wide range of conditions

【Extended lifetime in chemically challenging condition】



Triart Diol-HILIC provides highly reproducible separations even in high pH (pH 11) and at high temperature (50°C). Triart Diol-HILIC shows extremely long column lifetime even in such chemically harsh condition compared to conventional silica-based Diol column.

Column	: 5 μm, 150 X 4.6 mmI.D.
Eluent	: acetonitrile/water/NH3 (90/10/0.1) pH 11.3
Temperature	: 50℃
Flow rate	: 1.0 mL/min
Sample	: cytosine

YMC-Triart series 1.9 μm

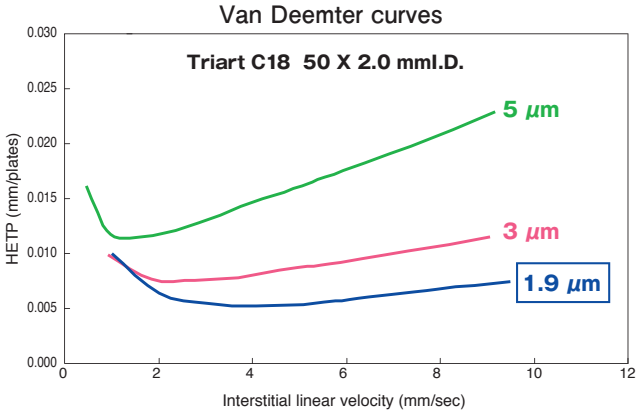
UHPLC column for ultra-fast separation and high resolution analysis

Features

YMC-Triart series 1.9 μm is designed for UHPLC with operating pressure up to 100 MPa. High resolution is achieved by 1.9 μm particles, and YMC-Triart series 1.9 μm is effective for ultra fast separation with short columns. YMC-Triart series 1.9μm is suitable for high-throughput analysis by increasing flow rate. YMC-Triart shows the same peak shapes and separation selectivity across all particle sizes. This allows smooth method transfer between conventional HPLC and UHPLC. In addition, YMC-Triart series 1.9 μm is also ideal as a high resolution column for peptide mapping and for separation of sample with complex constituents such as natural products.

Ideal for UHPLC analysis

【Correlation between linear velocity and column efficiency】

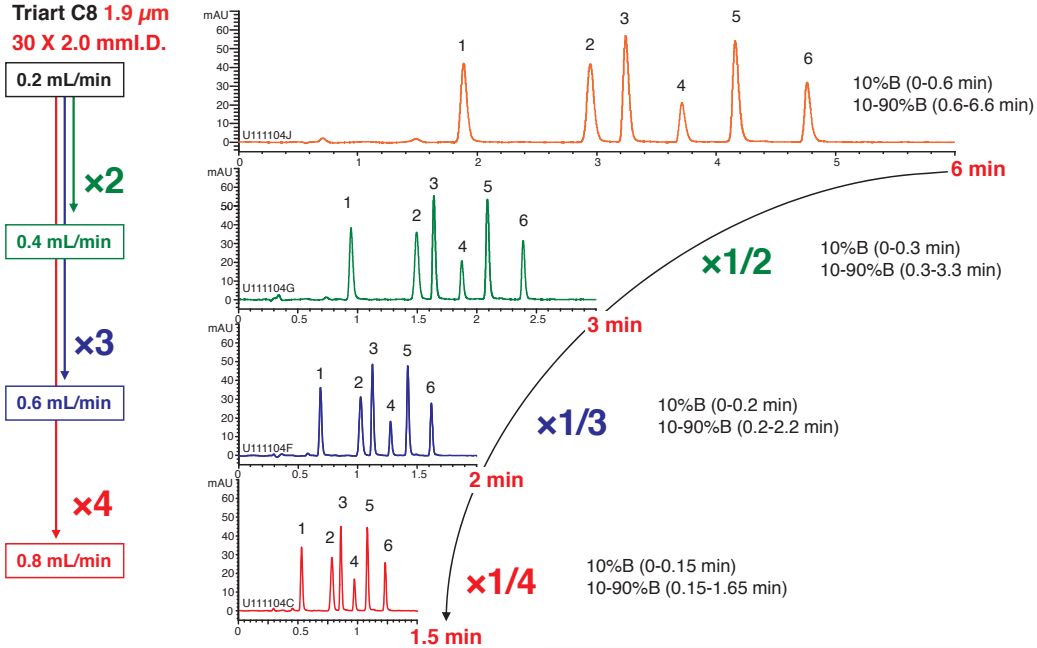


Eluent	: acetonitrile/water (60/40)
Temperature	: 25℃
Sample	: butyl benzoate

Triart 1.9 μm columns exhibit higher efficiency and maintain efficiency over a wide range of flow rate compared to 5 μm and 3 μm columns.

X axis : Interstitial linear velocity (Obtained by dividing column length by dead time (t0); the larger number means faster flow rate.)
Y axis : height equivalent of a theoretical plate (HETP; Obtained by dividing theoretical plate number by column length; the smaller number means higher column efficiency.)

【Increasing throughput】



Drug substances

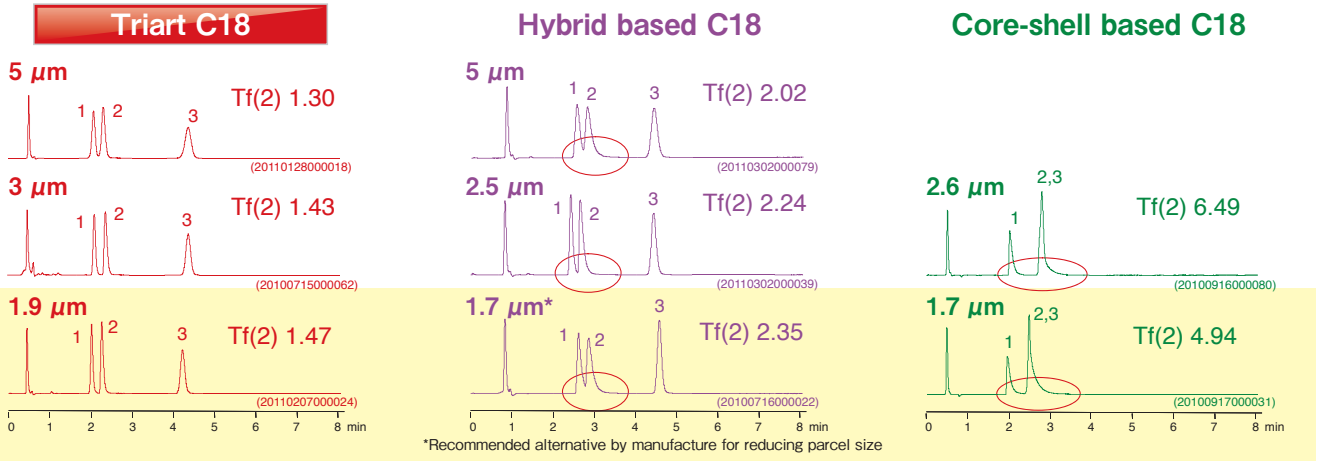
1. Hydrochlorothiazide
2. Valsartan
3. Losartan potassium
4. Amlodipine besilate
5. Atorvastatin calcium hydrate
6. Candesartan cilexetil

Eluent	: A) 10 mM CH_3COONH_4-CH_3COOH (pH 5.5) B) acetonitrile
Temperature	: 30℃
Detection	: UV at 254 nm
Injection	: 4 μL
System	: Agilent 1200SL

Triart C18 1.9 μm provides an ultrafast separation of six drug substances which are different in polarity and hydrophobicity within 1.5 minutes by using short column and increasing flow rate.

Seamless method transfer between HPLC and UHPLC

【Identical selectivity across various particle sizes】



*Recommended alternative by manufacture for reducing parcel size

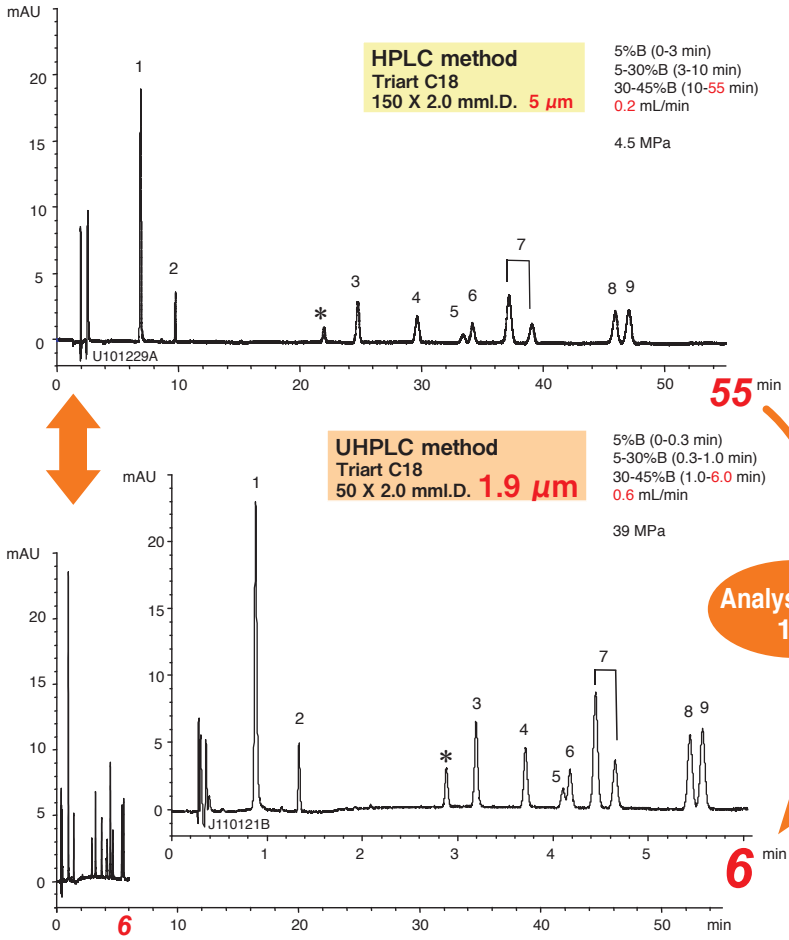
Basic drugs

1. Chlorpheniramine 2. Dextromethorphan 3. Propyl paraben (I.S.)

Column	: 50 X 2.0 mmI.D. or 2.1 mmI.D.
Eluent	: 20 mM KH_2PO_4-KH_2PO_4 (pH 6.9)/acetonitrile (65/35)
Flow rate	: 0.2 mL/min
Temperature	: 40℃
Detection	: UV at 235 nm

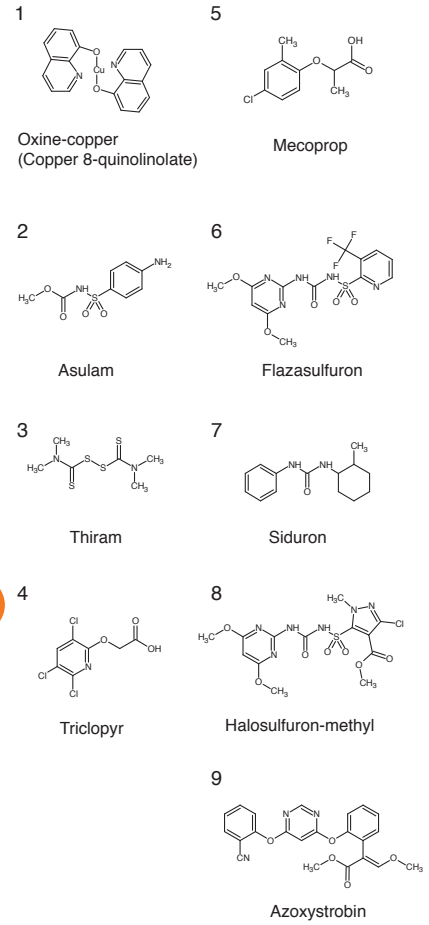
YMC-Triart columns show the identical selectivity and the excellent peak shapes of basic (ionic) compounds across all of the particle sizes including 1.9 μm. It allows predictable scale up from UHPLC to conventional HPLC and even to semi-preparative LC, and vice versa. In contrast, commercially available C18 columns often show some differences in selectivity, retention, and peak shape between different particle sizes.

【Method transfer between HPLC and UHPLC】



Eluent	: A) water/formic acid (100/0.1) B) acetonitrile/formic acid (100/0.1)
Temperature	: 40℃
Detection	: UV at 240 nm
Injection	: 1 μL (5 μg/mL)
System	: Agilent 1200SL

Agrichemicals



*Impurity derived from thiram

A 90% decrease of analysis time is achieved by transferring analysis method from conventional HPLC using 5 μm particle to UHPLC using 1.9 μm particle at three times faster linear velocity. Also, a method developed with UHPLC can easily be transferred to HPLC.

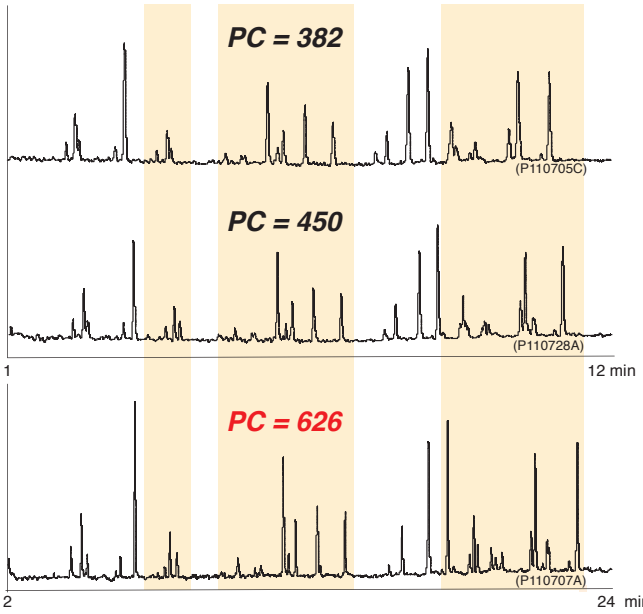
Effective as a high resolution column

【Peptide mapping】

100 X 2.0 mmI.D.
3 μm
9.4-9.8 MPa

100 X 2.0 mmI.D.
1.9 μm
27.6-28.6 MPa

200 X 2.0 mmI.D.
1.9 μm
Two coupled 1.9 μm,
100 X 2.0 mmI.D.
58.1-61.6 MPa



PC (peak capacity)
=1+(gradient time/peak width*)
*peak width = $2W_{0.5h}$ average

Co-elution peaks on 3 μm

↓ Changing particle size to 1.9 μm

Improvement of resolution and peak capacity on 1.9 μm

↓ Changing column length to 200 mm

Higher resolution is achieved

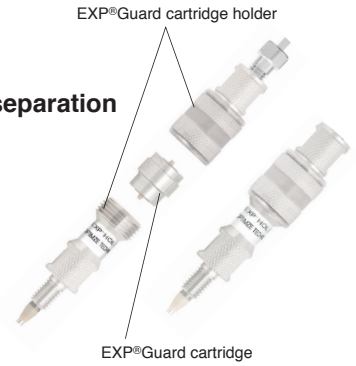
Column	: YMC-Triart C18	Temperature	: 70℃
Eluent	: A) water/TFA (100/0.1)	Detection	: UV at 220 nm
	B) acetonitrile/TFA (100/0.08)	Injection	: 10 μL for a single column
	5-40%B (0-15 min) for a single column		20 μL for two coupled columns
	5-40%B (0-30 min) for two coupled columns	Sample	: Triptic digest of Bovine Hemoglobin
Flow rate	: 0.4 mL/min	System	: Agilent 1290

YMC-Triart series 1.9 μm has superior column efficiency, and a coupling of two 100 mm length of Triart 1.9 μm columns offers outstanding separation ability. This allows the precise separation in an analysis of complicated samples, such as peptide mapping.

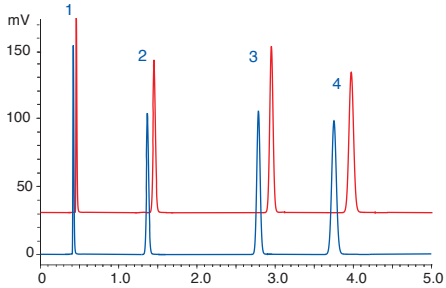
Guard cartridge column for UHPLC

Features

- **High Pressure resistance rated to 100 MPa (15,000 psi)**
- **Low-volume, low-dispersion cartridges minimize the impact on separation**
- **Zero-dead-volume direct connection to column**
- **Compatible with various column connection types**
- **Hand-tight guard replacement (No tool needed)**
- **Ideal for protecting Triart 1.9 μm analytical column**



【Low-volume, low-dispersion cartridges minimize the impact on separation】



With guard cartridge
N4 = 19,200

Main column only
N4 = 19,700

Column	: YMC-Triart C18 1.9 μm 100 X 2.0 mmI.D.
Eluent	: acetonitrile/water (60/40)
Flow rate	: 0.4 mL/min
Temperature	: 25℃
Detection	: UV at 270 nm
Injection	: 1 μL
Sample	: 1. Uracil 2. Methyl benzoate 3. Naphthalene 4. Butyl benzoate

EXP® guard cartridge column with low-volume and low-dispersion column minimize the impact on separation. EXP® guard cartridge column provides less than 3% decrease in theoretical plate count.

◆Fitting for connecting system and main column / guard cartridge is also available.

Hand-tight EXP® fitting

* EXP® is a registered trademark of Optimize Technologies, Inc.

YMC-Actus Triart series

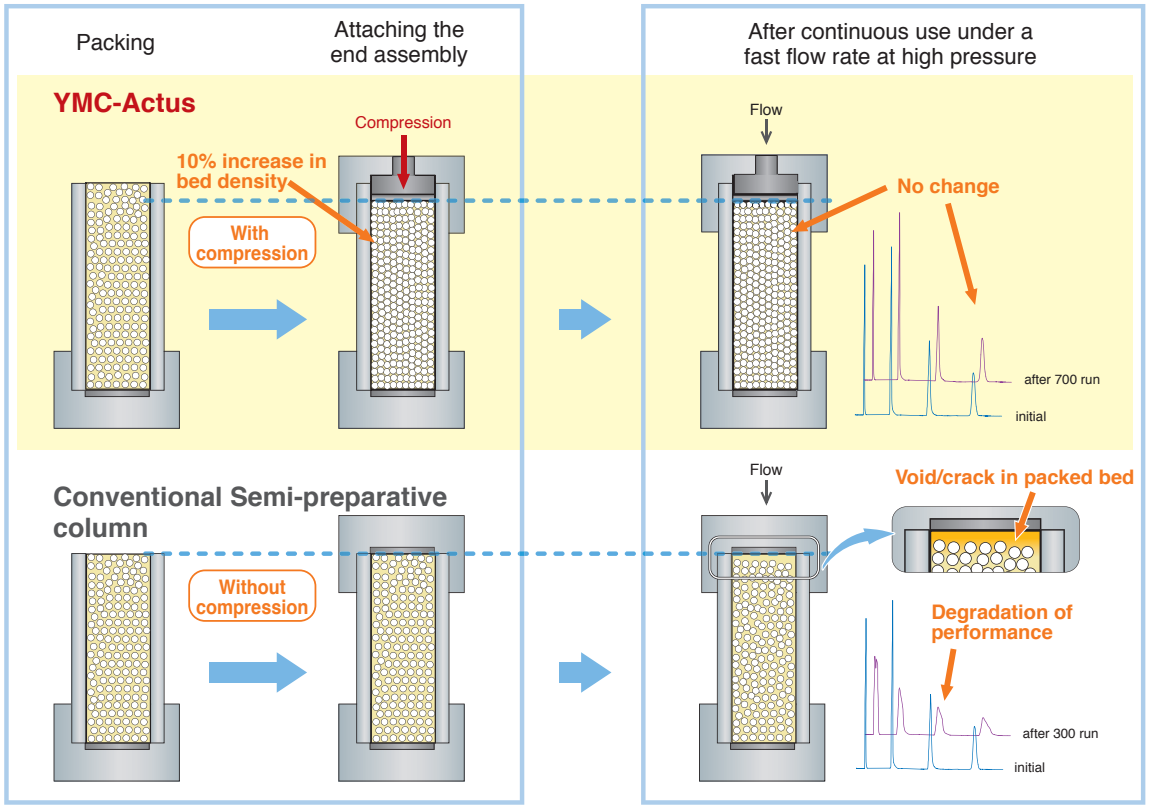
Semi-preparative HPLC columns with outstanding column durability

Features

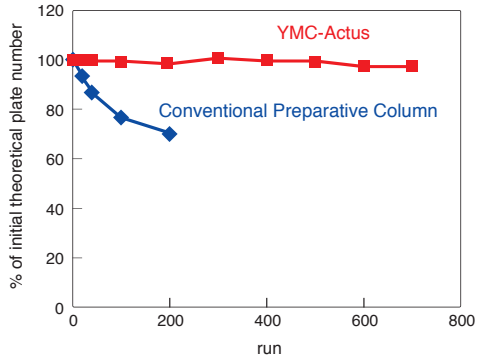
YMC-Actus is a semi-preparative HPLC column applying axial compression technology. The column bed is compressed adequately when attaching the end assembly. It provides proper bed density and shows 10% higher than conventional columns. High efficiency and superior durability are also obtained. The best properties of YMC-Actus and superior chemical durability of YMC-Triart are combined to produce outstanding preparative purifications.

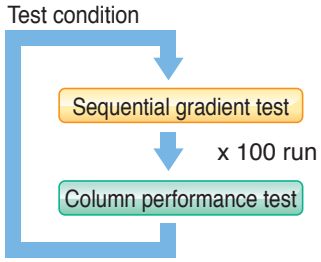
Great durability achieved by applying axial compression technology

【Excellent durability provided by improved bed density】



Column durability study





Sequential gradient test
(high-speed and high-pressure)
Column size : 5 μm, 50 X 20 mmI.D.
or 50 X 19 mmI.D.
Eluent : A) water B) methanol
Gradient : 5%B (0-0.5 min), 5-95%B (0.5-3.1 min), 95%B (3.1-3.6 min), 5%B (3.6-4.0 min)
Flow rate : 50 mL/min
Pressure : ~17 MPa

Column performance test
Column size : 5 μm, 50 X 20 mmI.D.
or 50 X 19 mmI.D.
Eluent : methanol/water (60/40)
Flow rate : 10 mL/min
Sample : naphthalene

Uniformly high density packing is necessary for high performance HPLC column. DAC (Dynamic Axial Compression) column is widely used for preparative separation in pilot or production scale. It allows uniformly high density packing and prevents formation of voids during use by applying continuous compression.

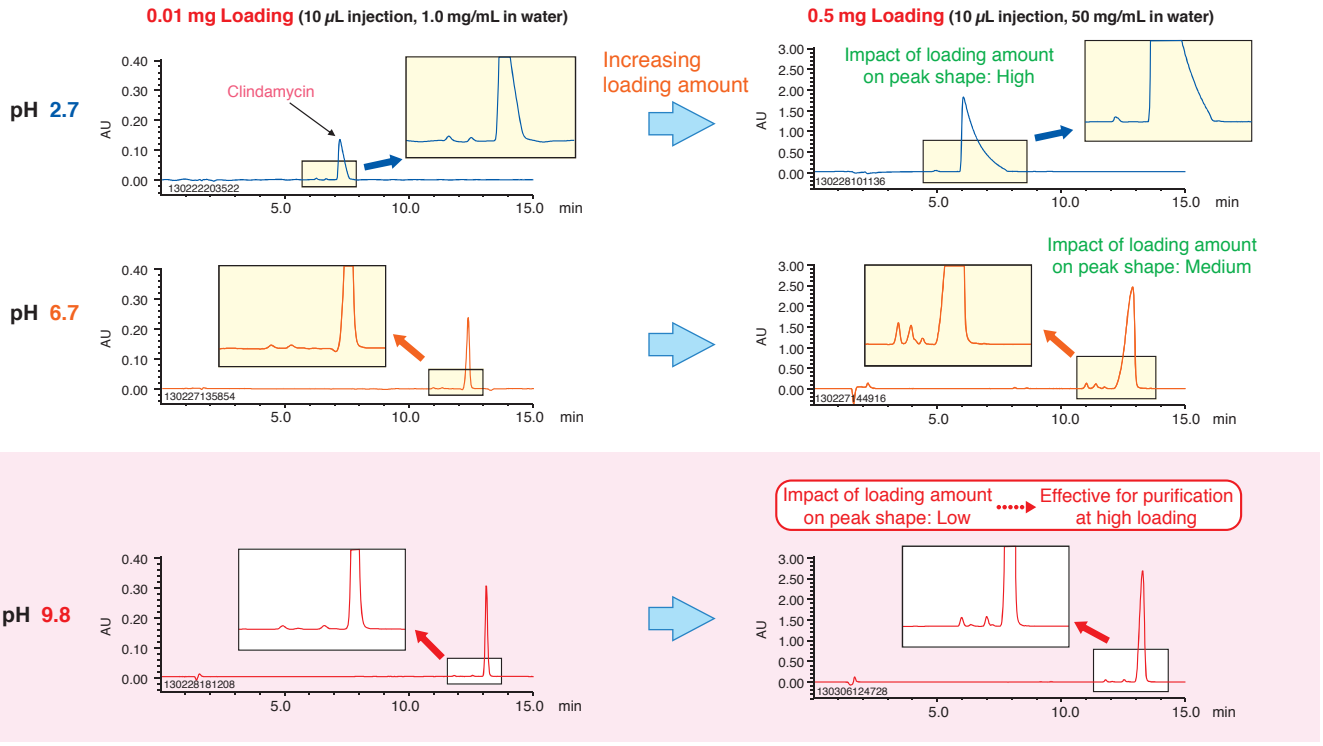
YMC-Actus series have been developed by applying this Axial Compression Technology to semi-prep column. This column bed is compressed adequately by attaching the end assembly newly designed for YMC-Actus. It provides proper bed density (10% higher than conventional columns) and results in higher efficiency and durability.

Separation at high loading

【Purification of basic pharmaceutical: Clindamycin】

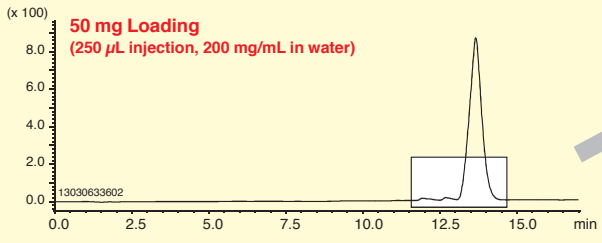
Purification method development

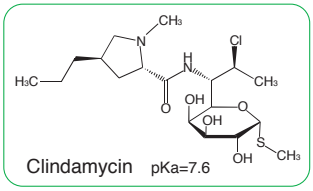
YMC-Triart C18 5 μm, 150 X 4.6 mmI.D.



Purification at pH 9.8

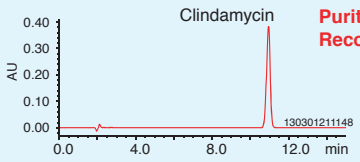
YMC-Actus Triart C18 5 μm, 150 X 20 mmI.D.





Eluent	: A) 20 mM HCOOH for pH 2.7 20 mM HCOONH4 for pH 6.7 20 mM HCOONH4-NH3 for pH 9.8 B) acetonitrile 10-75%B (0-15 min)
Flow rate	: 1.0 mL/min for 150 X 4.6 mmI.D. 18.9 mL/min for 150 X 20 mmI.D.
Temperature	: 25℃ for 150 X 4.6 mmI.D. ambient for 150 X 20 mmI.D.
Detection	: UV at 210 nm
Pressure	: 7.0 MPa for 150X4.6 mmI.D. 8.4 MPa for 150X20 mmI.D.

Fraction analysis



Column	: YMC-Triart C18 5 μm 150 X 4.6 mmI.D.
Eluent	: 50 mM KH_2PO_4 (pH 7.5 adjusted by 8 M KOH) /acetonitrile (55/45)
Flow rate	: 1.0 mL/min
Temperature	: 25℃
Detection	: UV at 210 nm
Injection	: 20 μL

Clindamycin and its impurities (related compounds) are more hydrophobic in their un-ionized form and are retained stronger at pH 9.8. At higher pH condition, the resolution between main peak and impurities is improved and the peak shape is less affected by increase of mass loading.

Excellent chemical durability of YMC-Triart offers an option of purification at a high pH that is effective for basic compounds by increasing retention and mass loading. Moreover, highly efficient YMC-Actus Triart has identical performance to YMC-Triart analytical column. This enables direct scale up from analytical condition to preparative condition. The combination of YMC-Triart and YMC-Actus offers highly efficient purification of various compounds.

Ordering information

【UHPLC&HPLC columns】

YMC-Triart series UHPLC&HPLC columns

Particle size (μm)	Pore size (nm)	Column size inner diameter X length(mm)	Product number				
			Triart C18	Triart C8	Triart Phenyl	Triart PFP	Triart Diol-HILIC
1.9	12	2.0 X 20	TA12SP9-0202PT	TO12SP9-0202PT	TPH12SP9-0202PT	TPF12SP9-0202PT	-
		2.0 X 30	TA12SP9-0302PT	TO12SP9-0302PT	TPH12SP9-0302PT	TPF12SP9-0302PT	-
		2.0 X 50	TA12SP9-0502PT	TO12SP9-0502PT	TPH12SP9-0502PT	TPF12SP9-0502PT	TDH12SP9-0502PT
		2.0 X 75	TA12SP9-L502PT	TO12SP9-L502PT	TPH12SP9-L502PT	TPF12SP9-L502PT	TDH12SP9-L502PT
		2.0 X 100	TA12SP9-1002PT	TO12SP9-1002PT	TPH12SP9-1002PT	TPF12SP9-1002PT	TDH12SP9-1002PT
		2.0 X 150	TA12SP9-1502PT	TO12SP9-1502PT	TPH12SP9-1502PT	TPF12SP9-1502PT	-
		3.0 X 50	TA12SP9-0503PT	TO12SP9-0503PT	TPH12SP9-0503PT	TPF12SP9-0503PT	TDH12SP9-0503PT
		3.0 X 75	TA12SP9-L503PT	TO12SP9-L503PT	TPH12SP9-L503PT	TPF12SP9-L503PT	TDH12SP9-L503PT
		3.0 X 100	TA12SP9-1003PT	TO12SP9-1003PT	TPH12SP9-1003PT	TPF12SP9-1003PT	TDH12SP9-1003PT
		3.0 X 150	TA12SP9-1503PT	TO12SP9-1503PT	TPH12SP9-1503PT	TPF12SP9-1503PT	-
3	12	2.0 X 20	TA12S03-0202WT	TO12S03-0202WT	TPH12S03-0202WT	TPF12S03-0202WT	TDH12S03-0202WT
		2.0 X 30	TA12S03-0302WT	TO12S03-0302WT	TPH12S03-0302WT	TPF12S03-0302WT	TDH12S03-0302WT
		2.0 X 50	TA12S03-0502WT	TO12S03-0502WT	TPH12S03-0502WT	TPF12S03-0502WT	TDH12S03-0502WT
		2.0 X 75	TA12S03-L502WT	TO12S03-L502WT	TPH12S03-L502WT	TPF12S03-L502WT	TDH12S03-L502WT
		2.0 X 100	TA12S03-1002WT	TO12S03-1002WT	TPH12S03-1002WT	TPF12S03-1002WT	TDH12S03-1002WT
		2.0 X 150	TA12S03-1502WT	TO12S03-1502WT	TPH12S03-1502WT	TPF12S03-1502WT	TDH12S03-1502WT
		3.0 X 50	TA12S03-0503WT	TO12S03-0503WT	TPH12S03-0503WT	TPF12S03-0503WT	TDH12S03-0503WT
		3.0 X 75	TA12S03-L503WT	TO12S03-L503WT	TPH12S03-L503WT	TPF12S03-L503WT	TDH12S03-L503WT
		3.0 X 100	TA12S03-1003WT	TO12S03-1003WT	TPH12S03-1003WT	TPF12S03-1003WT	TDH12S03-1003WT
		3.0 X 150	TA12S03-1503WT	TO12S03-1503WT	TPH12S03-1503WT	TPF12S03-1503WT	TDH12S03-1503WT
		4.6 X 35	TA12S03-H546WT	TO12S03-H546WT	TPH12S03-H546WT	TPF12S03-H546WT	TDH12S03-H546WT
		4.6 X 50	TA12S03-0546WT	TO12S03-0546WT	TPH12S03-0546WT	TPF12S03-0546WT	TDH12S03-0546WT
		4.6 X 75	TA12S03-L546WT	TO12S03-L546WT	TPH12S03-L546WT	TPF12S03-L546WT	TDH12S03-L546WT
		4.6 X 100	TA12S03-1046WT	TO12S03-1046WT	TPH12S03-1046WT	TPF12S03-1046WT	TDH12S03-1046WT
		4.6 X 150	TA12S03-1546WT	TO12S03-1546WT	TPH12S03-1546WT	TPF12S03-1546WT	TDH12S03-1546WT
		4.6 X 250	TA12S03-2546WT	TO12S03-2546WT	TPH12S03-2546WT	TPF12S03-2546WT	TDH12S03-2546WT
5	12	2.0 X 20	TA12S05-0202WT	TO12S05-0202WT	TPH12S05-0202WT	TPF12S05-0202WT	TDH12S05-0202WT
		2.0 X 30	TA12S05-0302WT	TO12S05-0302WT	TPH12S05-0302WT	TPF12S05-0302WT	TDH12S05-0302WT
		2.0 X 50	TA12S05-0502WT	TO12S05-0502WT	TPH12S05-0502WT	TPF12S05-0502WT	TDH12S05-0502WT
		2.0 X 75	TA12S05-L502WT	TO12S05-L502WT	TPH12S05-L502WT	TPF12S05-L502WT	TDH12S05-L502WT
		2.0 X 100	TA12S05-1002WT	TO12S05-1002WT	TPH12S05-1002WT	TPF12S05-1002WT	TDH12S05-1002WT
		2.0 X 150	TA12S05-1502WT	TO12S05-1502WT	TPH12S05-1502WT	TPF12S05-1502WT	TDH12S05-1502WT
		3.0 X 50	TA12S05-0503WT	TO12S05-0503WT	TPH12S05-0503WT	TPF12S05-0503WT	TDH12S05-0503WT
		3.0 X 75	TA12S05-L503WT	TO12S05-L503WT	TPH12S05-L503WT	TPF12S05-L503WT	TDH12S05-L503WT
		3.0 X 100	TA12S05-1003WT	TO12S05-1003WT	TPH12S05-1003WT	TPF12S05-1003WT	TDH12S05-1003WT
		3.0 X 125	TA12S05-R503WT	TO12S05-R503WT	TPH12S05-R503WT	TPF12S05-R503WT	TDH12S05-R503WT
		3.0 X 150	TA12S05-1503WT	TO12S05-1503WT	TPH12S05-1503WT	TPF12S05-1503WT	TDH12S05-1503WT
		4.0 X 125	TA12S05-R504WT	TO12S05-R504WT	TPH12S05-R504WT	TPF12S05-R504WT	TDH12S05-R504WT
		4.0 X 150	TA12S05-1504WT	TO12S05-1504WT	TPH12S05-1504WT	TPF12S05-1504WT	TDH12S05-1504WT
		4.0 X 250	TA12S05-2504WT	TO12S05-2504WT	TPH12S05-2504WT	TPF12S05-2504WT	TDH12S05-2504WT
		4.6 X 35	TA12S05-H546WT	TO12S05-H546WT	TPH12S05-H546WT	TPF12S05-H546WT	TDH12S05-H546WT
		4.6 X 50	TA12S05-0546WT	TO12S05-0546WT	TPH12S05-0546WT	TPF12S05-0546WT	TDH12S05-0546WT
		4.6 X 75	TA12S05-L546WT	TO12S05-L546WT	TPH12S05-L546WT	TPF12S05-L546WT	TDH12S05-L546WT
		4.6 X 100	TA12S05-1046WT	TO12S05-1046WT	TPH12S05-1046WT	TPF12S05-1046WT	TDH12S05-1046WT
		4.6 X 150	TA12S05-1546WT	TO12S05-1546WT	TPH12S05-1546WT	TPF12S05-1546WT	TDH12S05-1546WT
		4.6 X 250	TA12S05-2546WT	TO12S05-2546WT	TPH12S05-2546WT	TPF12S05-2546WT	TDH12S05-2546WT
		6.0 X 150	TA12S05-1506WT	TO12S05-1506WT	TPH12S05-1506WT	TPF12S05-1506WT	-
		6.0 X 250	TA12S05-2506WT	TO12S05-2506WT	TPH12S05-2506WT	TPF12S05-2506WT	-
		10 X 150	TA12S05-1510WT	TO12S05-1510WT	TPH12S05-1510WT	TPF12S05-1510WT	-
		10 X 250	TA12S05-2510WT	TO12S05-2510WT	TPH12S05-2510WT	TPF12S05-2510WT	-

Please inquire us for products other than listed above.

【High durability semi-preparative column】

YMC-Actus Triart series

Particle size (μm)	Pore size (nm)	Column size inner diameter X length(mm)	Product number				
			Triart C18	Triart C8	Triart Phenyl	Triart PFP	Triart Diol-HILIC
5	12	20 X 50	TA12S05-0520WX	TO12S05-0520WX	TPH12S05-0520WX	TPF12S05-0520WX	-
		20 X 100	TA12S05-1020WX	TO12S05-1020WX	TPH12S05-1020WX	TPF12S05-1020WX	-
		20 X 150	TA12S05-1520WX	TO12S05-1520WX	TPH12S05-1520WX	TPF12S05-1520WX	-
		20 X 250	TA12S05-2520WX	TO12S05-2520WX	TPH12S05-2520WX	TPF12S05-2520WX	-
		30 X 50	TA12S05-0530WX	TO12S05-0530WX	TPH12S05-0530WX	TPF12S05-0530WX	-
		30 X 75	TA12S05-L530WX	TO12S05-L530WX	TPH12S05-L530WX	TPF12S05-L530WX	-
		30 X 100	TA12S05-1030WX	TO12S05-1030WX	TPH12S05-1030WX	TPF12S05-1030WX	-
		30 X 150	TA12S05-1530WX	TO12S05-1530WX	TPH12S05-1530WX	TPF12S05-1530WX	-
		30 X 250	TA12S05-2530WX	TO12S05-2530WX	TPH12S05-2530WX	TPF12S05-2530WX	-

Please inquire us for products other than listed above.

Ordering information

【Guard Column and Connector for UHPLC】

EXP®Guard Cartridge Column (Max. pressure: 100 MPa, 3/pack)

Particle size (μm)	Pore size (nm)	Column size inner diameter X length(mm)	Product number				
			Triart C18	Triart C8	Triart Phenyl	Triart PFP	Triart Diol-HILIC
1.9	12	2.1 X 5	TA12SP9-E5Q1CC	TO12SP9-E5Q1CC	TPH12SP9-E5Q1CC	TPF12SP9-E5Q1CC	-
		3.0 X 5	TA12SP9-E503CC	TO12SP9-E503CC	TPH12SP9-E503CC	TPF12SP9-E503CC	-

EXP®Guard Cartridge Holder (Adjustable ferrule, Max. pressure: 137 MPa)

EXP® direct connect holder (for both 2.1 mm and 3.0 mm inner diameter , 2 titanium hybrid ferrule and 1 nut included)	XPCHUHP

Fitting for Connecting System and Main Column / Guard Cartridge (Adjustable ferrule, Max. pressure: 137 MPa)

Hand-tight EXP® fitting (Hand-tight nut and titanium hybrid ferrule included)	XRHTF-01

Replacement Ferrule

Titanium hybrid ferrule (5/pack)	XRHTF-05

【Guard Column for HPLC】

Guard Cartridge Column (2/pack; 3/pack for 4.0 mm inner diameter)

Particle size (μm)	Pore size (nm)	Column size inner diameter X length(mm)	Product number				
			Triart C18	Triart C8	Triart Phenyl	Triart PFP	Triart Diol-HILIC
3	12	2.0 X 10	TA12S03-0102CC	TO12S03-0102CC	TPH12S03-0102CC	TPF12S03-0102CC	TDH12S03-0102CC
		4.0 X 23	TA12S03-G304CC	TO12S03-G304CC	TPH12S03-G304CC	TPF12S03-G304CC	TDH12S03-G304CC
5	12	2.0 X 10	TA12S05-0102CC	TO12S05-0102CC	TPH12S05-0102CC	TPF12S05-0102CC	TDH12S05-0102CC
		4.0 X 23	TA12S05-G304CC	TO12S05-G304CC	TPH12S05-G304CC	TPF12S05-G304CC	TDH12S05-G304CC
		20 X 10	TA12S05-0120CC	TO12S05-0120CC	TPH12S05-0120CC	TPF12S05-0120CC	-
		30 X 10	TA12S05-0130CC	TO12S05-0130CC	TPH12S05-0130CC	TPF12S05-0130CC	-

A cartridge holder will need to be purchased separately before using this product for the first time.

Cartridge Holder

Semi-micro guard cartridge holder (inner diameter: 1.0, 1.5, 2.0 mm)	XPCHSMW
Cartridge holder (inner diameter: 4.0 mm)	XPCHW
Semi-preparative guard cartridge holder (inner diameter: 20 mm)	XPCHSPW2
Semi-preparative guard cartridge holder (inner diameter: 30 mm)	XPCHSPW3

YMC Guard Cartridge Pack

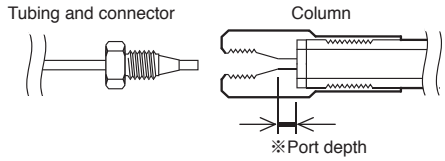
Particle size (μm)	Pore size (nm)	Column size inner diameter X length(mm)	Product number				
			Triart C18	Triart C8	Triart Phenyl	Triart PFP	Triart Diol-HILIC
3	12	4.0 X 23	TA12S03-G304CCPK	TO12S03-G304CCPK	TPH12S03-G304CCPK	TPF12S03-G304CCPK	TDH12S03-G304CCPK
5	12	4.0 X 23	TA12S05-G304CCPK	TO12S05-G304CCPK	TPH12S05-G304CCPK	TPF12S05-G304CCPK	TDH12S05-G304CCPK

A guard cartridge pack includes a cartridge holder (1 set), a guard cartridge column, and a column coupler (made of PEEK).

Guard Column

Particle size (μm)	Pore size (nm)	Column size inner diameter X length(mm)	Product number				
			Triart C18	Triart C8	Triart Phenyl	Triart PFP	Triart Diol-HILIC
5	12	10 X 30	TA12S05-0310WTG	TO12S05-0310WTG	TPH12S05-0310WTG	TPF12S05-0310WTG	-

Consideration of connector and column fittings



The end of the product number	Port depth	Style of endfitting
PT	2 mm	Parker style (UPLC compatible)
WT / WX / WTG	3 mm	Waters (W) style

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.ymcchina.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