05

Hybrid Silica Based Columns

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YMC-Triart

YMC-Triart is organic/inorganic hybrid silica based column, 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.

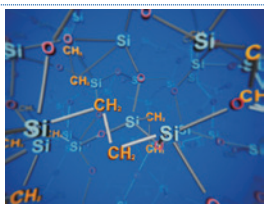
Various product lineup enables wide range of separation from UHPLC to HPLC analysis and even to preparative separation.

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
- Smooth method transfer from UHPLC to HPLC analysis and even to HPLC purification
- Available in metal free column for separation of coordination compounds

Versatile hybrid base material

YMC-Triart is based on novel organic/inorganic hybrid particles. The particle combines high mechanical stability and high efficiency derived from silica based packing material and high chemical stability derived from polymer based packing material. The granulation process utilizing microreactor technology enables continuous and highly controlled production of hybrid particles. The particle has uniform pore size distribution and smooth surface as well as uniform particle size. This feature greatly contributes to excellent peak shape and separation reproducibility.



Specifications

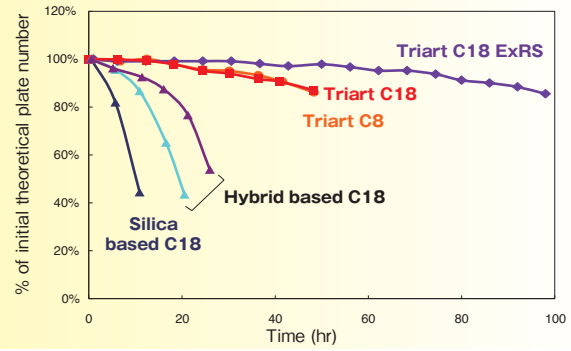
	Bonded phase	Separation mode	Particle size (µm)	Pore size (Å)	C% *	Endcapping	Usable pH range	USP Classification
Triart C18	-$C_{18}H_{37}$ (standard type)	Reversed-phase	1.9, 3, 5	120	20	Yes	1-12	L1
Triart C18 ExRS	-$C_{18}H_{37}$ (high density bonding)			80	25			
Triart C8	-C_8H_{17}			120	17			L7
Triart Phenyl	-$(CH_2)_4$-C$_6$H$_5$				17		1-10	L11
Triart PFP	-$(CH_2)_3$-C$_6$H$_2$F$_5$				15	No	1-8	L43
Triart Bio C4	-C_4H_9			300	-	Yes	1-10	L26
Triart Diol-HILIC	-$CH_2CH(OH)CH_2OH$	HILIC		120	12	No	2-10	L20

*Containing carbon content of hybrid silica base material.

Excellent durability

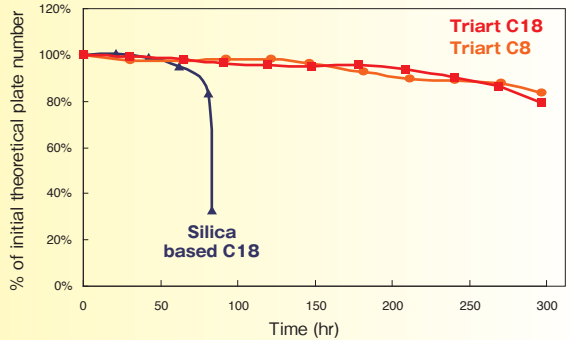
【Durability in high pH】

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

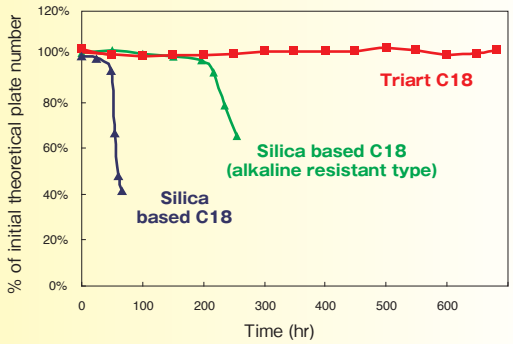
Triethylamine (pH 11.5), 40℃



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

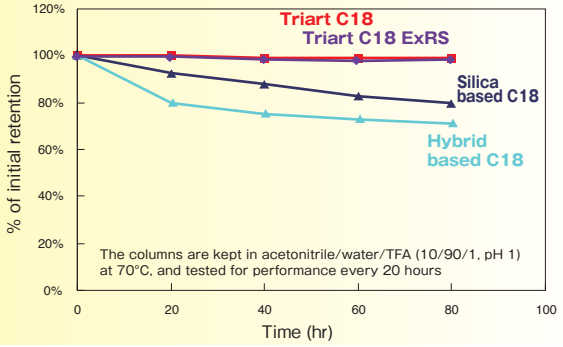
【Durability in high temperature】

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℃

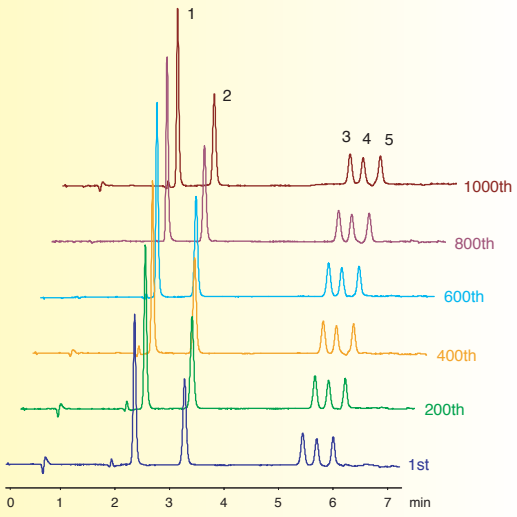


Test conditions	Column	: 5 µm, 50 X 2.0 mmI.D.
	Eluent	: acetonitrile/water (60/40)
	Flow rate	: 0.2 mL/min
	Temperature	: 37℃
	Sample	: butyl benzoate

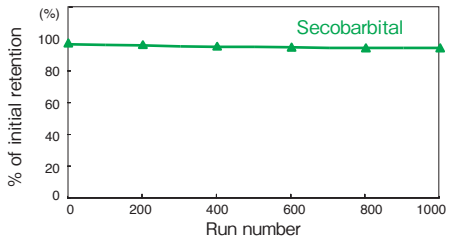
With innovative surface modification on organic hybrid silica, Triart columns show great chemical durability and they can be used over a wide pH range. Even at high-pH or high-temperature conditions, the lifetime of Triart C18, C18 ExRS and C8 is more than 10 times greater than that of conventional C18 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, 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

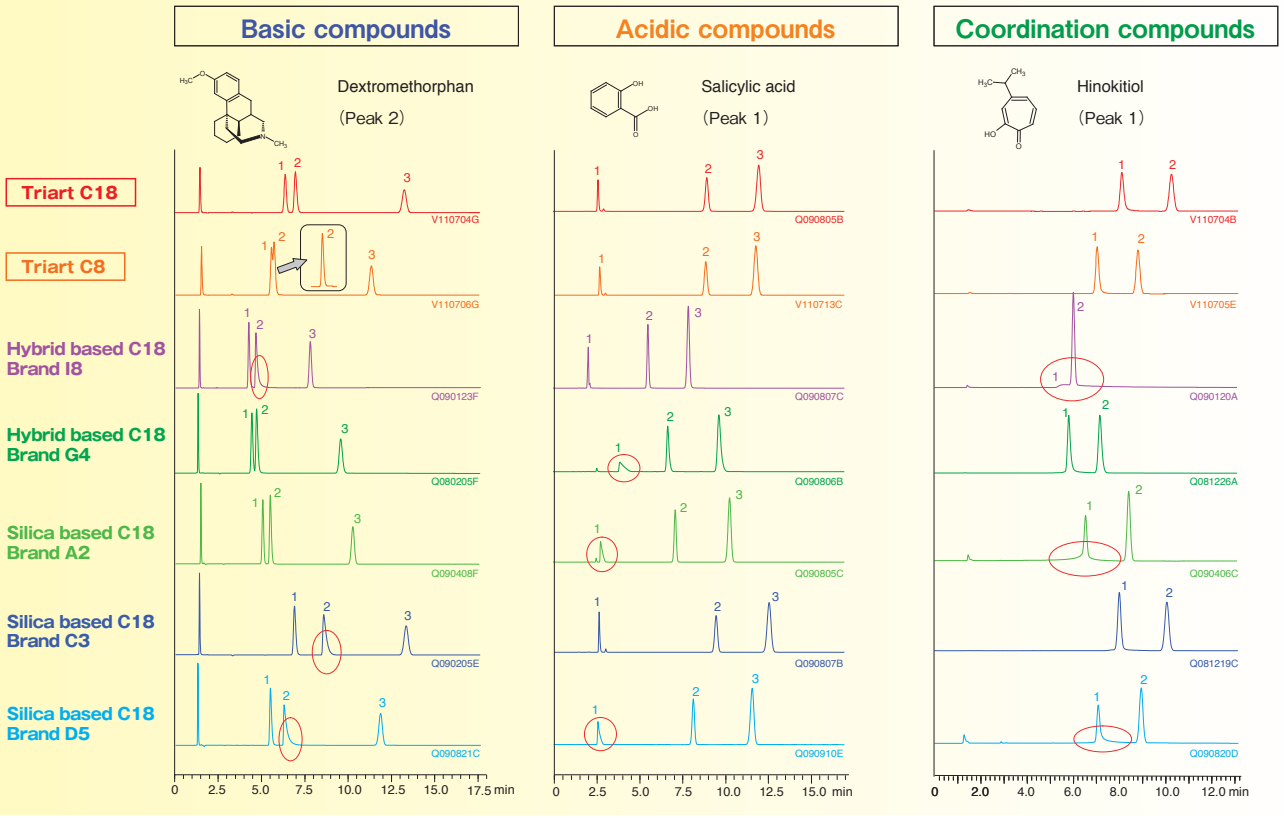


Column	: YMC-Triart C18 5 µm, 50 X 2.0 mmI.D.
Eluent	: A) 20 mM $HCOONH_4$-NH_3 (pH 9.5)
	B) methanol
	0-90%B (0-7 min)
Flow rate	: 0.2 mL/min
Temperature	: 25℃
Detection	: UV at 240 nm
Injection	: 1 µL

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.

Great peak shapes without adsorption/peak tailing

[Comparison of chromatographic behavior]



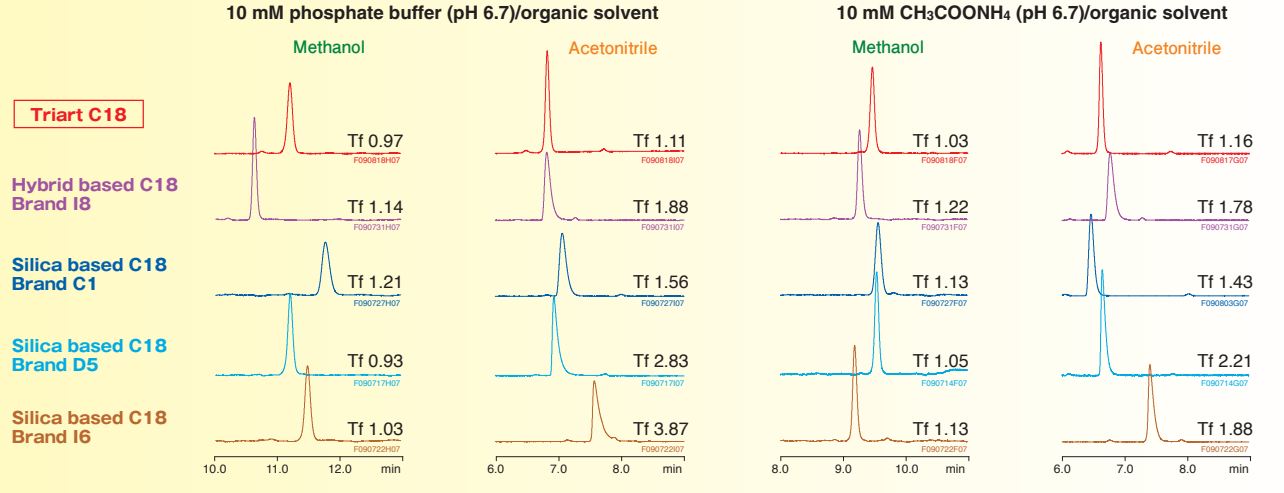
Column	: 5 µm, 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.
Eluent	: 20 mM KH_2PO_4-K_2HPO_4 (pH 6.9)/acetonitrile (65/35)
Flow rate	: 0.425 mL/min for 3.0 mmI.D., 1.0 mL/min for 4.6 mmI.D.
Temperature	: 40℃
Detection	: UV at 235 nm
Sample	: 1. Chlorpheniramine 2. Dextromethorphan 3. Propyl paraben (I.S.)

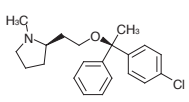
Column	: 5 µm, 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.
Eluent	: 10 mM CH_3COOH-CH_3COONH_4 (pH 4.2)/acetonitrile (75/25)
Flow rate	: 0.425 mL/min for 3.0 mmI.D., 1.0 mL/min for 4.6 mmI.D.
Temperature	: 40℃
Detection	: UV at 254 nm
Sample	: 1. Salicylic acid 2. Methyl paraben (I.S.) 3. Cinnamic acid

Column	: 5 µm, 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.)

Superior peak shapes across various mobile phases

[Peak shape comparison of basic compound]



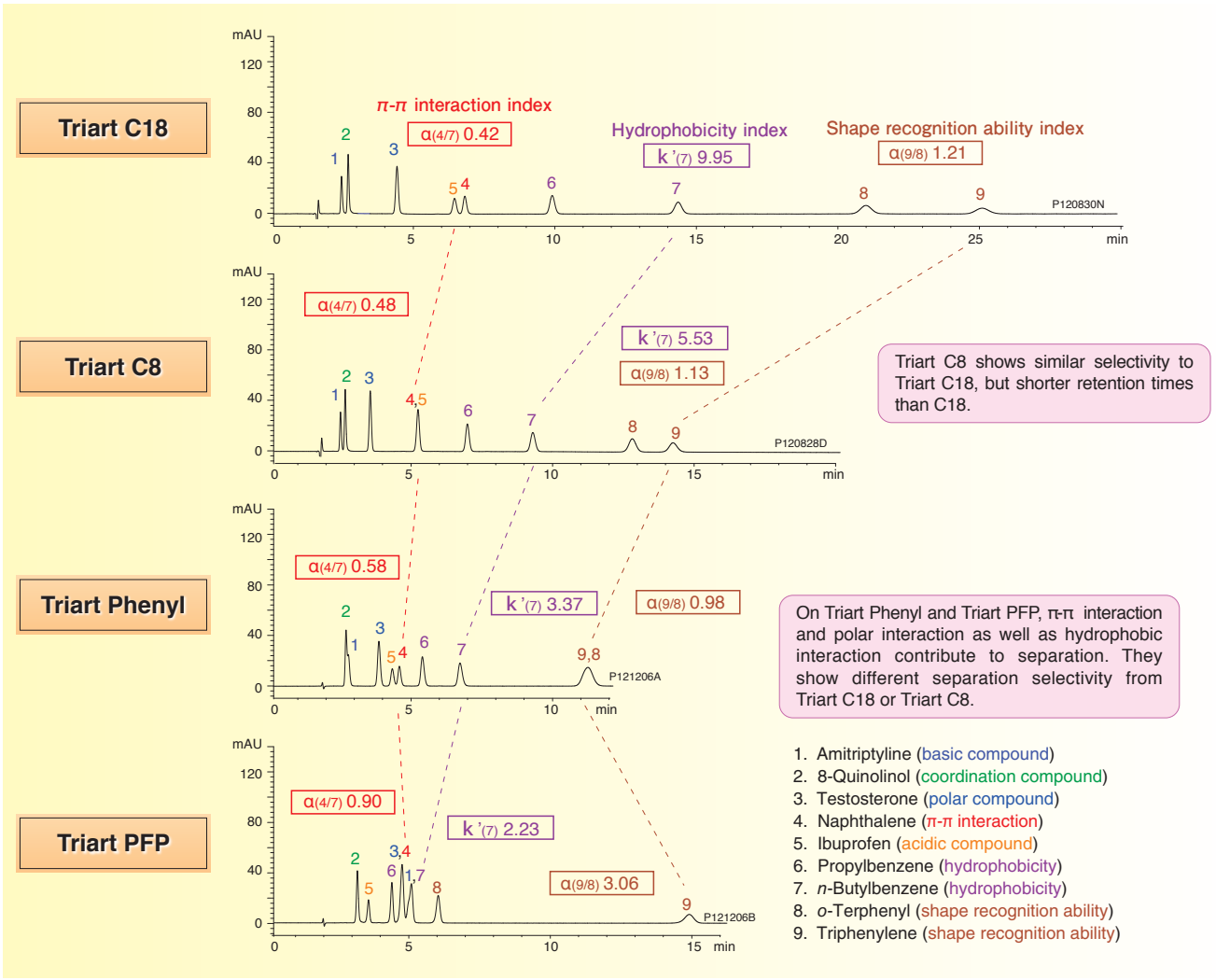


Clemastine

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. Triart C18 can analyze clemastine without any peak deterioration with any kinds of buffer/solvent combinations.

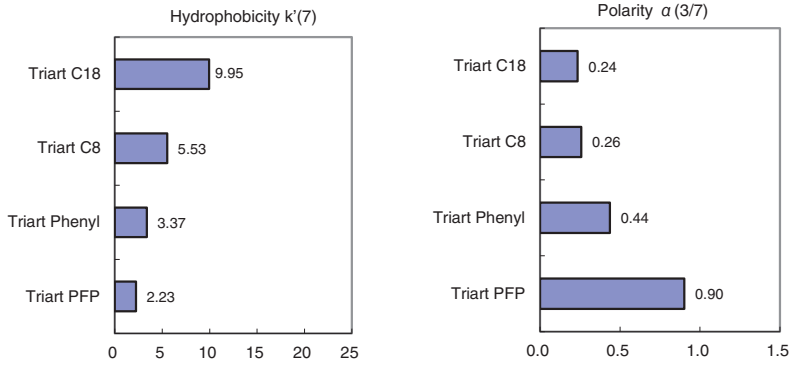
Comparison of separation selectivity among YMC-Triart

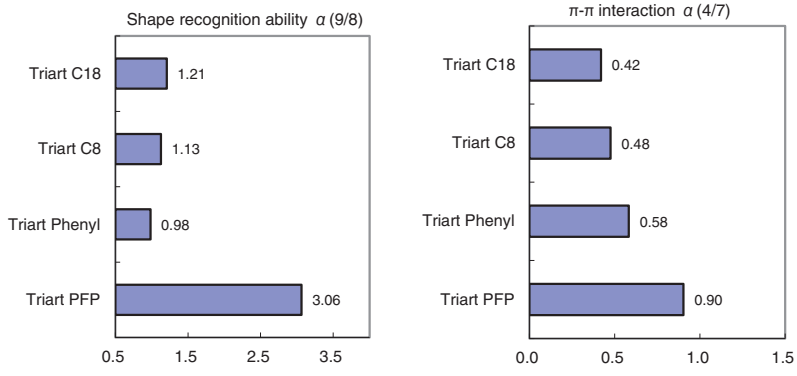


Triart C8 shows similar selectivity to Triart C18, but shorter retention times than C18.

On Triart Phenyl and Triart PFP, π-π interaction and polar interaction as well as hydrophobic interaction contribute to separation. They show different separation selectivity from Triart C18 or Triart C8.

1. Amitriptyline (basic compound)
2. 8-Quinolinol (coordination compound)
3. Testosterone (polar compound)
4. Naphthalene (π-π interaction)
5. Ibuprofen (acidic compound)
6. Propylbenzene (hydrophobicity)
7. *n*-Butylbenzene (hydrophobicity)
8. *o*-Terphenyl (shape recognition ability)
9. Triphenylene (shape recognition ability)



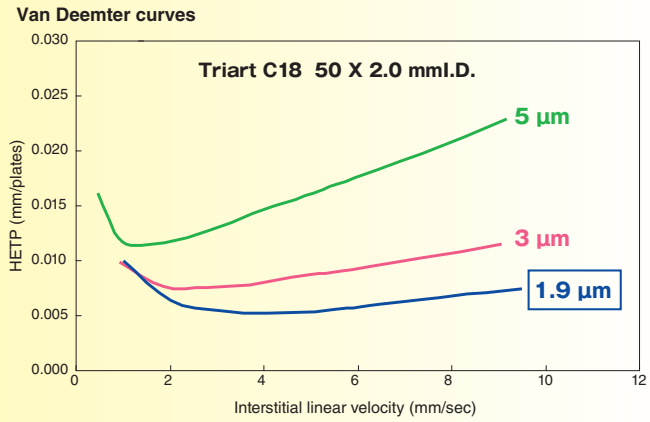


Column	: 5 µm, 150 X 3.0 mmI.D.
Eluent	: 20 mM H_3PO_4-KH_2PO_4 (pH 3.1)/ methanol (25/75)
Flow rate	: 0.425 mL/min
Temperature	: 40℃
Detection	: UV at 265 nm
Injection	: 4 µL

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.

Ideal for UHPLC analysis

【Correlation between linear velocity and column efficiency】

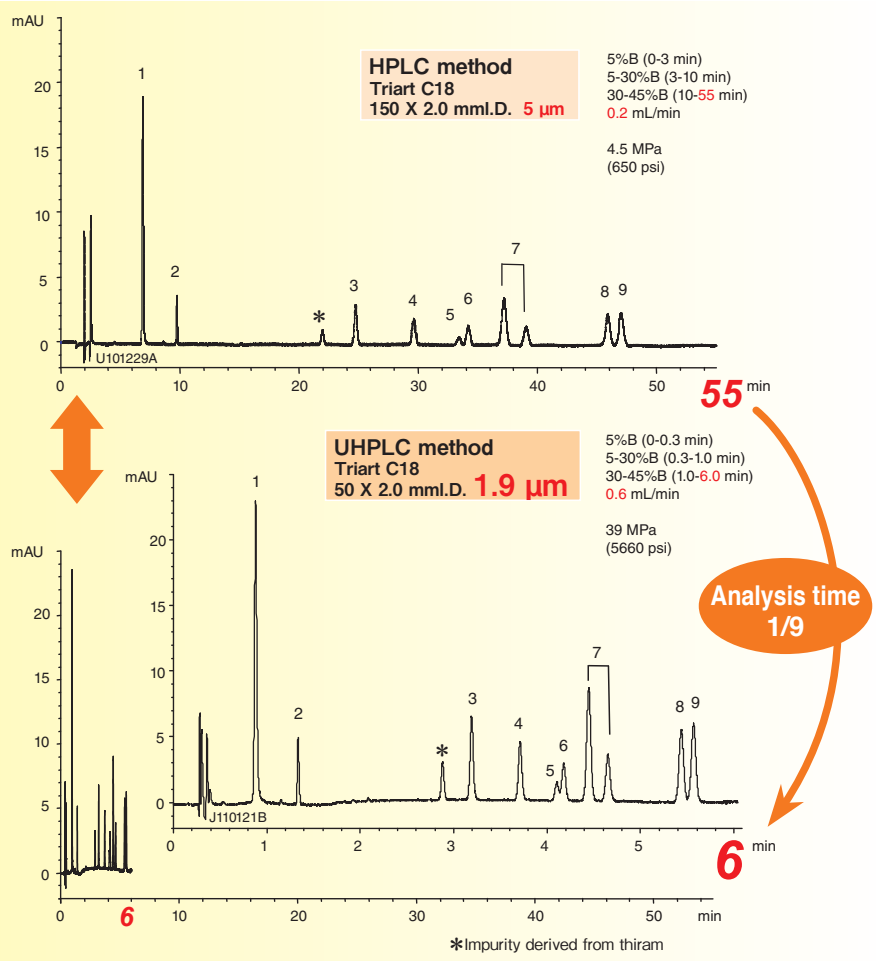


Eluent	: acetonitrile/water (60/40)
Temperature	: 25℃
Sample	: butyl benzoate

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.)

【Method transfer between HPLC and UHPLC】



Agrichemicals

1. Oxine-copper (Copper 8-quinolinolate)
2. Asulam
3. Thiram
4. Triclopyr
5. Mecoprop
6. Flazasulfuron
7. Siduron
8. Halosulfuron-methyl
9. Azoxystrobin

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)

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.

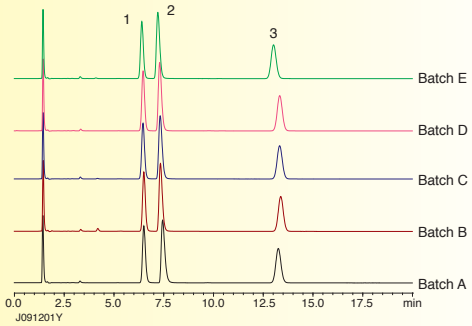
Quality control

【Excellent reproducibility】

Packing material

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

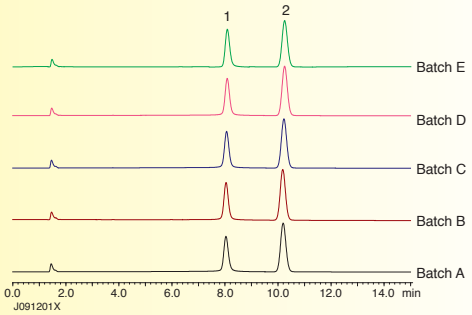
Basic compounds



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

Column	: YMC-Triart C18 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

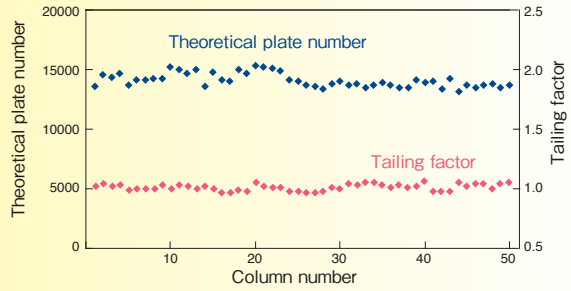


1. Hinokitiol
2. Methyl benzoate (I.S.)

Column	: YMC-Triart C18 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.

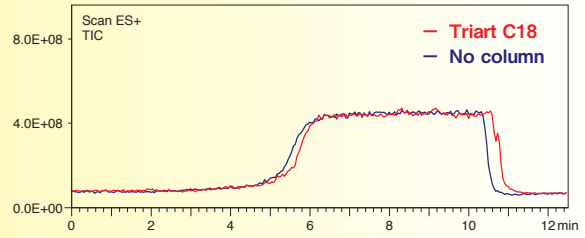


Column	: YMC-Triart C18 5 µm 150 X 4.6 mmI.D.
Eluent	: acetonitrile/water (60/40)
Flow rate	: 1.0 mL/min
Temperature	: ambient
Sample	: butyl benzoate

Effective for high-sensitive analysis using LC/MS

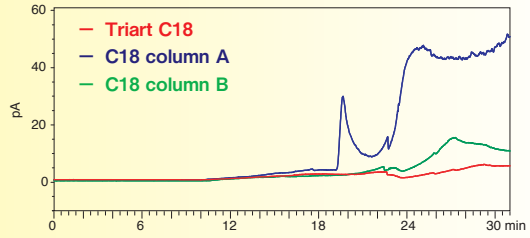
【Low bleeding】

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.

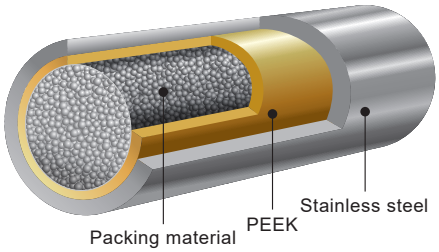
*Corona and CAD are registered trademarks of Thermo Fisher Scientific.

YMC-Triart [Metal free column]

- YMC-Triart materials packed in a “metal free” column hardware that consists of PEEK-lined stainless steel tube and PEEK frit
- Suitable for analysis of coordination compounds
- High pressure tolerance guaranteed

Ideal for high sensitive analysis

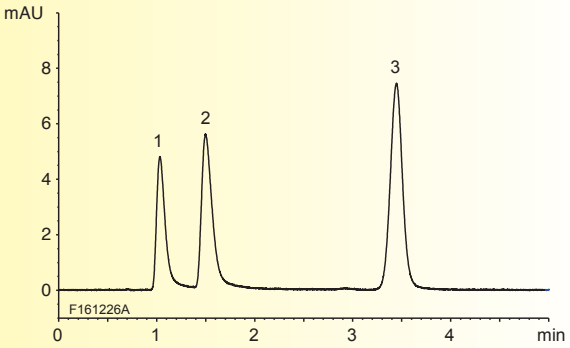
YMC-Triart [Metal free column] consists by a double-layered structure: PEEK-lined inner surface and stainless steel outer tube. YMC-Triart [Metal free column] is suitable for analysis of coordination compounds.



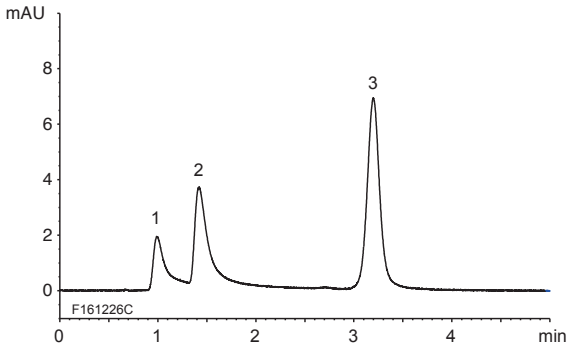
Wetted part (liner)	: PEEK
Outer tube	: Stainless steel
Frit	: PEEK

Improved sensitivity on coordination compounds analysis

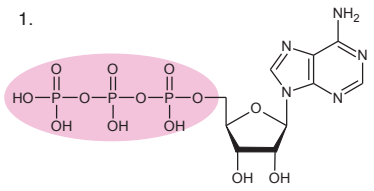
Metal free column



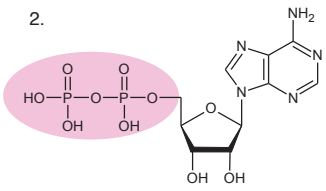
Standard column



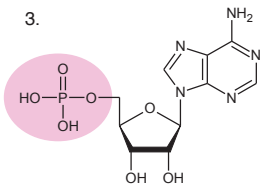
1. ATP



2. ADP



3. AMP



Column	: YMC-Triart C18 (3 µm, 120 Å) 50 X 2.1 mmI.D.
Eluent	: 5 mM $HCOONH_4$
Flow rate	: 0.21 mL/min
Temperature	: 25℃
Detection	: UV at 265 nm
Injection	: 1.0 µL (10 µg/mL)

Metal coordination compounds which have phosphate group in their structure tend to show poor peak shape by interacting with metal, such as stainless steel column. On nucleotides analysis shown above, better peak shape was obtained with the metal free column.
The metal free column is effective for highly-sensitive analysis using LC/MS, as well.

YMC-Triart C18

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

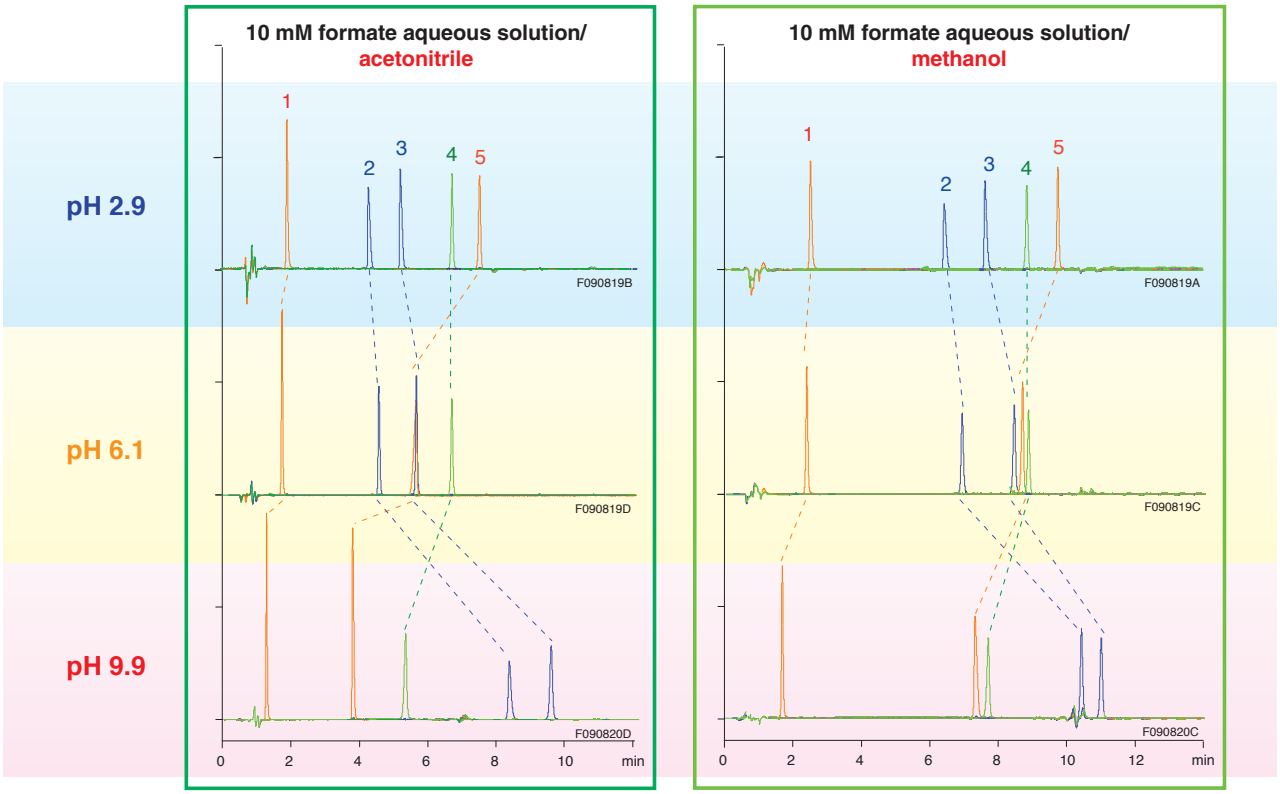
- Pore size : 120 Å
- Carbon content : 20%
- Usable pH range : 1-12
- USP L1

Highly durable column suitable as a first choice

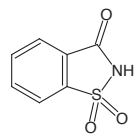
Main features of YMC-Triart C18 are great chemical durability and outstanding peak shape. YMC-Triart C18 can be used under conditions of wide range of pH or high temperature. Preferable balance of surface hydrophobicity and hydrogen bonding capacity are achieved by the optimization of density of C18 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

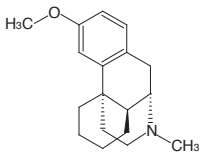
[Efficient mobile phase screening for ionic compounds]



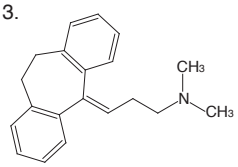
1. Saccharin (Acidic compound) pKa=2.2



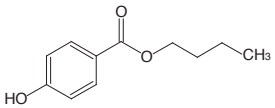
2. Dextromethorphan (Basic compound) pKa=8.3



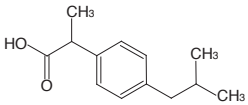
3. Amitriptyline (Basic compound) pKa=9.4



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

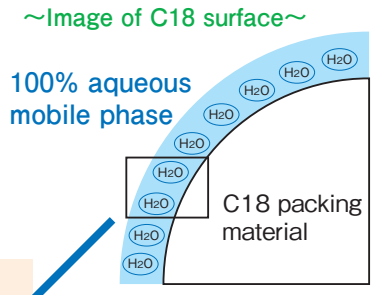
On reversed-phase HPLC, pH and organic solvent are the most important factors to control retention and selectivity. Triart C18 with wide usable pH range offers significant advantage in selection of mobile phase condition. Triart C18 delivers symmetrical peak shapes for all types of compounds. Moreover, 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.

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



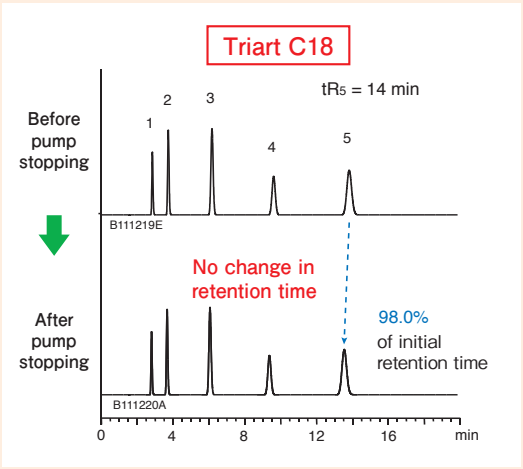
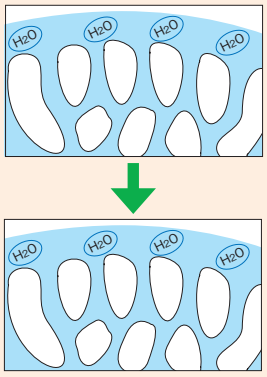


Image of C18 surface hydration



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℃
Detection	: UV at 254 nm

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

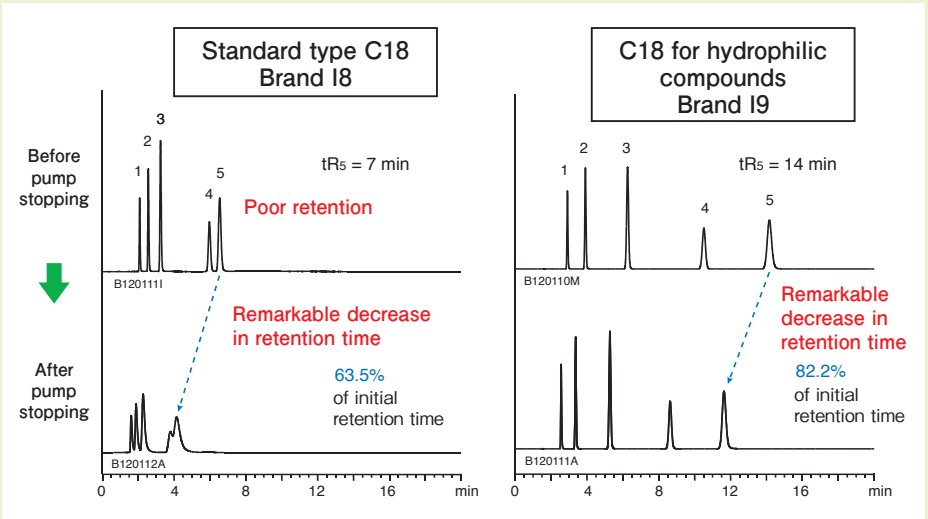
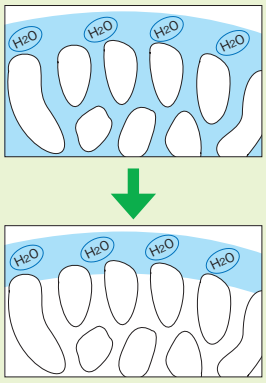


Image of C18 surface hydration



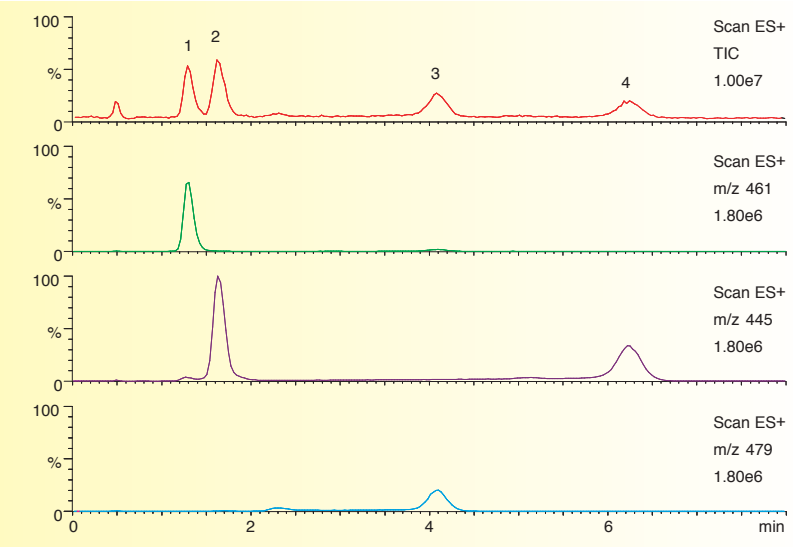
The surface of packing material is not fully hydrated. Compounds are not partitioned between mobile phase and stationary phase, and therefore its retention becomes shorter.

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. There are several C18 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.

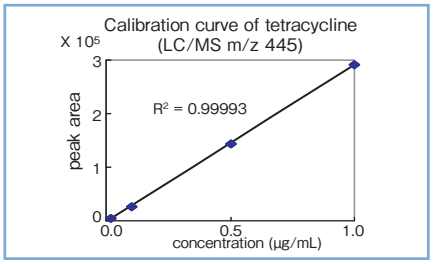
To overcome the shortcomings of classical silica-based columns designed for highly aqueous compatibility, Triart C18 is a highly durable C18 column with trifunctional bonding C18 phase on the organic/inorganic hybrid silica. Triart C18 is designed to retain both moderate hydrogen bonding capacity and 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】



1. Oxytetracycline (MW 460.4)
2. Tetracycline (MW 444.4)
3. Chlortetracycline (MW 478.8)
4. Doxycycline (MW 444.4)



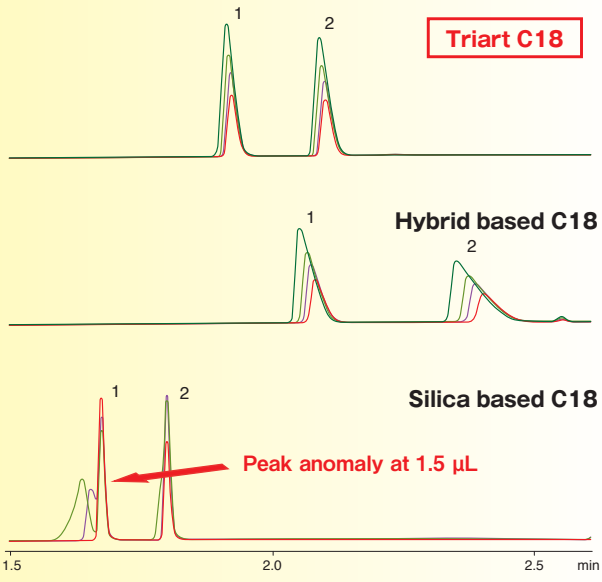
Column	: YMC-Triart C18 5 μm 50 X 2.0 mmI.D.
Eluent	: acetonitrile/water/formic acid (15/85/0.1)
Flow rate	: 0.4 mL/min
Temperature	: 40℃
Detection	: ESI positive mode
Injection	: 10 μL

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.

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)

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 C18 ExRS

- C18 phase with high density bonding on organic/inorganic hybrid silica gel
- Excellent selectivity of isomers and structural analogs
- Superior chemical durability

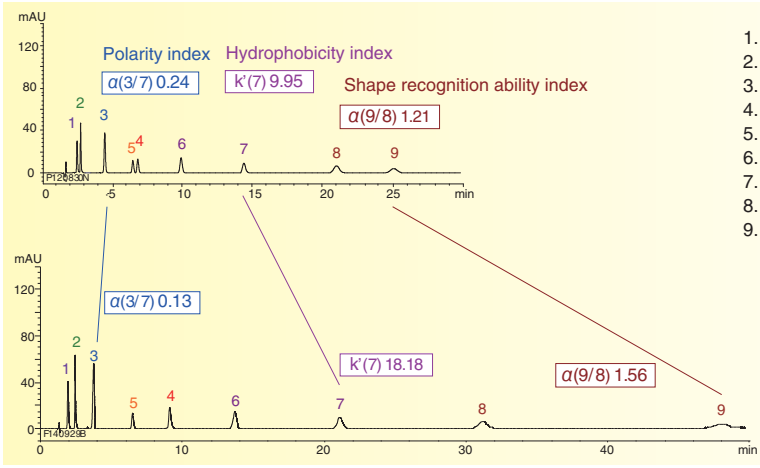
- Pore size : 80 Å
- Carbon content : 25%
- Usable pH range : 1-12
- USP L1

Alternative selectivity to standard C18 columns

YMC-Triart C18 ExRS is C18 phase with high density bonding on organic/inorganic hybrid silica particles. In the case of YMC-Triart C18 ExRS, hydrophobicity is high due to the high carbon loading (25%). This makes YMC-Triart C18 ExRS suitable for use with hydrophobic isomers and structural analogs. Given the superior chemical and physical durability of YMC-Triart C18 ExRS, chromatographers are afforded additional flexibility in choosing separation conditions for both method development and routine column usage.

Comparison of fundamental separation selectivity

Triart C18



Triart C18 ExRS

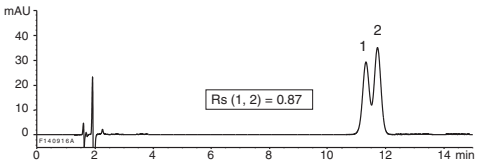
1. Amitriptyline (basic compound)
2. 8-Quinolinol (coordination compound)
3. Testosterone (polar compound)
4. Naphthalene (π-π interaction)
5. Ibuprofen (acidic compound)
6. Propylbenzene (hydrophobicity)
7. *n*-Butylbenzene (hydrophobicity)
8. *o*-Terphenyl (shape recognition ability)
9. Triphenylene (shape recognition ability)

Column	: 5 µm, 150 X 3.0 mmI.D.
Eluent	: 20 mM KH_2PO_4-H_3PO_4 (pH 3.1)/methanol (25/75)
Flow rate	: 0.425 mL/min
Temperature	: 40℃
Detection	: UV at 265 nm
Injection	: 4 µL

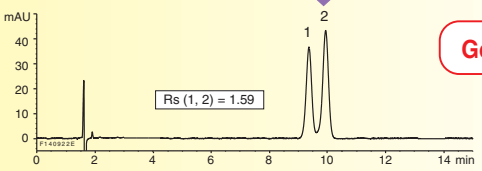
A mixture that consists of compounds with various characteristics is analyzed with Triart C18 and Triart C18 ExRS. Triart C18 ExRS has lower polarity and higher hydrophobicity than the standard Triart C18 column. It also shows improved planar cognitive ability.

Ideal for separations of structural analogs

Triart C18

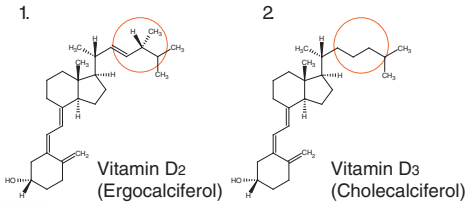


Triart C18 ExRS



Good resolution

Vitamin D_2 / Vitamin D_3

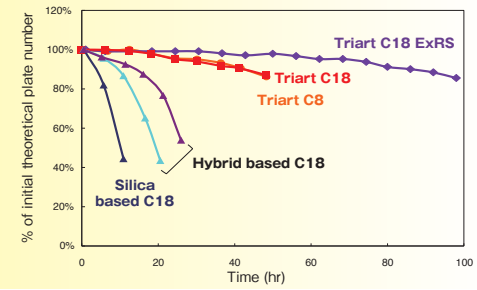


Column	: 5 µm, 150 X 3.0 mmI.D.
Eluent	: THF/acetonitrile (10/90)
Flow rate	: 0.425 mL/min
Temperature	: 30℃
Detection	: UV at 265 nm
Injection	: 4.25 µL (10 µg/mL)

Triart C18 ExRS is effective for separating of structural analogs. This feature is especially useful for separating pharmaceuticals with structurally similar impurities.

Improved durability

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

High density bonding of C18 greatly contributes to improved chemical durability.

YMC-Triart C8

- Alternative to the more widely-used C18
- Usable over wide range of pH and temperature
- Ideal for separations of isomers or structural analogs

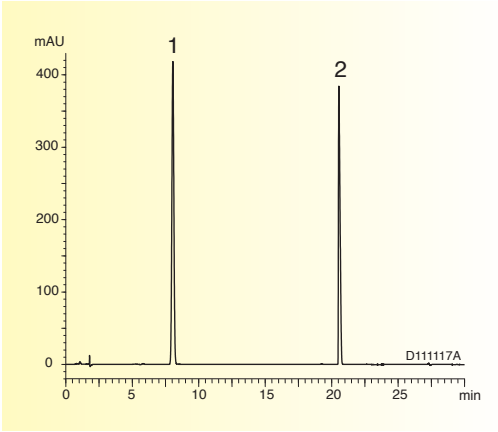
- Pore size : 120 Å
- Carbon content : 17%
- Usable pH range : 1-12
- USP L7

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

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. YMC-Triart C8 is also ideal for the separation of isomers and structural analogs.

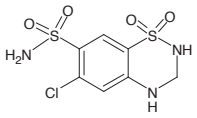
Comparable versatility to C18

【Analysis of drugs】



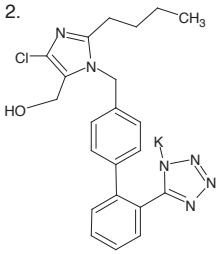
Losartan potassium / hydrochlorothiazide

1.



Hydrochlorothiazide

2.



Losartan potassium

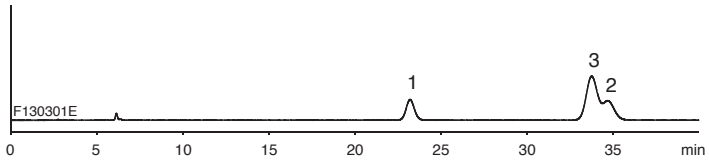
Column	: YMC-Triart C8 5 µm, 150 X 4.0 mmI.D.
Eluent	: A) phosphate buffer (pH 6.7)*/acetonitrile (93/7)
	B) acetonitrile
	0-8%B (0-12 min), 8-62%B (12-28 min)
	** Dissolve 1.25 g of KH_2PO_4 and 2.01 g of $Na_2HPO_4 \cdot 12H_2O$ in 1000 mL of water*
Flow rate	: 1.0 mL/min
Temperature	: 35℃
Detection	: UV at 280 nm
Injection	: 20 µL
(The United States Pharmacopeia 34th; Assay)	

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

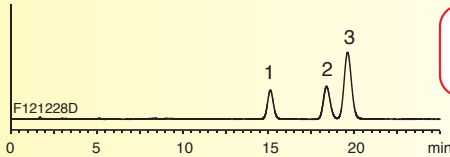
Ideal for separations of isomers or structural analogs

【Separation of positional isomers】

Triart C18



Triart C8



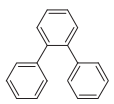
Baseline resolution in shorter analysis time

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.

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

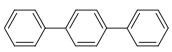
Terphenyl isomers

1.



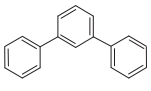
o -Terphenyl

2.



p -Terphenyl

3.



m -Terphenyl

YMC-Triart Phenyl

- 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

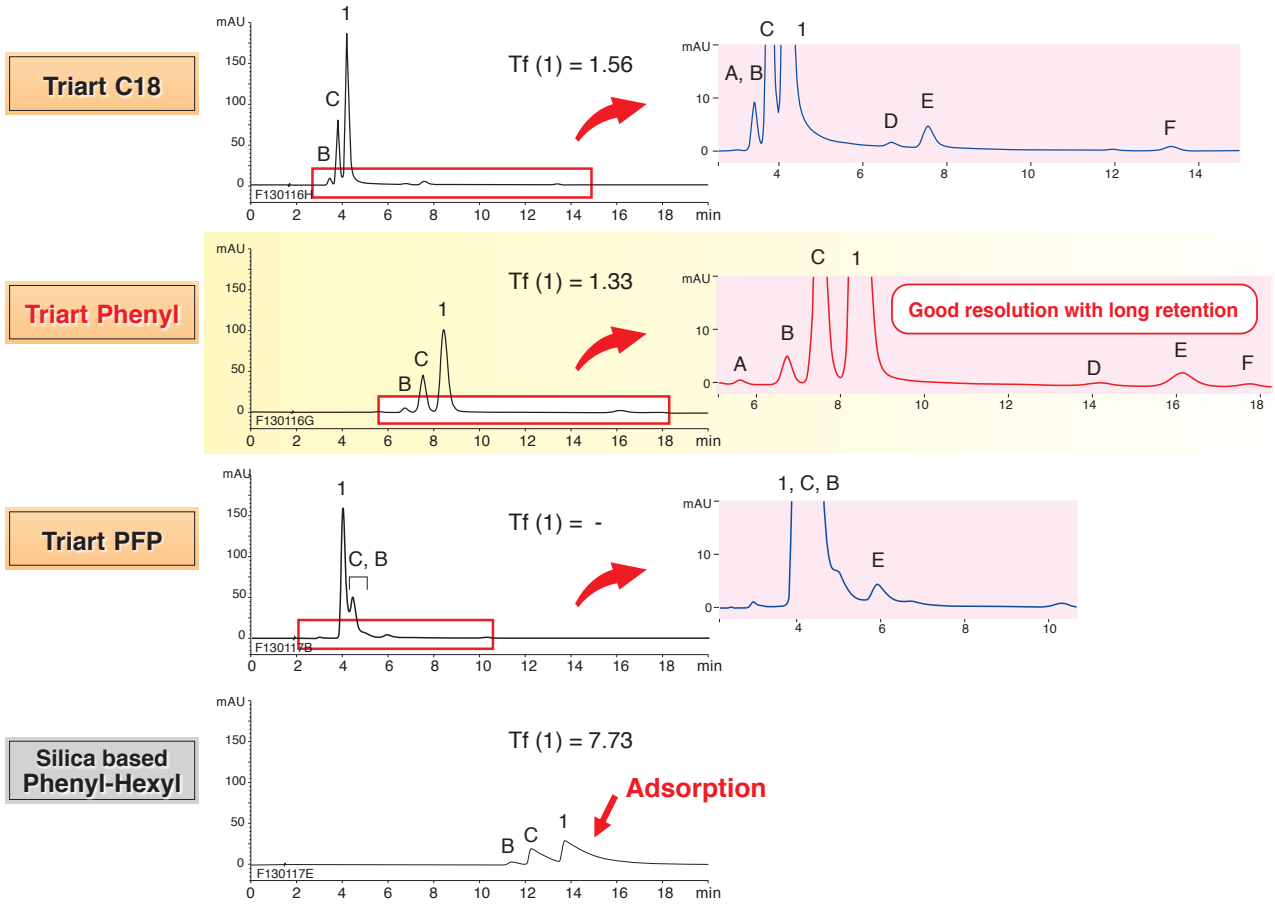
- Pore size : 120 Å
- Carbon content : 17%
- Usable pH range : 1-10
- USP L11

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

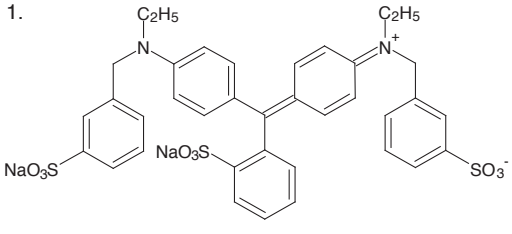
YMC-Triart Phenyl is a phenylbutyl group bonded phase. Well balanced hydrophobic interaction and π-π interaction that is unique to phenyl group has been achieved by optimization of bonded density and spacer chain length (C4). Especially, compounds with aromatic ring or long conjugated system tend to have strong retention. YMC-Triart Phenyl is ideal for separations of such isomers or structural analogs. The surface modification common among YMC-Triart 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]



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	: VIS 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 Triart C18. On the other hand, they are retained well on 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, Triart Phenyl is more suitable than C18 due to strong retention by π-π interaction.

YMC-Triart PFP

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

- Pore size : 120 Å
- Carbon content : 15%
- Usable pH range : 1-8
- USP L43

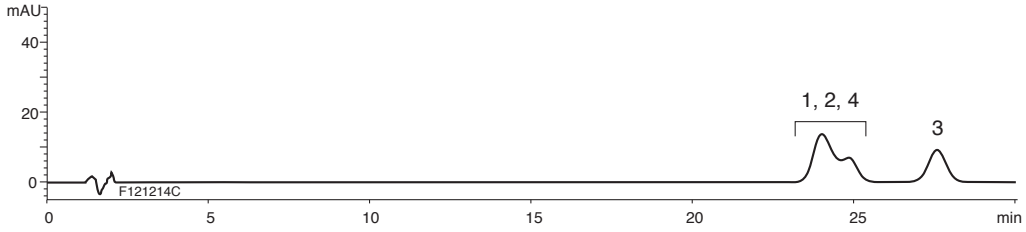
Effective for separation of polar compounds or isomers provided by unique polar interaction

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.

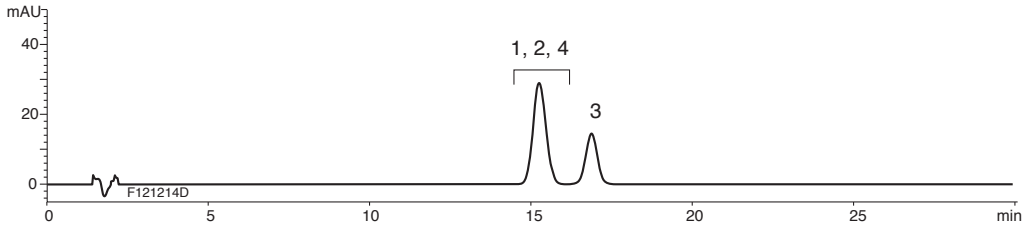
Effective for separation of polar compounds or isomers

【Unique separation provided by various interactions】

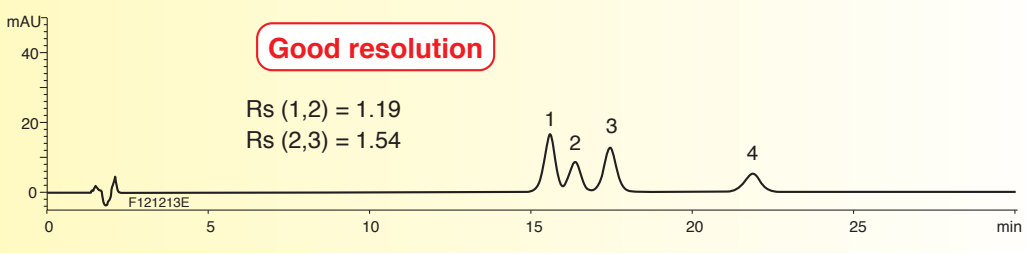
Triart C18



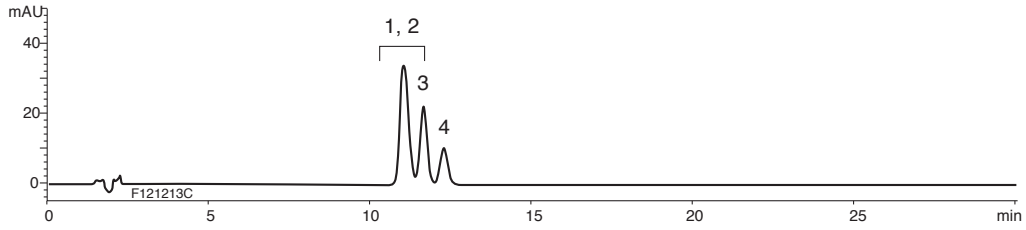
Triart Phenyl



Triart PFP

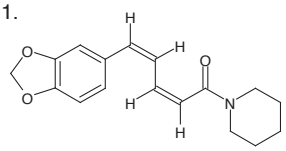


Silica based PFP



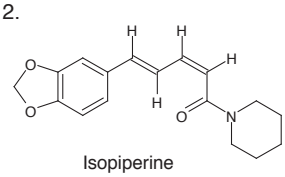
Piperine *cis-trans* isomers

1.



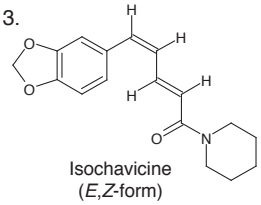
Chavicine
(*Z*,*Z*-form)

2.



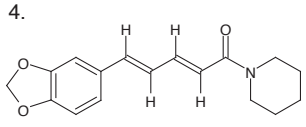
Isopiperine
(*Z*,*E*-form)

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, Triart PFP can work well because 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.

YMC-Triart Bio C4

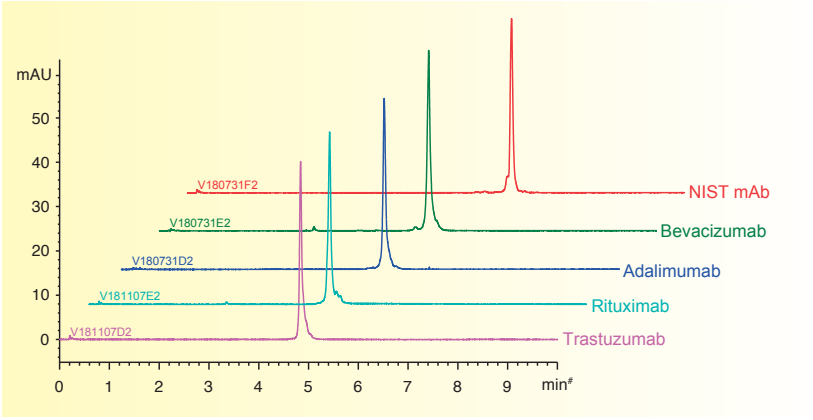
- Wide pore columns with organic/inorganic hybrid silica
- Suitable for separation of biomolecules such as proteins and oligonucleotides
- Useful for separation of intact antibodies under high temperatures
- Good peak shapes with mobile phase suitable for LC/MS

- Pore size : 300 Å
- Usable pH range : 1-10
- USP L26

Effective for separation of biomolecules

YMC-Triart Bio C4 is an organic/inorganic hybrid silica based wide pore column suitable for separation of proteins. YMC-Triart Bio C4 can separate proteins with molecular weight of up to 150,000 such as antibodies under high temperature. YMC-Triart Bio C4 achieves excellent peak shape even when using mobile phase containing formic acid. Therefore it is effective for the high sensitive LC/MS analysis. YMC-Triart Bio C4 is also useful for separation of peptides, oligonucleotides, and small molecules with high hydrophobicity which are difficult to be separated with C18 columns.

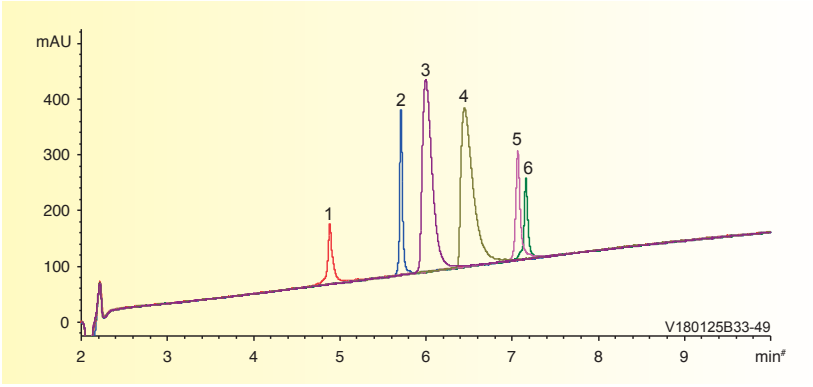
Useful for separation of intact antibodies under high temperature



Column	: YMC-Triart Bio C4 1.9 µm 50 X 2.1 mmI.D.
Eluent	: A) water/TFA (100/0.1) B) acetonitrile/TFA (100/0.1) 25-45%B (0-10 min)
Flow rate	: 0.4 mL/min
Temperature	: 80℃
Detection	: UV at 280 nm
Injection	: 2 µL (0.5 mg/mL)

Triart Bio C4 provides good peak shapes of intact monoclonal antibodies of high molecular weights under high temperature.

Good peak shapes with mobile phase suitable for LC/MS

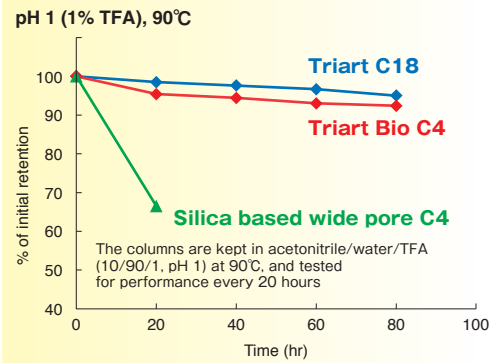


1. Cytochrome *c* (Horse heart)
2. Insulin (Bovine pancreas)
3. Transferrin (Human)
4. BSA
5. β -Lactoglobulin A (Bovine)
6. α -Chymotrypsinogen A (Bovine pancreas)

Column	: YMC-Triart Bio C4 3 µm 150 X 3.0 mmI.D.
Eluent	: A) water/formic acid (100/0.1) B) acetonitrile/formic acid (100/0.1) 10-95%B (0-15 min)
Flow rate	: 0.4 mL/min
Temperature	: 40℃
Detection	: UV at 220 nm

Good peak shapes were obtained when analyzing proteins using Triart Bio C4 even with mobile phase containing formic acid.
The result shows that Triart Bio C4 is ideal for the high sensitive analysis using LC/MS.

Excellent chemical durability



Test conditions	
Column	: 5 µm, 150 X 3.0 mmI.D. for C4 5 µm, 50 X 2.0 mmI.D. for C18
Eluent	: acetonitrile/water (60/40)
Flow rate	: 0.4 mL/min for 3.0 mmI.D. 0.2 mL/min for 2.0 mmI.D.
Temperature	: 37℃
Sample	: butyl benzoate

Generally, improvement of peptide and protein separation is expected under a high temperature condition using a mobile phase containing TFA, although shorter lifetime of conventional columns becomes a problem under such a condition. Since Triart is based on organic/inorganic hybrid particle, which has its innovative surface modification, it keeps excellent durability even under harsh conditions such as 1% TFA and/or 90℃ .

YMC-Triart Diol-HILIC

- Ideal for separations 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

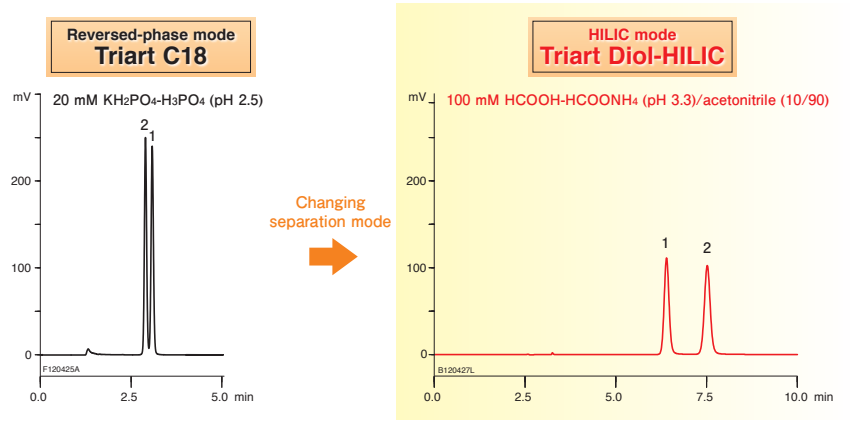
- Pore size : 120 Å
- Carbon content : 12%
- Usable pH range : 2-10
- USP L20

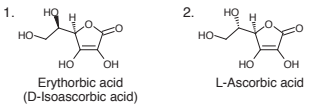
Effective for separation of highly polar compounds

YMC-Triart Diol-HILIC is a HILIC (hydrophilic interaction chromatography) column based on an organic/inorganic hybrid particle synthesized with dihydroxypropyl group. YMC-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. YMC-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】



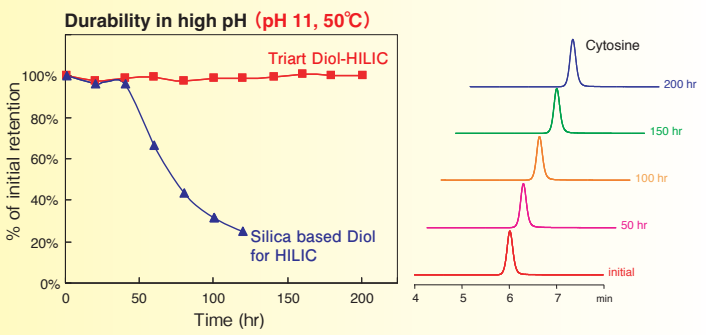


Column	: 5 µm, 150 X 3.0 mmI.D.
Flow rate	: 0.425 mL/min
Temperature	: 40℃
Detection	: UV at 254 nm
Injection	: 4 µL

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】

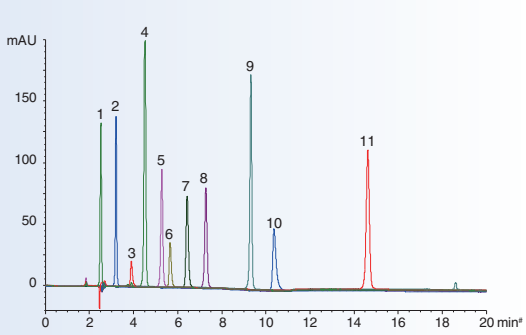


Column	: 5 µm, 150 X 4.6 mmI.D.
Eluent	: acetonitrile/water/NH_3 (90/10/0.1) pH 11.3
Flow rate	: 1.0 mL/min
Temperature	: 50℃
Sample	: cytosine

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

Application

(F121012A)



Water-soluble vitamins

1. Caffeine
2. Nicotinamide
3. Pyridoxine hydrochloride
4. Riboflavin
5. Orotic acid
6. Erythorbic acid (D-Isoascorbic acid)
7. L-Ascorbic acid
8. Nicotinic acid
9. 2-*O*-α-D-Glucopyranosyl-L-ascorbic acid (Ascorbic acid 2-glucoside)
10. Thiamine hydrochloride
11. Cyanocobalamin

Column	: YMC-Triart Diol-HILIC (5 µm, 120 Å), 150 X 3.0 mmI.D.
Eluent	: A) acetonitrile/200 mM HCOOH-$HCOONH_4$ (pH 3.6)/water (90/5/5) B) acetonitrile/200 mM HCOOH-$HCOONH_4$ (pH 3.6)/water (50/5/45) 0-75%B (0-20 min)
Flow rate	: 0.425 mL/min
Temperature	: 40℃
Detection	: UV at 254 nm
Injection	: 4 µL (50 µg/mL)

Ordering Information –Columns–

Pressure limit : 100 MPa for 1.9 µm, 45 MPa for 3 µm and 5 µm; Style of endfitting : Parker style (UPLC compatible)

Particle size (µm)	Column size inner diameter X length (mm)	Triart C18 (120 Å)	Triart C18 ExRS (80 Å)	Triart C8 (120 Å)	Triart Phenyl (120 Å)	Triart PFP (120 Å)	Triart Bio C4 (300 Å)	Triart Diol-HILIC (120 Å)
1.9	2.0 X 20	TA12SP9-0202PT	TAR08SP9-0202PT	TO12SP9-0202PT	TPH12SP9-0202PT	TPF12SP9-0202PT	—	—
	2.0 X 30	TA12SP9-0302PT	TAR08SP9-0302PT	TO12SP9-0302PT	TPH12SP9-0302PT	TPF12SP9-0302PT	—	—
	2.0 X 50	TA12SP9-0502PT	TAR08SP9-0502PT	TO12SP9-0502PT	TPH12SP9-0502PT	TPF12SP9-0502PT	—	TDH12SP9-0502PT
	2.0 X 75	TA12SP9-L502PT	TAR08SP9-L502PT	TO12SP9-L502PT	TPH12SP9-L502PT	TPF12SP9-L502PT	—	TDH12SP9-L502PT
	2.0 X 100	TA12SP9-1002PT	TAR08SP9-1002PT	TO12SP9-1002PT	TPH12SP9-1002PT	TPF12SP9-1002PT	—	TDH12SP9-1002PT
	2.0 X 150	TA12SP9-1502PT	TAR08SP9-1502PT	TO12SP9-1502PT	TPH12SP9-1502PT	TPF12SP9-1502PT	—	—
	2.1 X 20	TA12SP9-02Q1PT	TAR08SP9-02Q1PT	TO12SP9-02Q1PT	TPH12SP9-02Q1PT	TPF12SP9-02Q1PT	TB30SP9-02Q1PT	—
	2.1 X 30	TA12SP9-03Q1PT	TAR08SP9-03Q1PT	TO12SP9-03Q1PT	TPH12SP9-03Q1PT	TPF12SP9-03Q1PT	TB30SP9-03Q1PT	—
	2.1 X 50	TA12SP9-05Q1PT	TAR08SP9-05Q1PT	TO12SP9-05Q1PT	TPH12SP9-05Q1PT	TPF12SP9-05Q1PT	TB30SP9-05Q1PT	TDH12SP9-05Q1PT
	2.1 X 75	TA12SP9-L5Q1PT	TAR08SP9-L5Q1PT	TO12SP9-L5Q1PT	TPH12SP9-L5Q1PT	TPF12SP9-L5Q1PT	TB30SP9-L5Q1PT	TDH12SP9-L5Q1PT
	2.1 X 100	TA12SP9-10Q1PT	TAR08SP9-10Q1PT	TO12SP9-10Q1PT	TPH12SP9-10Q1PT	TPF12SP9-10Q1PT	TB30SP9-10Q1PT	TDH12SP9-10Q1PT
	2.1 X 150	TA12SP9-15Q1PT	TAR08SP9-15Q1PT	TO12SP9-15Q1PT	TPH12SP9-15Q1PT	TPF12SP9-15Q1PT	TB30SP9-15Q1PT	—
	3.0 X 50	TA12SP9-0503PT	TAR08SP9-0503PT	TO12SP9-0503PT	TPH12SP9-0503PT	TPF12SP9-0503PT	TB30SP9-0503PT	TDH12SP9-0503PT
	3.0 X 75	TA12SP9-L503PT	TAR08SP9-L503PT	TO12SP9-L503PT	TPH12SP9-L503PT	TPF12SP9-L503PT	TB30SP9-L503PT	TDH12SP9-L503PT
	3.0 X 100	TA12SP9-1003PT	TAR08SP9-1003PT	TO12SP9-1003PT	TPH12SP9-1003PT	TPF12SP9-1003PT	TB30SP9-1003PT	TDH12SP9-1003PT
	3.0 X 150	TA12SP9-1503PT	TAR08SP9-1503PT	TO12SP9-1503PT	TPH12SP9-1503PT	TPF12SP9-1503PT	TB30SP9-1503PT	—
3	2.1 X 20	TA12S03-02Q1PTH	TAR08S03-02Q1PTH	TO12S03-02Q1PTH	TPH12S03-02Q1PTH	TPF12S03-02Q1PTH	TB30S03-02Q1PTH	TDH12S03-02Q1PTH
	2.1 X 33	TA12S03-H3Q1PTH	TAR08S03-H3Q1PTH	TO12S03-H3Q1PTH	TPH12S03-H3Q1PTH	TPF12S03-H3Q1PTH	TB30S03-H3Q1PTH	TDH12S03-H3Q1PTH
	2.1 X 50	TA12S03-05Q1PTH	TAR08S03-05Q1PTH	TO12S03-05Q1PTH	TPH12S03-05Q1PTH	TPF12S03-05Q1PTH	TB30S03-05Q1PTH	TDH12S03-05Q1PTH
	2.1 X 75	TA12S03-L5Q1PTH	TAR08S03-L5Q1PTH	TO12S03-L5Q1PTH	TPH12S03-L5Q1PTH	TPF12S03-L5Q1PTH	TB30S03-L5Q1PTH	TDH12S03-L5Q1PTH
	2.1 X 100	TA12S03-10Q1PTH	TAR08S03-10Q1PTH	TO12S03-10Q1PTH	TPH12S03-10Q1PTH	TPF12S03-10Q1PTH	TB30S03-10Q1PTH	TDH12S03-10Q1PTH
	2.1 X 150	TA12S03-15Q1PTH	TAR08S03-15Q1PTH	TO12S03-15Q1PTH	TPH12S03-15Q1PTH	TPF12S03-15Q1PTH	TB30S03-15Q1PTH	TDH12S03-15Q1PTH
	3.0 X 50	TA12S03-0503PTH	TAR08S03-0503PTH	TO12S03-0503PTH	TPH12S03-0503PTH	TPF12S03-0503PTH	TB30S03-0503PTH	TDH12S03-0503PTH
	3.0 X 75	TA12S03-L503PTH	TAR08S03-L503PTH	TO12S03-L503PTH	TPH12S03-L503PTH	TPF12S03-L503PTH	TB30S03-L503PTH	TDH12S03-L503PTH
	3.0 X 100	TA12S03-1003PTH	TAR08S03-1003PTH	TO12S03-1003PTH	TPH12S03-1003PTH	TPF12S03-1003PTH	TB30S03-1003PTH	TDH12S03-1003PTH
	3.0 X 150	TA12S03-1503PTH	TAR08S03-1503PTH	TO12S03-1503PTH	TPH12S03-1503PTH	TPF12S03-1503PTH	TB30S03-1503PTH	TDH12S03-1503PTH
	4.6 X 33	TA12S03-H346PTH	TAR08S03-H346PTH	TO12S03-H346PTH	TPH12S03-H346PTH	TPF12S03-H346PTH	TB30S03-H346PTH	TDH12S03-H346PTH
	4.6 X 50	TA12S03-0546PTH	TAR08S03-0546PTH	TO12S03-0546PTH	TPH12S03-0546PTH	TPF12S03-0546PTH	TB30S03-0546PTH	TDH12S03-0546PTH
	4.6 X 75	TA12S03-L546PTH	TAR08S03-L546PTH	TO12S03-L546PTH	TPH12S03-L546PTH	TPF12S03-L546PTH	TB30S03-L546PTH	TDH12S03-L546PTH
	4.6 X 100	TA12S03-1046PTH	TAR08S03-1046PTH	TO12S03-1046PTH	TPH12S03-1046PTH	TPF12S03-1046PTH	TB30S03-1046PTH	TDH12S03-1046PTH
	4.6 X 150	TA12S03-1546PTH	TAR08S03-1546PTH	TO12S03-1546PTH	TPH12S03-1546PTH	TPF12S03-1546PTH	TB30S03-1546PTH	TDH12S03-1546PTH
	4.6 X 250	TA12S03-2546PTH	TAR08S03-2546PTH	TO12S03-2546PTH	TPH12S03-2546PTH	TPF12S03-2546PTH	TB30S03-2546PTH	TDH12S03-2546PTH
5	2.1 X 20	TA12S05-02Q1PTH	TAR08S05-02Q1PTH	TO12S05-02Q1PTH	TPH12S05-02Q1PTH	TPF12S05-02Q1PTH	TB30S05-02Q1PTH	TDH12S05-02Q1PTH
	2.1 X 33	TA12S05-H3Q1PTH	TAR08S05-H3Q1PTH	TO12S05-H3Q1PTH	TPH12S05-H3Q1PTH	TPF12S05-H3Q1PTH	TB30S05-H3Q1PTH	TDH12S05-H3Q1PTH
	2.1 X 50	TA12S05-05Q1PTH	TAR08S05-05Q1PTH	TO12S05-05Q1PTH	TPH12S05-05Q1PTH	TPF12S05-05Q1PTH	TB30S05-05Q1PTH	TDH12S05-05Q1PTH
	2.1 X 75	TA12S05-L5Q1PTH	TAR08S05-L5Q1PTH	TO12S05-L5Q1PTH	TPH12S05-L5Q1PTH	TPF12S05-L5Q1PTH	TB30S05-L5Q1PTH	TDH12S05-L5Q1PTH
	2.1 X 100	TA12S05-10Q1PTH	TAR08S05-10Q1PTH	TO12S05-10Q1PTH	TPH12S05-10Q1PTH	TPF12S05-10Q1PTH	TB30S05-10Q1PTH	TDH12S05-10Q1PTH
	2.1 X 150	TA12S05-15Q1PTH	TAR08S05-15Q1PTH	TO12S05-15Q1PTH	TPH12S05-15Q1PTH	TPF12S05-15Q1PTH	TB30S05-15Q1PTH	TDH12S05-15Q1PTH
	3.0 X 50	TA12S05-0503PTH	TAR08S05-0503PTH	TO12S05-0503PTH	TPH12S05-0503PTH	TPF12S05-0503PTH	TB30S05-0503PTH	TDH12S05-0503PTH
	3.0 X 75	TA12S05-L503PTH	TAR08S05-L503PTH	TO12S05-L503PTH	TPH12S05-L503PTH	TPF12S05-L503PTH	TB30S05-L503PTH	TDH12S05-L503PTH
	3.0 X 100	TA12S05-1003PTH	TAR08S05-1003PTH	TO12S05-1003PTH	TPH12S05-1003PTH	TPF12S05-1003PTH	TB30S05-1003PTH	TDH12S05-1003PTH
	3.0 X 150	TA12S05-1503PTH	TAR08S05-1503PTH	TO12S05-1503PTH	TPH12S05-1503PTH	TPF12S05-1503PTH	TB30S05-1503PTH	TDH12S05-1503PTH
	4.0 X 150	TA12S05-1504PTH	TAR08S05-1504PTH	TO12S05-1504PTH	TPH12S05-1504PTH	TPF12S05-1504PTH	TB30S05-1504PTH	TDH12S05-1504PTH
	4.0 X 250	TA12S05-2504PTH	TAR08S05-2504PTH	TO12S05-2504PTH	TPH12S05-2504PTH	TPF12S05-2504PTH	TB30S05-2504PTH	TDH12S05-2504PTH
	4.6 X 33	TA12S05-H346PTH	TAR08S05-H346PTH	TO12S05-H346PTH	TPH12S05-H346PTH	TPF12S05-H346PTH	TB30S05-H346PTH	TDH12S05-H346PTH
	4.6 X 50	TA12S05-0546PTH	TAR08S05-0546PTH	TO12S05-0546PTH	TPH12S05-0546PTH	TPF12S05-0546PTH	TB30S05-0546PTH	TDH12S05-0546PTH
	4.6 X 75	TA12S05-L546PTH	TAR08S05-L546PTH	TO12S05-L546PTH	TPH12S05-L546PTH	TPF12S05-L546PTH	TB30S05-L546PTH	TDH12S05-L546PTH
	4.6 X 100	TA12S05-1046PTH	TAR08S05-1046PTH	TO12S05-1046PTH	TPH12S05-1046PTH	TPF12S05-1046PTH	TB30S05-1046PTH	TDH12S05-1046PTH
	4.6 X 150	TA12S05-1546PTH	TAR08S05-1546PTH	TO12S05-1546PTH	TPH12S05-1546PTH	TPF12S05-1546PTH	TB30S05-1546PTH	TDH12S05-1546PTH
	4.6 X 250	TA12S05-2546PTH	TAR08S05-2546PTH	TO12S05-2546PTH	TPH12S05-2546PTH	TPF12S05-2546PTH	TB30S05-2546PTH	TDH12S05-2546PTH

∗ See p.114 for preparative columns other than those listed above.

Ordering Information –Columns–

Pressure limit : 10-25 MPa, depending on dimensions; Style of endfitting : Waters (W) style

Particle size (µm)	Column size inner diameter X length (mm)	Triart C18 (120 Å)	Triart C8 (120 Å)	Triart Phenyl (120 Å)	Triart PFP (120 Å)	Triart Diol-HILIC (120 Å)
3	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	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 150	TA12S05-1503WT	TO12S05-1503WT	TPH12S05-1503WT	TPF12S05-1503WT	TDH12S05-1503WT
	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	—

✻ See p.114 for preparative columns other than those listed above.

Ordering Information –Columns–

Metal free columns

Pressure limit : 100 MPa for 1.9 µm, 45 MPa for 3 µm and 5 µm; Style of endfitting : Parker style (UPLC compatible)

Particle size (µm)	Column size inner diameter X length (mm)	Triart C18 (120 Å)	Triart C18 ExRS (80 Å)	Triart C8 (120 Å)	Triart Phenyl (120 Å)	Triart PFP (120 Å)	Triart Bio C4 (300 Å)	Triart Diol-HILIC (120 Å)
1.9	2.1 X 50	TA12SP9-05Q1PTP	TAR08SP9-05Q1PTP	TO12SP9-05Q1PTP	TPH12SP9-05Q1PTP	TPF12SP9-05Q1PTP	TB30SP9-05Q1PTP	TDH12SP9-05Q1PTP
	2.1 X 100	TA12SP9-10Q1PTP	TAR08SP9-10Q1PTP	TO12SP9-10Q1PTP	TPH12SP9-10Q1PTP	TPF12SP9-10Q1PTP	TB30SP9-10Q1PTP	TDH12SP9-10Q1PTP
	2.1 X 150	TA12SP9-15Q1PTP	TAR08SP9-15Q1PTP	TO12SP9-15Q1PTP	TPH12SP9-15Q1PTP	TPF12SP9-15Q1PTP	TB30SP9-15Q1PTP	TDH12SP9-15Q1PTP
3	2.1 X 50	TA12S03-05Q1PTP	TAR08S03-05Q1PTP	TO12S03-05Q1PTP	TPH12S03-05Q1PTP	TPF12S03-05Q1PTP	TB30S03-05Q1PTP	TDH12S03-05Q1PTP
	2.1 X 100	TA12S03-10Q1PTP	TAR08S03-10Q1PTP	TO12S03-10Q1PTP	TPH12S03-10Q1PTP	TPF12S03-10Q1PTP	TB30S03-10Q1PTP	TDH12S03-10Q1PTP
	2.1 X 150	TA12S03-15Q1PTP	TAR08S03-15Q1PTP	TO12S03-15Q1PTP	TPH12S03-15Q1PTP	TPF12S03-15Q1PTP	TB30S03-15Q1PTP	TDH12S03-15Q1PTP
	4.6 X 50	TA12S03-0546PTP	TAR08S03-0546PTP	TO12S03-0546PTP	TPH12S03-0546PTP	TPF12S03-0546PTP	TB30S03-0546PTP	TDH12S03-0546PTP
	4.6 X 100	TA12S03-1046PTP	TAR08S03-1046PTP	TO12S03-1046PTP	TPH12S03-1046PTP	TPF12S03-1046PTP	TB30S03-1046PTP	TDH12S03-1046PTP
	4.6 X 150	TA12S03-1546PTP	TAR08S03-1546PTP	TO12S03-1546PTP	TPH12S03-1546PTP	TPF12S03-1546PTP	TB30S03-1546PTP	TDH12S03-1546PTP
5	2.1 X 50	TA12S05-05Q1PTP	TAR08S05-05Q1PTP	TO12S05-05Q1PTP	TPH12S05-05Q1PTP	TPF12S05-05Q1PTP	TB30S05-05Q1PTP	TDH12S05-05Q1PTP
	2.1 X 100	TA12S05-10Q1PTP	TAR08S05-10Q1PTP	TO12S05-10Q1PTP	TPH12S05-10Q1PTP	TPF12S05-10Q1PTP	TB30S05-10Q1PTP	TDH12S05-10Q1PTP
	2.1 X 150	TA12S05-15Q1PTP	TAR08S05-15Q1PTP	TO12S05-15Q1PTP	TPH12S05-15Q1PTP	TPF12S05-15Q1PTP	TB30S05-15Q1PTP	TDH12S05-15Q1PTP
	4.6 X 50	TA12S05-0546PTP	TAR08S05-0546PTP	TO12S05-0546PTP	TPH12S05-0546PTP	TPF12S05-0546PTP	TB30S05-0546PTP	TDH12S05-0546PTP
	4.6 X 100	TA12S05-1046PTP	TAR08S05-1046PTP	TO12S05-1046PTP	TPH12S05-1046PTP	TPF12S05-1046PTP	TB30S05-1046PTP	TDH12S05-1046PTP
	4.6 X 150	TA12S05-1546PTP	TAR08S05-1546PTP	TO12S05-1546PTP	TPH12S05-1546PTP	TPF12S05-1546PTP	TB30S05-1546PTP	TDH12S05-1546PTP

Ordering Information –Guard Cartridge Columns–

EXP®Guard Cartridge Columns (3/pack)

Particle size (µm)	Column size inner diameter X length (mm)	Triart C18 (120 Å)	Triart C18 ExRS (80 Å)	Triart C8 (120 Å)	Triart Phenyl (120 Å)	Triart PFP (120 Å)	Triart Bio C4 (300 Å)
1.9	2.1 X 5	TA12SP9-E5Q1CC	TAR08SP9-E5Q1CC	TO12SP9-E5Q1CC	TPH12SP9-E5Q1CC	TPF12SP9-E5Q1CC	TB30SP9-E5Q1CC
	3.0 X 5	TA12SP9-E503CC	TAR08SP9-E503CC	TO12SP9-E503CC	TPH12SP9-E503CC	TPF12SP9-E503CC	TB30SP9-E503CC

*EXP®Guard cartridge holder required, part no. XPCHUHP.
*EXP is registered trademark of Optimize Technologies, Inc.

Guard Cartridge Columns

Particle size (µm)	Column size inner diameter X length (mm)	/pack	Triart C18 (120 Å)	Triart C18 ExRS (80 Å)	Triart C8 (120 Å)	Triart Phenyl (120 Å)	Triart PFP (120 Å)	Triart Bio C4 (300 Å)	Triart Diol-HILIC (120 Å)
3	2.1 X 10	5	TA12S03-01Q1GC	TAR08S03-01Q1GC	TO12S03-01Q1GC	TPH12S03-01Q1GC	TPF12S03-01Q1GC	TB30S03-01Q1GC	TDH12S03-01Q1GC
	3.0 X 10		TA12S03-0103GC	TAR08S03-0103GC	TO12S03-0103GC	TPH12S03-0103GC	TPF12S03-0103GC	TB30S03-0103GC	TDH12S03-0103GC
	4.0 X 10		TA12S03-0104GC	TAR08S03-0104GC	TO12S03-0104GC	TPH12S03-0104GC	TPF12S03-0104GC	TB30S03-0104GC	TDH12S03-0104GC
5	2.1 X 10	5	TA12S05-01Q1GC	TAR08S05-01Q1GC	TO12S05-01Q1GC	TPH12S05-01Q1GC	TPF12S05-01Q1GC	TB30S05-01Q1GC	TDH12S05-01Q1GC
	3.0 X 10		TA12S05-0103GC	TAR08S05-0103GC	TO12S05-0103GC	TPH12S05-0103GC	TPF12S05-0103GC	TB30S05-0103GC	TDH12S05-0103GC
	4.0 X 10		TA12S05-0104GC	TAR08S05-0104GC	TO12S05-0104GC	TPH12S05-0104GC	TPF12S05-0104GC	TB30S05-0104GC	TDH12S05-0104GC
	10 X 10	2	TA12S05-0110CC	TAR08S05-0110CC	TO12S05-0110CC	TPH12S05-0110CC	TPF12S05-0110CC	TB30S05-0110CC	—

*Guard cartridge holder required, part no. XPGCH-Q1 for 2.1-4.0 mmI.D. and XPCHSPW1 for 10 mmI.D.