

# YMC-Triart C18

Versatile Hybrid Silica Based HPLC Column



## Specifications

Base	: organic/inorganic hybrid silica	Carbon %	: 20 %
Stationary	: C18 (as USP-L1)	Bonding	: polymeric type
Particle	: 3 $\mu$ m, 5 $\mu$ m	End-capping	: multi-stage end-capping
Pore	: 12 nm	pH range	: pH 1 ~ 12

Versatile Hybrid Silica Based HPLC Column

# YMC-Triart C18

**Rugged, long lasting, hybrid particle technology**  
**Integration of triple artistic technologies**

Feature	Benefit
• Hybrid silica base	▶ Usable over a wide pH range makes the column excellent for method development.
• Great chemical durability	▶ Long column lifetime over wide pH range. Low cost per analysis.
• Lower back pressure	▶ Ability to use on both older and newer instrumentation.
• Excellent resolution	▶ Rugged, first choice option for analysis of acids, bases and neutral compounds.

Particle  
synthesis by  
Microreaction

Versatile  
hybrid silica  
material

Multistage  
endcapping

## YMC-Triart C18

### Integration of Three Technologies

YMC-Triart is a hybrid silica based ODS column emphasizing durability, low operating pressure, and excellent performance.

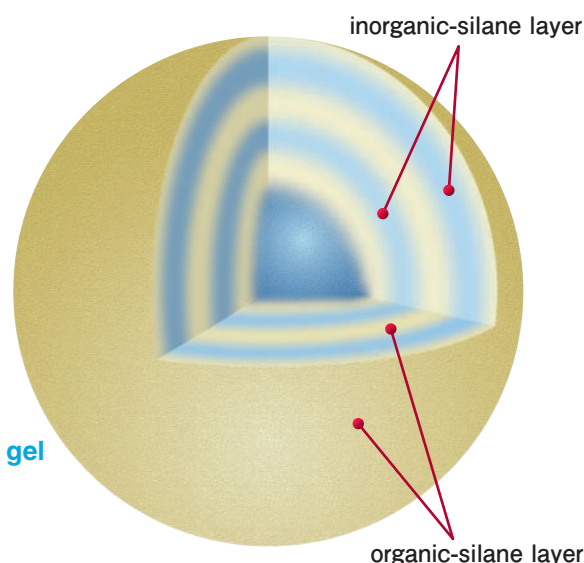
YMC-Triart C18 has been developed and is manufactured using state-of-the-art technologies that define materials, granulation and surface modification.

#### Versatile hybrid material

1

YMC-Triart C18 is a multi-layer hybrid particle consisting of two types of layers: a silica based layer (inorganic) and a hybrid polymer based layer (organic). This layered structure contributes to Triart's combined physical durability and chromatographic performance.

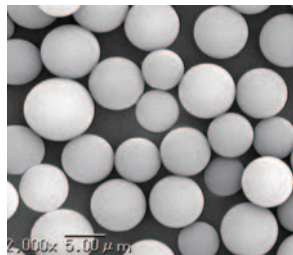
Image structure  
for hybrid-silica gel



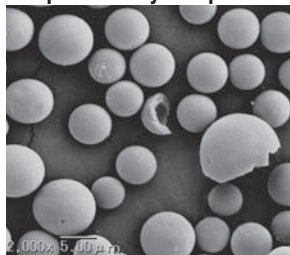
## New granulation process by microreactor technology

### Homogeneous and uniform particle

Triart C18

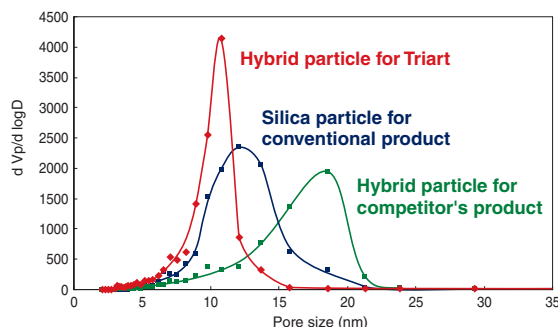


Competitor's hybrid particle



Use of microreactor technology produces homogeneous and uniform particles that results in low operating pressure and very reproducible surface modification making for the ultimate in column to column and lot to lot reproducibility.

### Narrow pore distribution



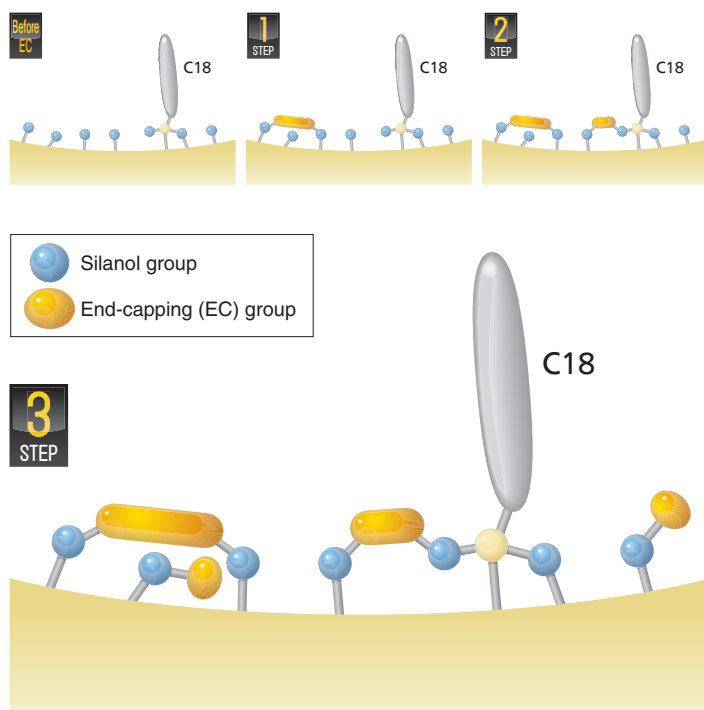
YMC-Triart C18 has a very narrow pore size distribution that enables narrow and reproducible peak shapes for analytes.

## Surface modification technology

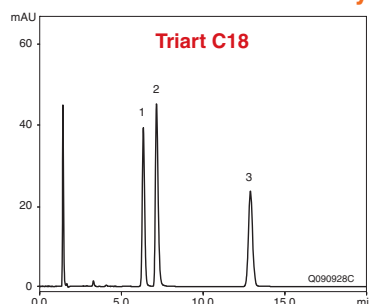
### Multi-stage end-capping

End-capping methods employed for production of conventional products typically employ a single end-capping compound in one chemical step to "neutralize" highly reactive silanols. Unfortunately, highly reactive silanols are easily hydrolyzed and contribute to poor durability. Additionally, low reactive silanols end-cap stubbornly, producing a surface modification that is often non-reproducible, and leading to peak tailing. YMC-Triart C18 solves this problem by using an innovative, newly developed "measured multi-stage/multi-compound surface modification" technology which results in the thorough end-capping of all silanols that are accessible to analytes.

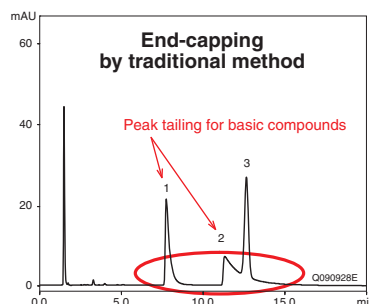
### Reaction image for "multi-stage end-capping"



### Evaluation of silanol activity



Ingredients in cough/  
cold medication  
1. Chlorpheniramine  
2. Dextromethorphan  
3. Propyl *p*-hydroxybenzoate



Column : 5  $\mu$ m, 150 X 3.0 mm I.D.  
Eluent : 20 mM  $\text{KH}_2\text{PO}_4$ - $\text{K}_2\text{HPO}_4$  (pH 6.9)/acetonitrile (65/35)  
Flow rate : 0.425 mL/min  
Temperature : 40°C  
Detection : UV at 235 nm

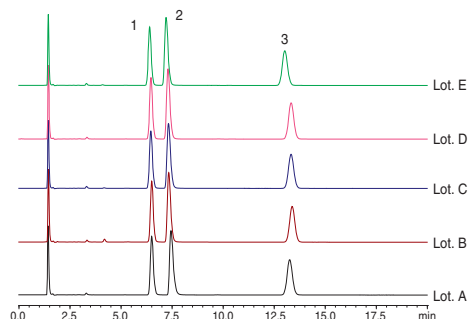
# Quality Control

Excellent reproducibility

## Packing Material

YMC-Triart C18 exhibits excellent lot to lot reproducibility for all types of compounds including difficult to chromatograph molecules that exhibit basic and coordination compound behavior.

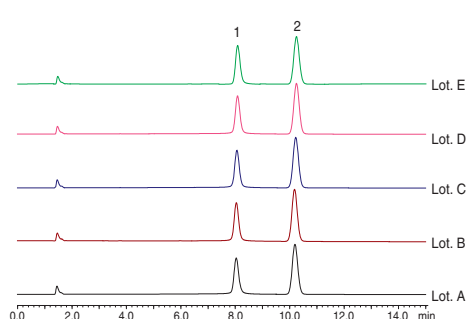
### Basic compounds



1. Chlorpheniramine
2. Dextromethorphan
3. Propyl *p*-hydroxybenzoate

Column : 5  $\mu$ m, 150 X 3.0 mmI.D.  
Eluent : 20 mM  $\text{KH}_2\text{PO}_4$ - $\text{K}_2\text{HPO}_4$  (pH 6.9)/acetonitrile (65/35)  
Flow rate : 0.425 mL/min  
Temperature : 40°C  
Detection : UV at 235 nm

### Coordination compounds

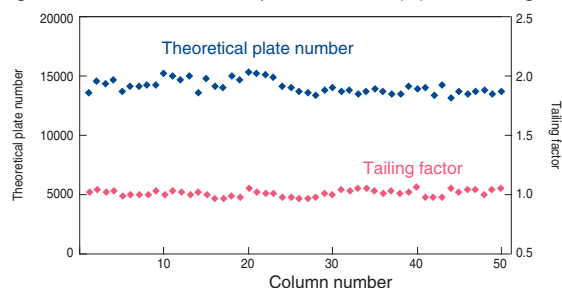


1. Hinokitiol
2. Methyl benzoate

Column : 5  $\mu$ m, 150 X 3.0 mmI.D.  
Eluent : acetonitrile/0.1%  $\text{H}_3\text{PO}_4$  (40/60)  
Flow rate : 0.425 mL/min  
Temperature : 40°C  
Detection : UV at 254 nm

## Packed Column

Rigid control of theoretical plate number (N) and tailing factor (Tf) are exhibited for each YMC-Triart C18 packed column.

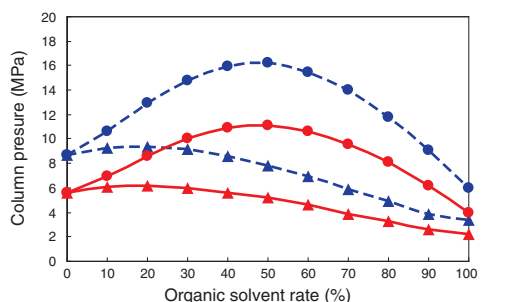


Column : 5  $\mu$ m, 150 X 4.6 mmI.D.  
Eluent : acetonitrile/water (60/40)  
Flow rate : 1.0 mL/min  
Temperature : ambient  
Sample : butyl benzoate

## Low back-pressure

Free from pressure problem

### Column pressure and solvents



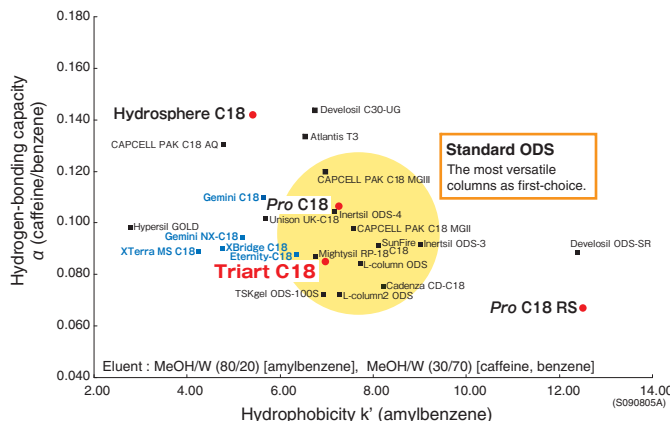
Column : 5  $\mu$ m, 150 X 4.6 mmI.D.  
Eluent : acetonitrile/water or methanol/water  
Flow rate : 1.0 mL/min  
Temperature : 25°C

YMC-Triart C18 is designed for use in all conditions. Even with higher viscous methanol, YMC-Triart C18 can operate with lower pressure (typically 30% less than conventional columns).

## Standard ODS

Best balance between  $\alpha$  and  $k'$

### Comparison of $\alpha/k'$ of columns in market



Conventional hybrid silica based ODS columns tend to be less hydrophobic than silica based columns. YMC-Triart C18 has a favorable carbon balance and may be used as a "versatile first-choice" method development column.

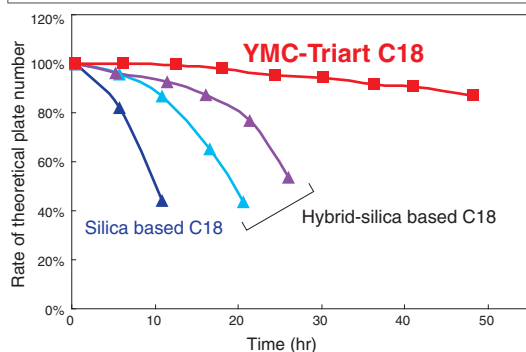


## Great durability

Wide pH range and long lifetime

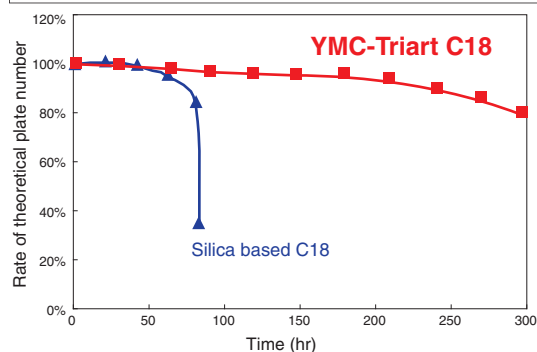
### Durability in high pH

#### Phosphate buffer (pH 11.5, 40 °C)



Column : 5  $\mu$ m, 150 X 4.6 mm.I.D.  
Eluent : 50 mM  $K_2HPO_4$ - $K_3PO_4$  (pH 11.5)/methanol (90/10)  
Flow rate : 1.0 mL/min  
Temperature : 40°C  
Sample : benzyl alcohol

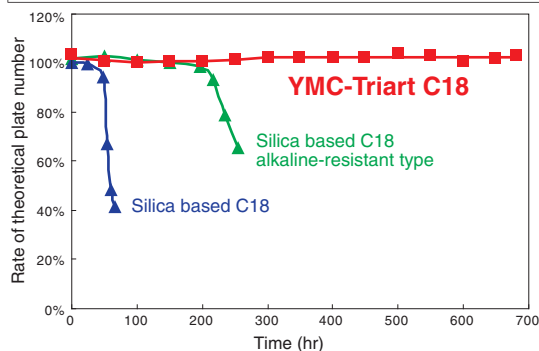
#### Triethylamine (pH 11.5, 40 °C)



Column : 5  $\mu$ m, 150 X 4.6 mm.I.D.  
Eluent : 50 mM triethylamine (pH 11.5)/methanol (90/10)  
Flow rate : 1.0 mL/min  
Temperature : 40°C  
Sample : benzyl alcohol

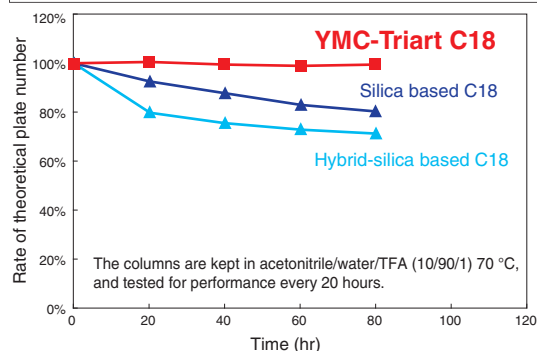
### Durability in high temperature

#### pH 6.9, 70 °C



Column : 5  $\mu$ m, 50 X 2.0 mm.I.D.  
Eluent : 20 mM  $KH_2PO_4$ - $K_2HPO_4$  (pH 6.9)/acetonitrile (90/10)  
Flow rate : 0.2 mL/min  
Temperature : 70°C  
Sample : phenol

#### pH 1, 70 °C



The columns are kept in acetonitrile/water/TFA (10/90/1) 70 °C, and tested for performance every 20 hours.

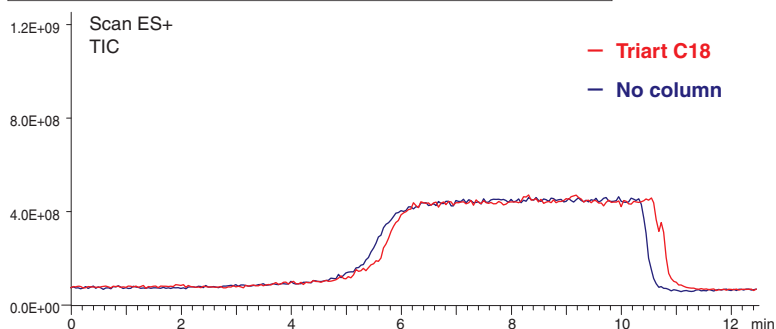
Test conditions Column : 5  $\mu$ m, 50 X 2.0 mm.I.D.  
Eluent : acetonitrile/water (60/40)  
Flow rate : 0.2 mL/min  
Temperature : 37°C  
Sample : butyl benzoate

YMC-Triart C18 shows great chemical stability provided by newly developed hybrid silica. Even in high pH or high temperature conditions, the lifetime of YMC-Triart C18 is more than 10X greater than conventional ODS columns.

## Reduced column bleed

Operate at high sensitivity

### Bleed test by LC/MS



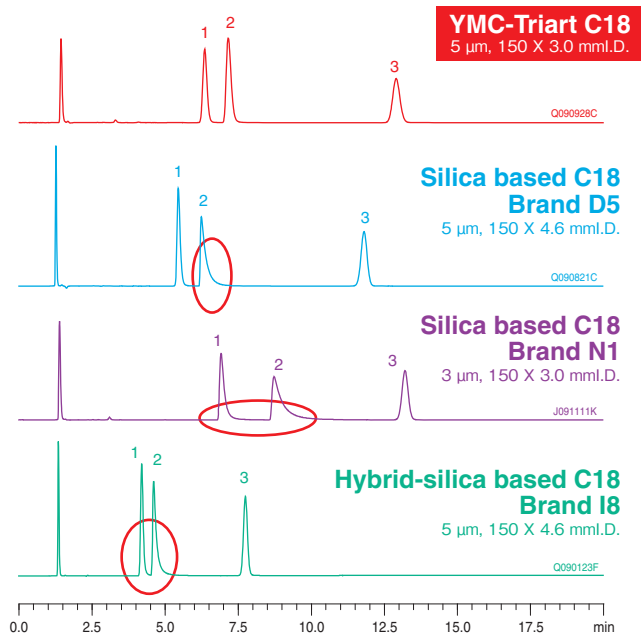
Column : 5  $\mu$ m, 50 X 2.0 mm.I.D.  
Eluent : A) water/formic acid (100/0.1)  
B) acetonitrile/formic acid (100/0.1)  
5%B (0-1 min), 5-100%B (1-5 min), 100%B (5-10 min), 100-5%B (10-10.1 min), 5%B (10.1-12.5 min)  
Flow rate : 0.4 mL/min  
Temperature : 40°C  
Detection : ESI positive, TIC (Mass Range: 50-1000)

Bleeding of stationary phase can often contribute to high background signals when employing MS and other hyphenated detection techniques. In the example cited above, use of a 2 x 50 mm YMC-Triart C18 column shows no contribution to the signal observed by the MS positive total ion current (TIC) trace. Such performance allows for low limits of detection (high S/N ratio) for MS and other detection techniques. The inherent hybrid particle strength is also superior to conventional silica materials for detection techniques that are sensitive to particle degradation.

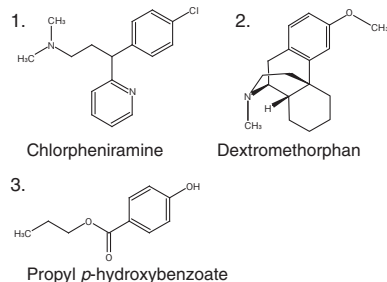
# Excellent resolution

Without adsorption and tailing

## Analysis of basic compounds



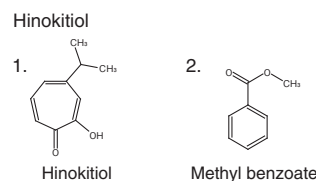
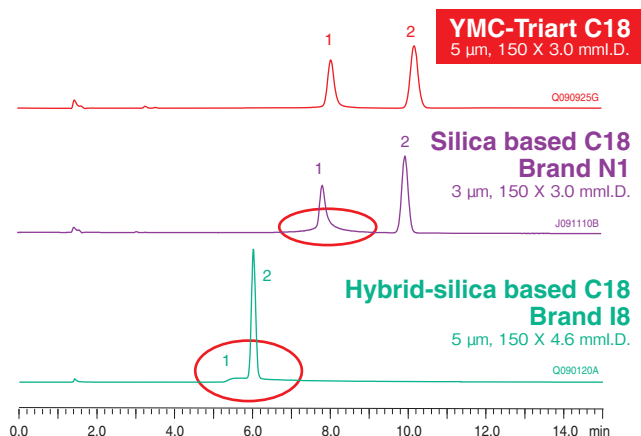
Ingredients in a cough/cold medication



Column : 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.  
Eluent : 20 mM KH<sub>2</sub>PO<sub>4</sub>-K<sub>2</sub>HPO<sub>4</sub> (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°C  
Detection : UV at 235 nm

YMC-Triart C18's innovative surface modification technology results in excellent peak shapes even for the basic compounds that often exhibit tailing shapes on conventional silica and hybrid silica based ODS columns.

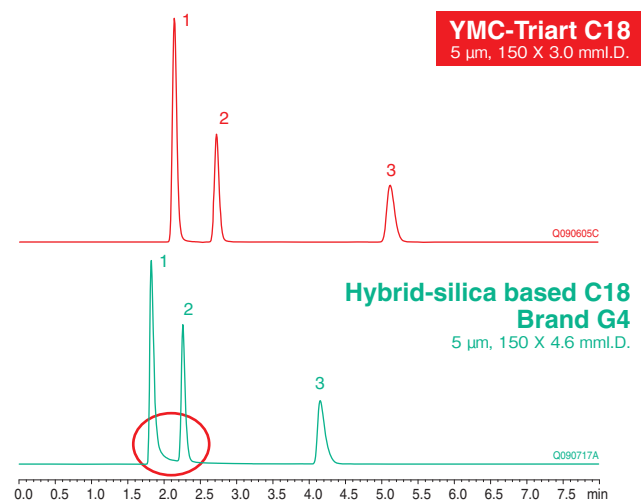
## Analysis of coordination compounds



Column : 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.  
Eluent : acetonitrile/0.1% H<sub>3</sub>PO<sub>4</sub> (40/60)  
Flow rate : 0.425 mL/min for 3.0 mmI.D.  
1.0 mL/min for 4.6 mmI.D.  
Temperature : 40°C  
Detection : UV at 254 nm

YMC-Triart C18 has an extremely low level of metal impurities, much lower than conventional products.  
YMC-Triart C18 is able to provide excellent peak shape for coordination compounds.

## Analysis of acidic compounds



Organic acid

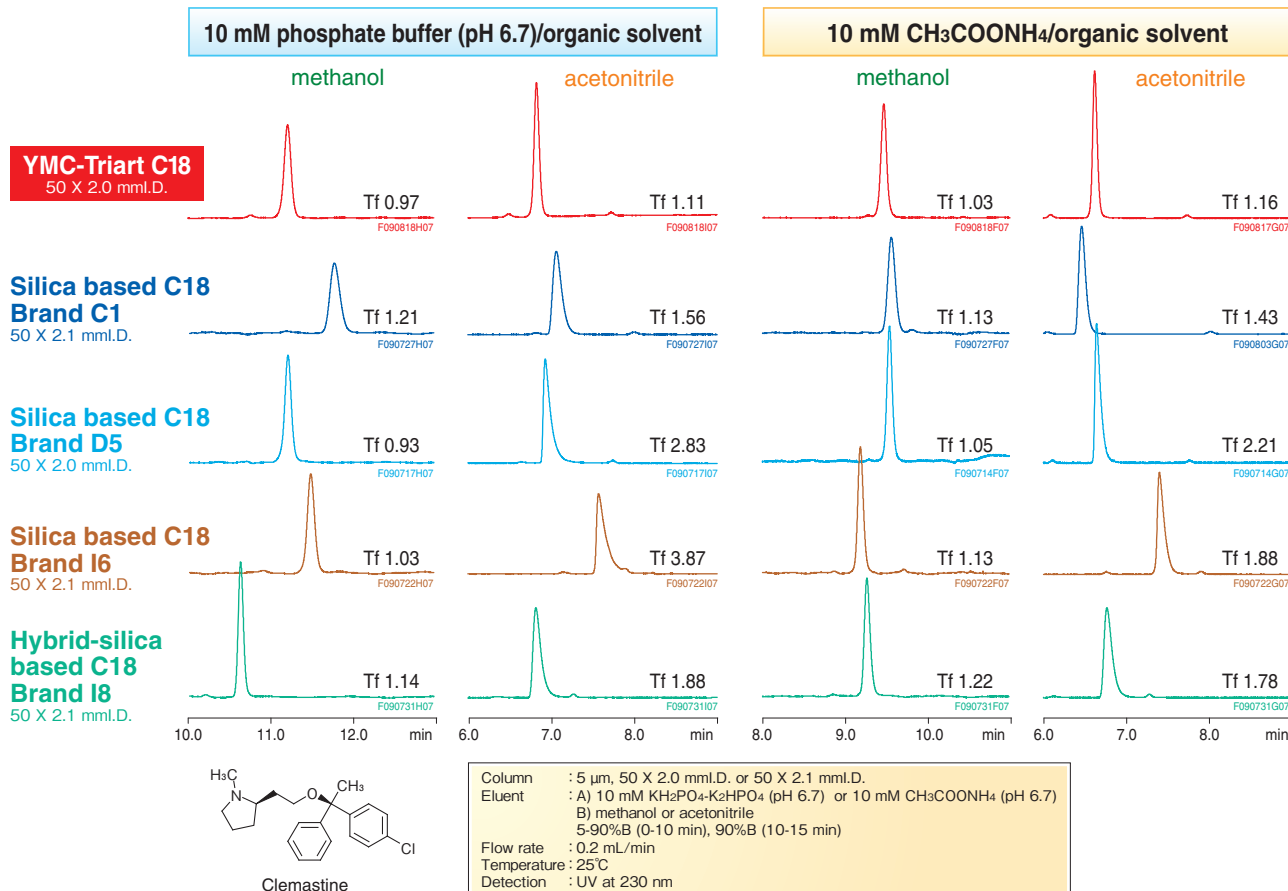
1. Formic acid
2. Acetic acid
3. Propionic acid

Column : 150 X 3.0 mmI.D. or 150 X 4.6 mmI.D.  
Eluent : acetonitrile/0.1% H<sub>3</sub>PO<sub>4</sub> (5/95)  
Flow rate : 0.425 mL/min for 3.0 mmI.D.  
1.0 mL/min for 4.6 mmI.D.  
Temperature : 37°C  
Detection : UV at 210 nm

YMC-Triart C18 is synthesized utilizing methodology borrowed from microreactor technology. This synthesis technique allows for a reduction of impurities that contribute to peak tailing during the analysis of some types of acidic compounds.

## buffer-independency

### Comparison of clemastine analysis with conventional columns

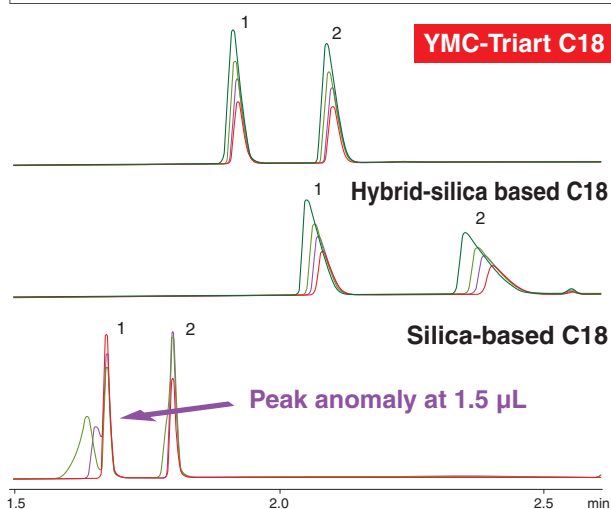


Clemastine is a well known basic compound which can easily tail on conventional ODS columns. YMC-Triart C18 can separate clemastine sharply using many buffer/solvent combinations.

## Improvement of loadability

## Minimizing strong solvent/sample loading effects

### Influence on peak shapes by injection volume



solvent for sample

acetonitrile

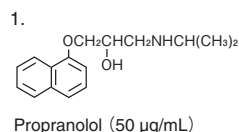
injection volume

1.0  $\mu$ L

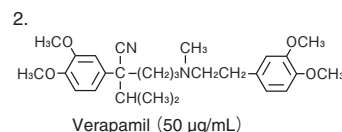
1.5  $\mu\text{L}$

2.0  $\mu\text{L}$ 3.0  $\mu\text{L}$ 

Column	: 5 $\mu$ m, 50 X 2.0 mm I.D. or 2.1 mm I.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°C
Detection	: UV at 275 nm



Propranolol (50 µg/mL)



Verapamil (50 µg/mL)

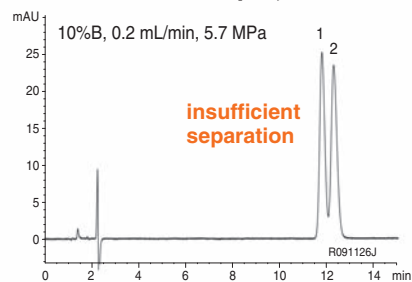
YMC-Triart C18 can tolerate larger injection volumes of samples containing strong solvents (e.g., acetonitrile) while allowing for better peak shape than traditional columns. This can be important for difficult to solubilize samples that need higher concentrations of organic solvent for solubilization prior to analysis.

# Application

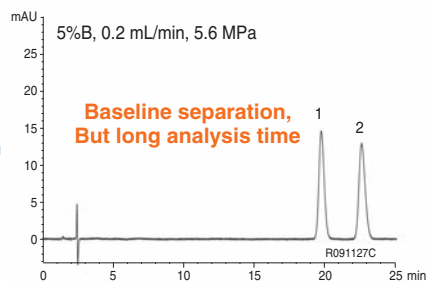
Utilization of 3 micron YMC-Triart C18

## Fast analysis of paraquat and diquat

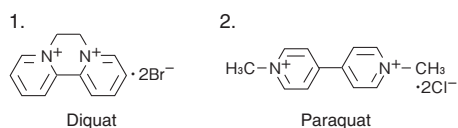
YMC-Triart C18 5  $\mu$ m, 150 X 2.0 mm.I.D.



Eluent optimization

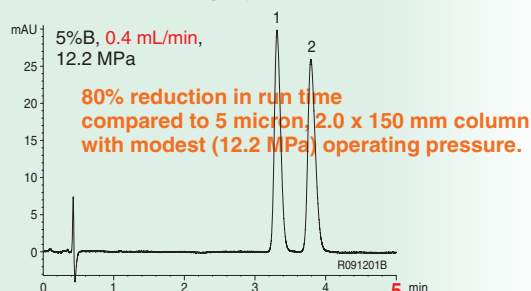


Downsizing



Eluent : A) water/HFBA\* (100/0.1)  
B) acetonitrile/HFBA\* (100/0.1)  
Temperature : 37°C  
Detection : UV at 290 nm  
Injection : 1  $\mu$ L (0.1 mg/mL)  
\*heptafluorobutyric acid

YMC-Triart C18 3  $\mu$ m, 50 X 2.0 mm.I.D.



## Ordering Information

### Analytical column YMC-Triart C18

Particle ( $\mu$ m)	Pore (nm)	Column size I.D.X Length (mm)	Product Code
3	12	2.0 X 30	TA12S03-0302WT
		2.0 X 50	TA12S03-0502WT
		2.0 X 75	TA12S03-L502WT
		2.0 X 100	TA12S03-1002WT
		2.0 X 150	TA12S03-1502WT
		3.0 X 50	TA12S03-0503WT
		3.0 X 100	TA12S03-1003WT
		3.0 X 150	TA12S03-1503WT
		4.6 X 50	TA12S03-0546WT
		4.6 X 75	TA12S03-L546WT
5	12	4.6 X 100	TA12S03-1046WT
		4.6 X 150	TA12S03-1546WT
		2.0 X 30	TA12S05-0302WT
		2.0 X 50	TA12S05-0502WT
		2.0 X 75	TA12S05-L502WT
		2.0 X 100	TA12S05-1002WT
		2.0 X 150	TA12S05-1502WT
		3.0 X 50	TA12S05-0503WT
		3.0 X 75	TA12S05-L503WT
		3.0 X 100	TA12S05-1003WT

### Analytical column YMC-Triart C18

Particle ( $\mu$ m)	Pore (nm)	Column size I.D.X Length (mm)	Product Code
5	12	4.6 X 50	TA12S05-0546WT
		4.6 X 75	TA12S05-L546WT
		4.6 X 100	TA12S05-1046WT
		4.6 X 150	TA12S05-1546WT
		4.6 X 250	TA12S05-2546WT

### Guard cartridge column

(inner diameter 2.0 mm : 2-pack inner diameter 4.0 mm : 3-pack)

3	12	2.0 X 10	TA12S03-0102CC
		4.0 X 23	TA12S03-G304CC
5	12	2.0 X 10	TA12S05-0102CC
		4.0 X 23	TA12S05-G304CC

Cartridge holder will need to be purchased separately before using this product for the first time

### Guard cartridge holder

cartridge holder for 2.0 mm I.D.	XPCHSMW
cartridge holder for 4.0 mm I.D.	XPCHW

### Semi-preparative column YMC-Actus Triart C18

5	12	20 X 50	TA12S05-0520WX
		20 X 100	TA12S05-1020WX
		30 X 50	TA12S05-0530WX
		30 X 100	TA12S05-1030WX



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