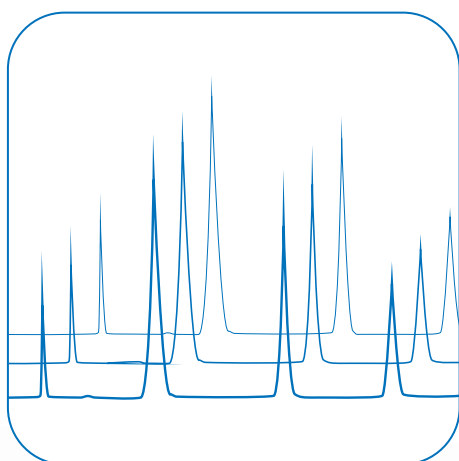


Reliable · Robust · Reproducible

# (U)HPLC columns

## YMC-Triart



LC/MS  
(U)HPLC  
SFC



**Industry Solution**

Pharmaceutical  
QA/QC  
Drug Discovery  
Isolation to Purification  
Manufacturing



**Life Science**

Amino Acids  
Peptides to Proteins/Antibodies  
Oligonucleotides



**Food & Beverages**

Food Safety  
QA/QC  
Environmental

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“

**“Good resolution, separation efficiency and broad pH range and capacity”**

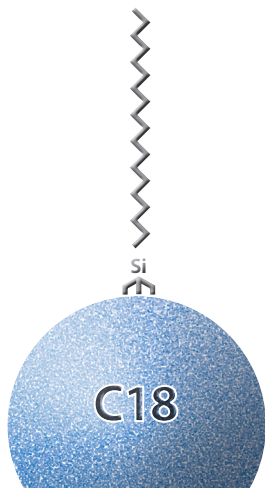
*“This column has a broad pH tolerance. It has a very good resolution and separation efficiency for peptides fractionation for LC-MS/MS sample preparation.”*

*Chi Li Yu, The University of Iowa (US)*

”

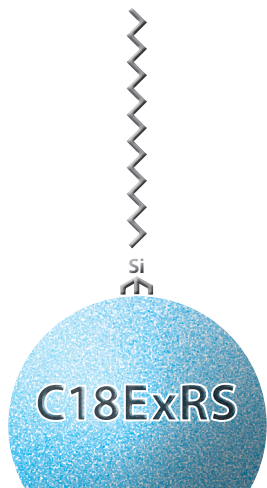
## Phase overview

YMC-Triart C18



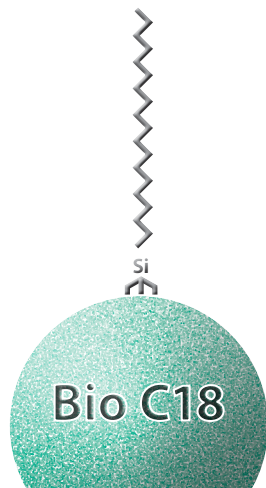
versatile applications  
 first choice for  
 method development  
 pH 1–12/90 °C max.  
 100% aqueous eluents ✓

YMC-Triart C18 ExRS



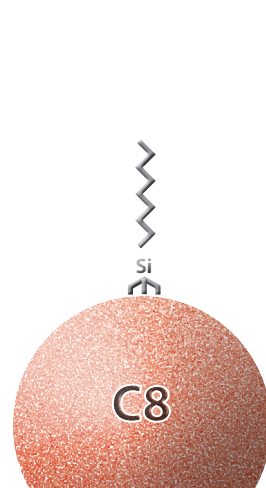
hydrophobic substances  
 positional isomers  
 extended pH and stability  
 pH 1–12/90 °C max.

YMC-Triart Bio C18



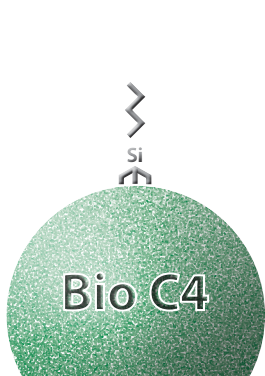
peptides/proteins/  
 oligonucleotides  
 300 Å widepore  
 pH 1–12/90 °C max.  
 100% aqueous eluents ✓

YMC-Triart C8



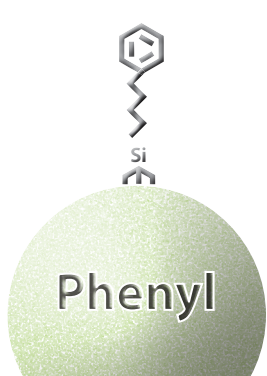
alternative to C18  
 short retention time  
 pH 1–12/90 °C max.

YMC-Triart Bio C4



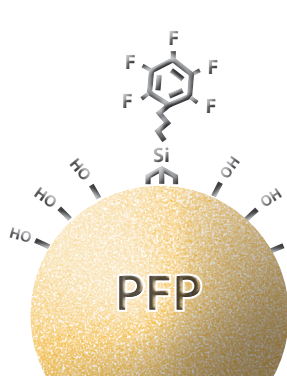
proteins/antibodies/peptides  
 300 Å widepore  
 pH 1–10/90 °C max.  
 100% aqueous eluents ✓

YMC-Triart Phenyl



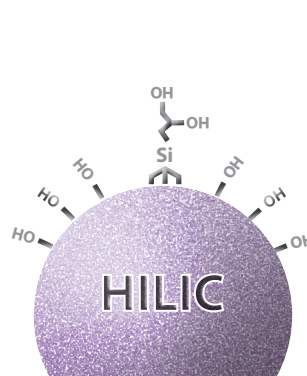
aromatic compounds  
 (π-electron donor)  
 conjugated systems  
 100% aqueous eluents ✓

YMC-Triart PFP



aromatic compounds  
 (π-electron donor)  
 cis-trans isomers  
 polar halogenated  
 compounds  
 100% aqueous eluents ✓

YMC-Triart Diol-HILIC



very polar compounds  
 less ionic adsorption  
 ideal choice for SFC  
 100% aqueous eluents ✓

### TIP

In order to offer a convenient solution for method developers YMC is offering price attractive Method Development Kits with a selection of 3 different YMC-Triart (U)HPLC columns.

## Phase overview

### Specification YMC-Triart

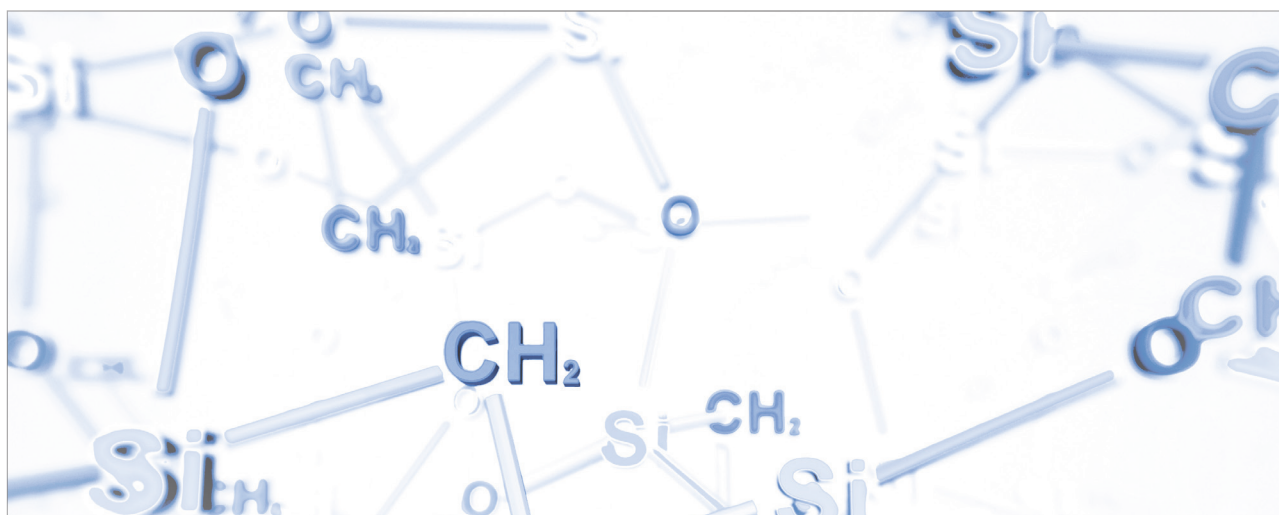
	C18	C18 ExRS	Bio C18	C8	Bio C4	Phenyl	PFP	Diol-HILIC
Base	organic/inorganic hybrid silica							
Stationary phase	C18 (USP L1)	C18 (USP L1)	C18 (USP L1)	C8 (USP L7)	C4 (USP L26)	Phenyl (USP L11)	Penta-fluorophenyl (USP L43)	Diol (USP L20)
Particle size	1.9, 3 and 5 µm							
Pore size	12 nm	8 nm	30 nm	12 nm	30 nm	12 nm	12 nm	12 nm
Specific surface	360 m <sup>2</sup> /g	430 m <sup>2</sup> /g	–	360 m <sup>2</sup> /g	–	360 m <sup>2</sup> /g	360 m <sup>2</sup> /g	360 m <sup>2</sup> /g
Carbon content	20%	25%	–	17%	–	17%	15%	–
Bonding	trifunctional							
Endcapping	multi-stage	multi-stage	multi-stage	multi-stage	multi-stage	multi-stage	none	none
pH range	1 ~ 12	1 ~ 12	1 ~ 12	1 ~ 12	1 ~ 10	1 ~ 10	1 ~ 8	2 ~ 10
Temperature range	pH < 7: 90 °C pH > 7: 50 °C	pH < 7: 90 °C pH > 7: 50 °C	pH < 9: 90 °C pH > 9: 50 °C	pH < 7: 90 °C pH > 7: 50 °C	pH < 7: 90 °C pH > 7: 50 °C	50 °C	50 °C	50 °C
Pressure limit	1.9 µm: 100 MPa (15,000 psi) 3/5 µm: 45 MPa (6,525 psi)*							
100% aqueous eluents	✓	✗	✓	✗	✓	✓	✓	✓

\* selected hardware options may have different pressure limits

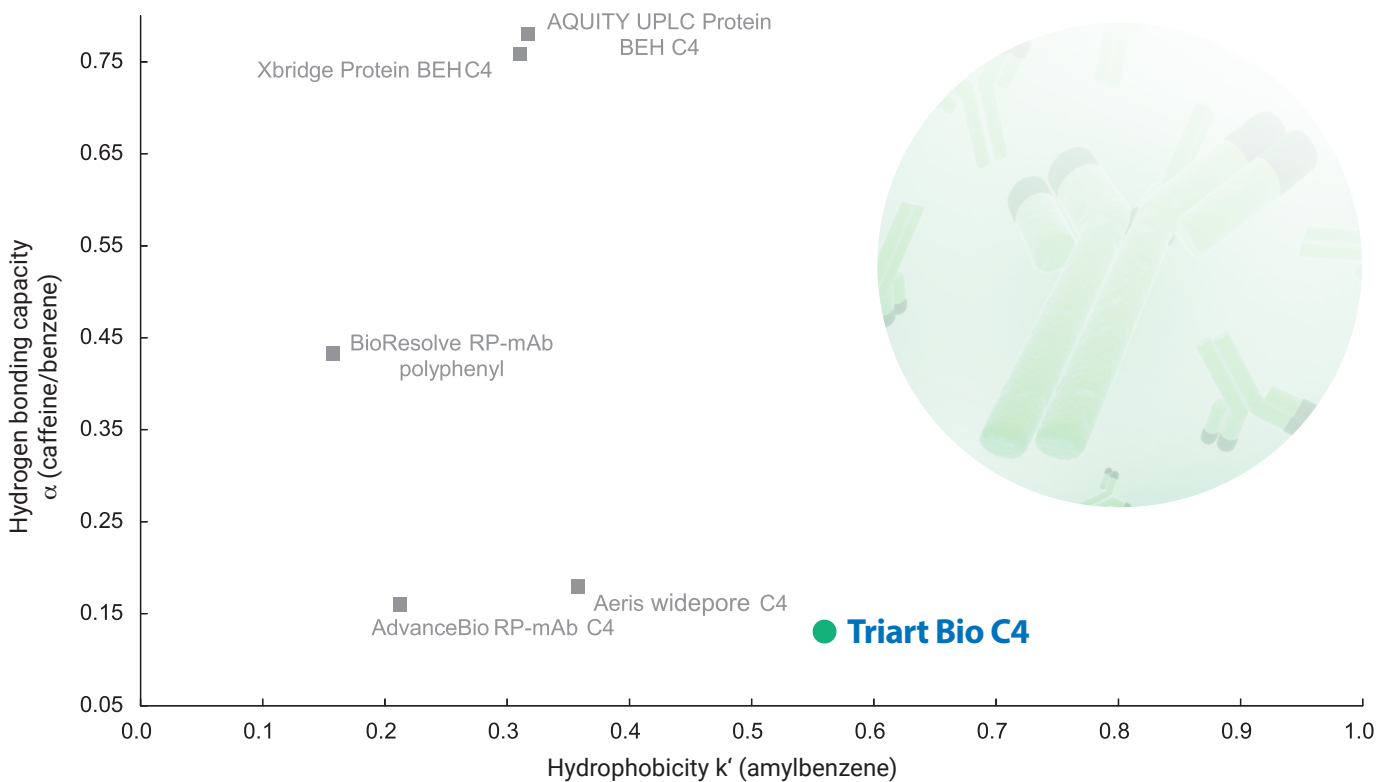
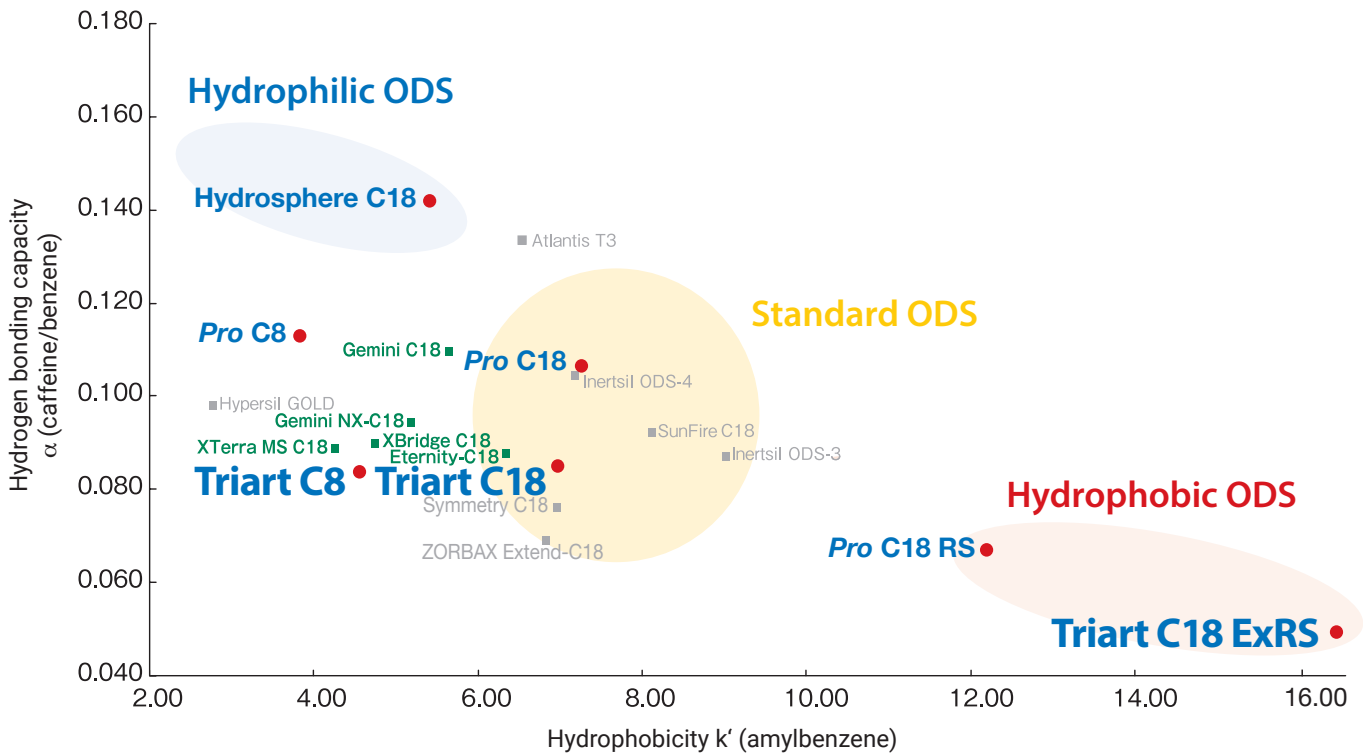
### Particle technology

YMC-Triart is a versatile material prepared using tightly controlled particle formation technology which has been adapted from micro-reactor technology. This recently developed production process developed by YMC results in exceptionally narrow particle and pore size distributions.

With YMC-Triart, challenging pH and high temperature conditions are no longer a limitation to the day-to-day work in laboratories. Most importantly, due to its unique particle composition, a balanced hydrophobicity and silanol activity are achieved which makes YMC-Triart a "First Choice" column in method development.



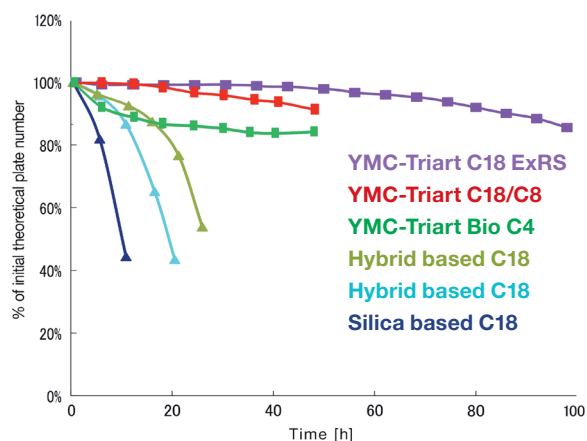
## "First choice" column for method development



# pH & temperature

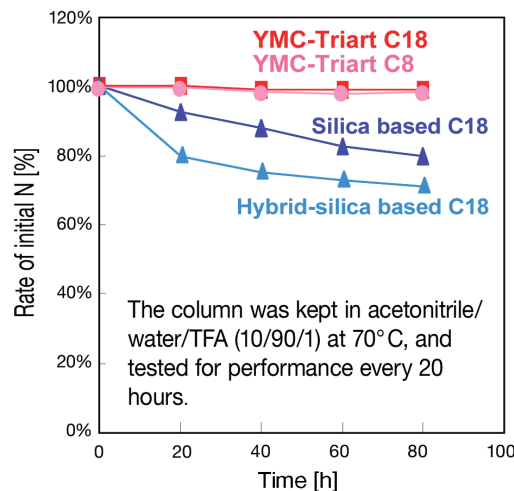
## Versatile wide pH stability

Phosphate buffer (pH 11.5, 40°C)



Column: YMC-Triart (5 µm, 12 nm) 150 x 4.6 mm ID  
 Part No.: TA12S05-1546PTH  
 Eluent: 50 mM K<sub>2</sub>HPO<sub>4</sub>-K<sub>3</sub>PO<sub>4</sub> (pH 11.5)/methanol (90/10)  
 Flow rate: 1.0 mL/min  
 Temperature: 40°C  
 Sample: Benzyl alcohol

1% TFA (pH 1, 70°C)

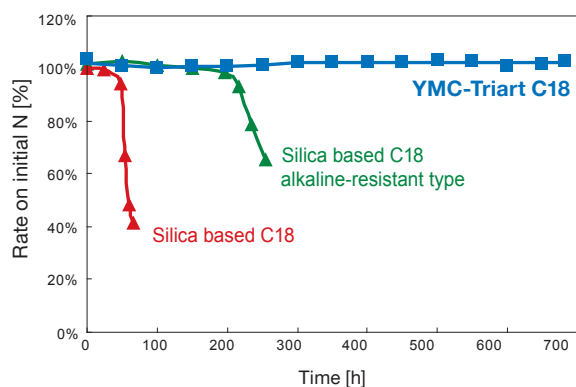


Column: YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12S05-0502WT  
 Eluent: acetonitrile/water (60/40)  
 Flow rate: 0.2 mL/min  
 Temperature: 37°C  
 Sample: Butyl benzoate

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

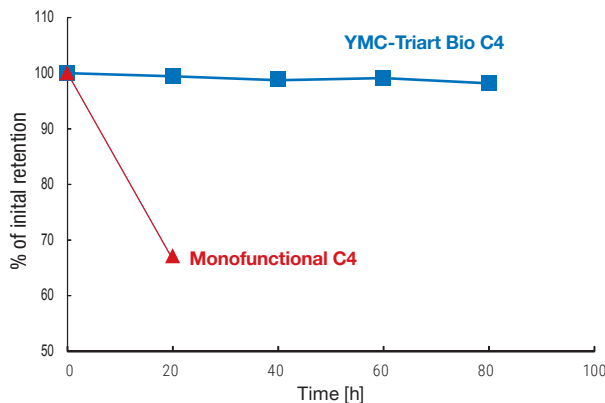
## Stability at high temperature

pH 6.9, 70°C



Column: YMC-Triart C18 (5 µm, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12S05-0502WT  
 Eluent: 20 mM KH<sub>2</sub>PO<sub>4</sub>-K<sub>2</sub>HPO<sub>4</sub> (pH 6.9)/acetonitrile (90/10)  
 Flow rate: 0.2 mL/min  
 Temperature: 70°C  
 Sample: Phenol

pH 1, 90°C

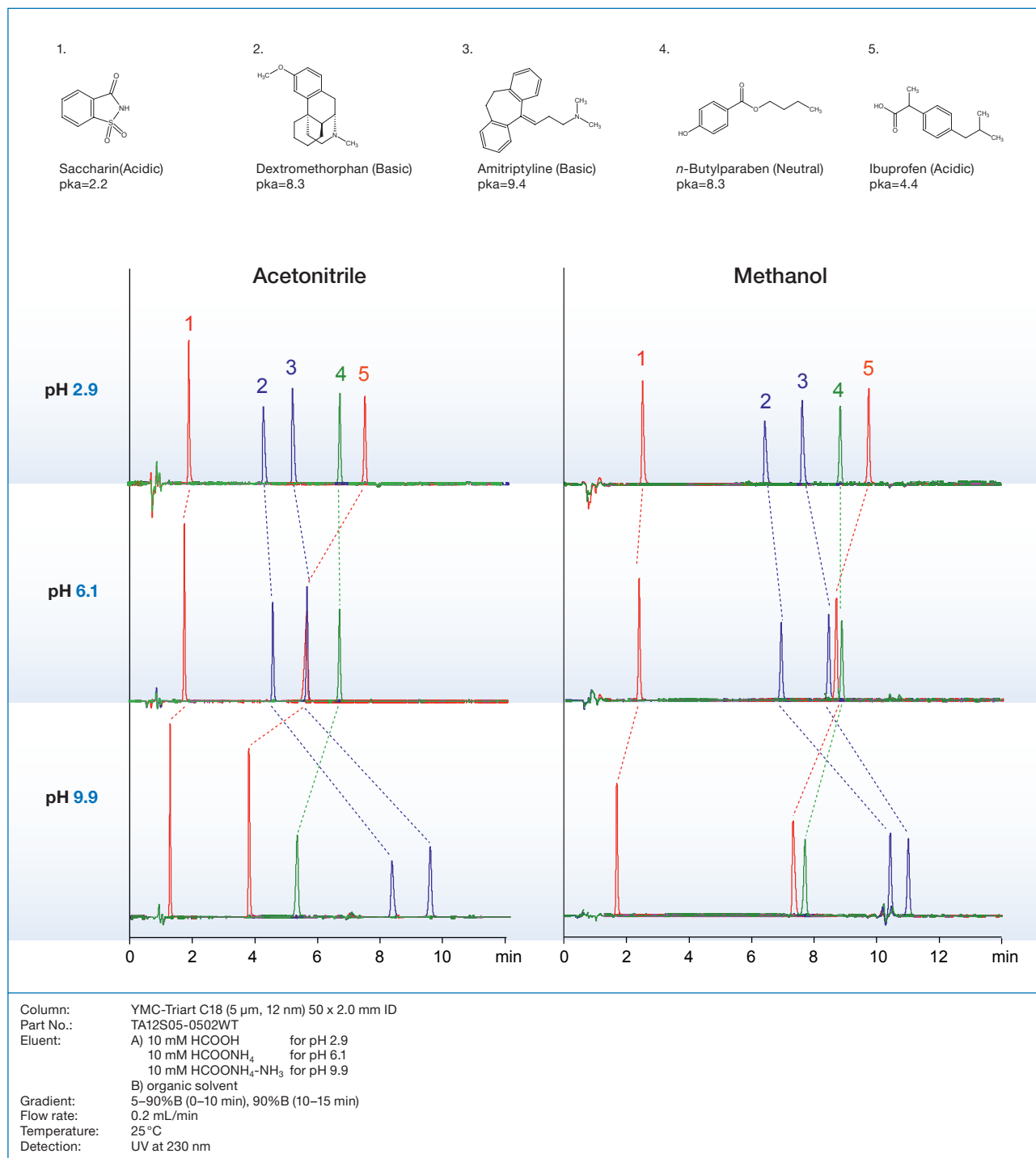


Column: YMC-Triart Bio C4 (5 µm, 30 nm) 150 x 3.0 mm ID  
 Part No.: TB30S05-1503PTH  
 Eluent: acetonitrile/water (60/40)  
 Flow rate: 0.4 mL/min  
 Temperature: 37°C  
 Sample: Butyl benzoate

YMC-Triart phases show great chemical stability due to the highly developed hybrid-silica matrix. Even under high pH or high temperature conditions, the lifetime of YMC-Triart phases is more than 10 x greater than conventional reversed phase columns.

# pH flexibility

## Combination of pH and organic solvent



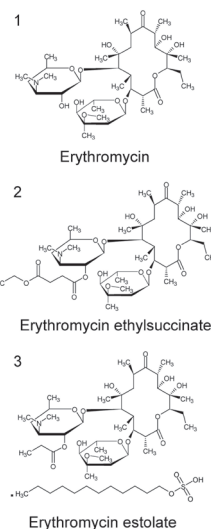
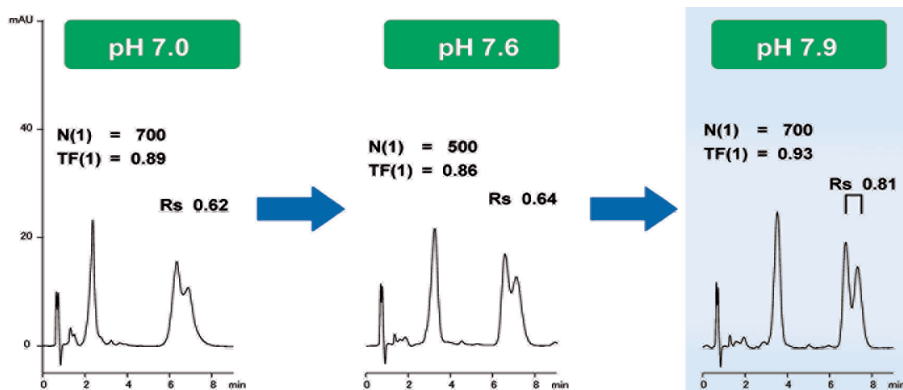
In reversed phase HPLC, pH and organic solvent are the most important factors to control retention and selectivity. YMC-Triart C18 with its wide range of usable pH offers significant advantage in selection of mobile phase conditions. YMC-Triart C18 delivers symmetrical peak shapes for all types of compounds irrespective of the pH and composition of the mobile phase. Chromatographers can select the optimal condition by combining various mobile phase parameters such as mobile phase pH, and type of organic solvent or buffer system.



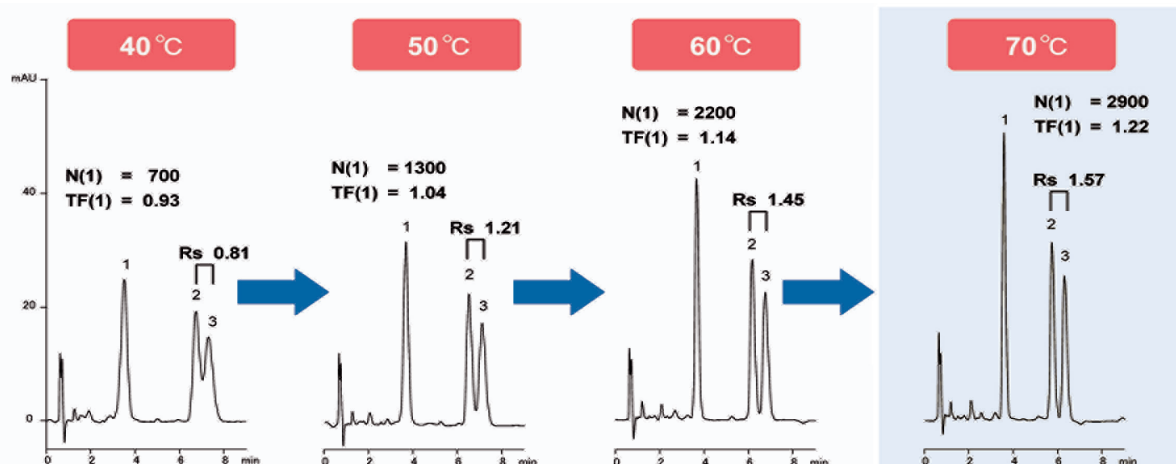
# Temperature flexibility

## Erythromycin at elevated pH and temperature

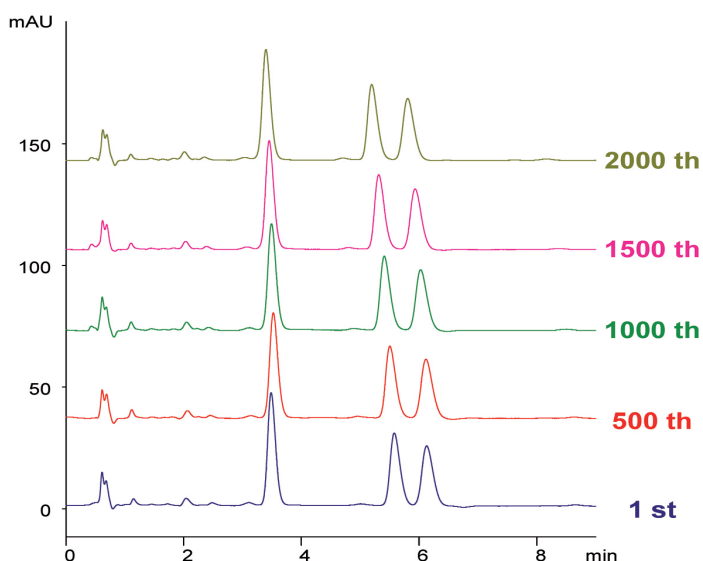
### 1. Optimisation of pH



### 2. Optimisation of temperature (pH 7.9)



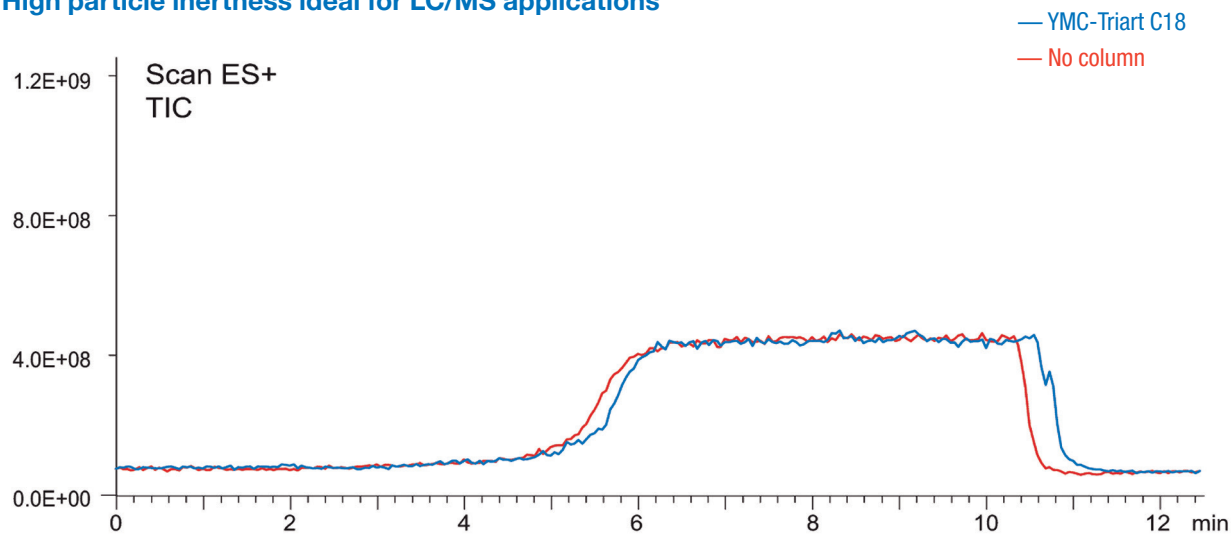
### 3. Stability test: pH 7.9, 70 °C



Column: YMC-Triart C18 (3  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12S03-0502WT  
 Eluent: 20 mM  $KH_2PO_4$ - $K_2HPO_4$ /acetonitrile / methanol (40/45/15)  
 Flow rate: 0.2 mL/min  
 Detection: UV at 210 nm

## LC/MS compatibility

### High particle inertness ideal for LC/MS applications

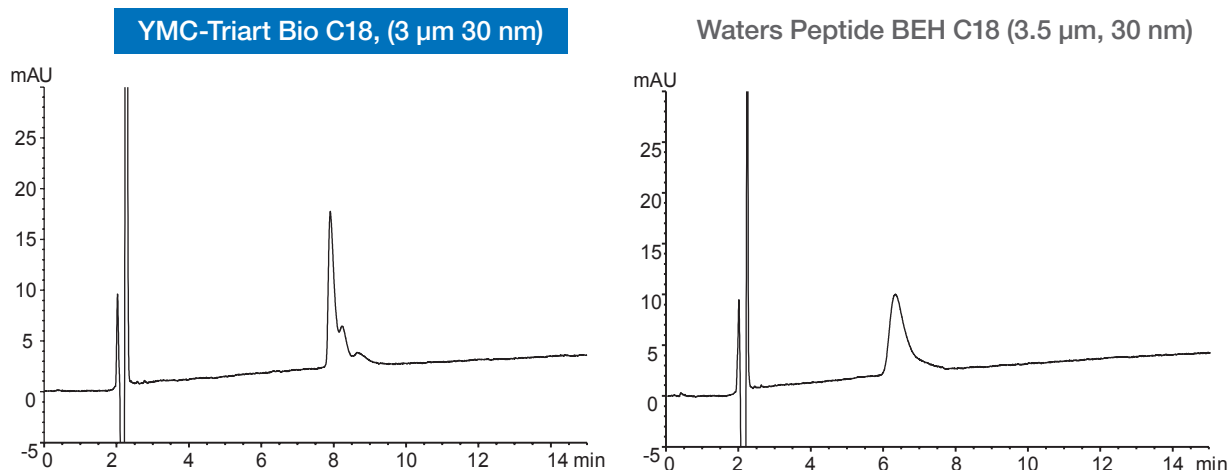


Column: 5  $\mu$ m, 50 x 2.0 mm ID  
 Part-No.: TA12S05-0502WT  
 Eluent: A) water + 0.1% formic acid  
 B) acetonitrile + 0.1% formic acid  
 Gradient: 5%B (0–1 min), 5–100%B (1–5 min),  
 100%B (5–10 min), 100–5%B (10–10.1 min),  
 5%B (10.1–12.5 min)

Flow rate: 0.4 mL/min  
 Temperature: 40°C  
 Detection: ESI positive, TIC (Mass Range: 50–1,000)

Column bleeding, caused by the fragments of stationary phase, is the main reason for background noise and restrictions on detection limits. No bleed is observed in the test of total ion current (TIC) measured by LC/MS with blank or with YMC-Triart C18. So in terms of the signal/noise ratio (S/N ratio), YMC-Triart C18 can be expected to not only reduce the background noise but to also increase the sensitivity of the analysis.

### Good peak shapes with formic acid due to high particle inertness

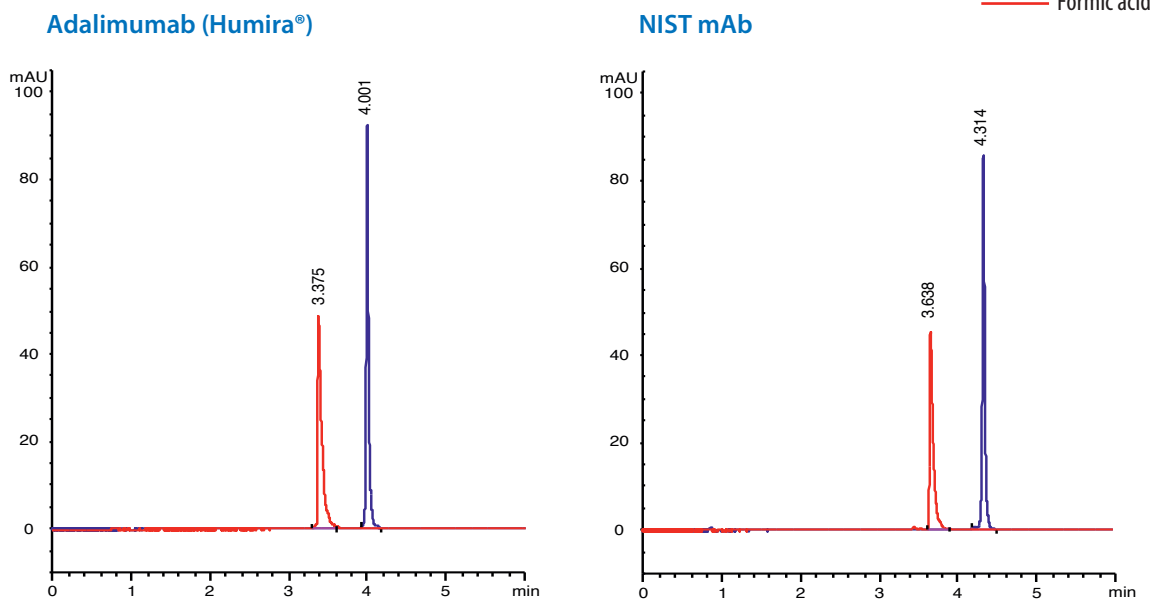


Column: 150 x 3.0 mm ID; 150 x 4.6 mm ID  
 Part No.: TA30S03-1503PTH  
 Eluent: A) water/formic acid (100/0.1)  
 B) acetonitrile/formic acid (100/0.08)  
 Gradient: 45–65%B (0–15 min)  
 Flow rate: 0.425 mL/min for 3.0 mm ID; 1.0 mL/min for 4.6 mm ID  
 Temperature: 40°C

Detection: UV at 220 nm  
 Sample: Somatropin (0.1 mg/mL)

## LC/MS compatibility

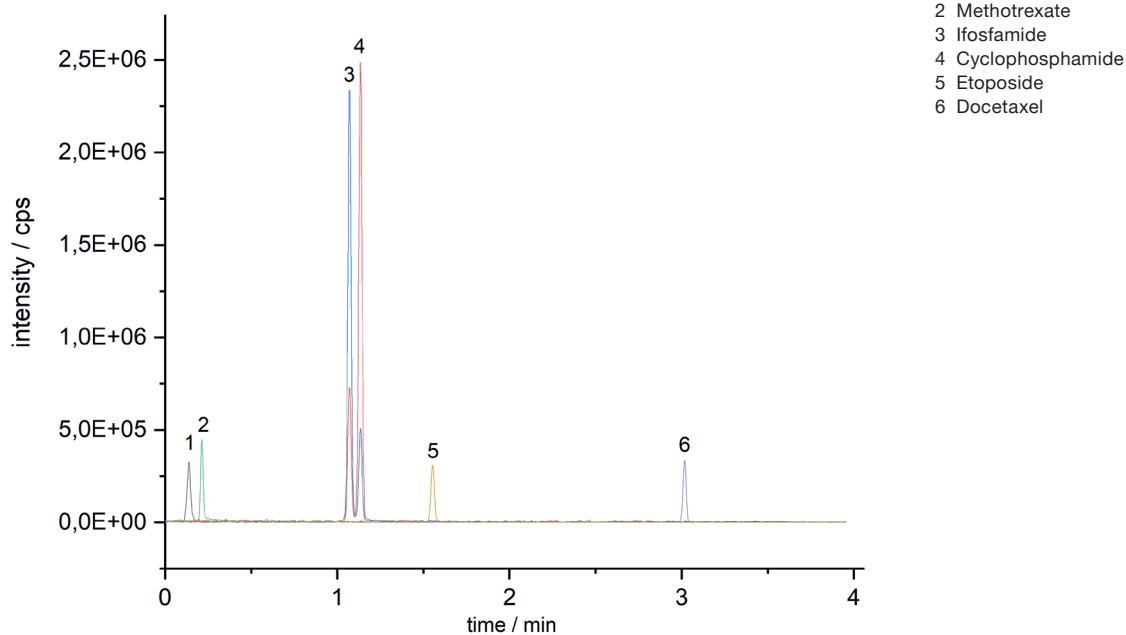
### Suitable peaks with MS compatible conditions



Column: YMC-Triart Bio C4 (1.9  $\mu$ m, 30nm) 150 x 2.1 mm ID  
 Part No.: TB30SP9-15Q1PT  
 Eluent: A) water/TFA or formic acid (100/0.1)  
 B) acetonitrile/TFA or formic acid (100/0.1)  
 Gradient: 10–95%B (0–10 min)

Flow rate: 0.4 mL/min  
 Temperature: 80°C  
 Detection: UV at 280 nm (0.13s, 40Hz)  
 Injection: 2  $\mu$ L (0.5 mg/mL)

### High sensitivity screening of antineoplastic drugs



Column: YMC-Triart C18 (1.9  $\mu$ m, 12nm) 50 x 1 mm ID  
 Part No.: TA12SP9-0501WT  
 Eluent: A) H<sub>2</sub>O + 0.1% formic acid  
 B) acetonitrile + 0.1% formic acid  
 Gradient: 10%B (0–0.05 min), 10–50%B (0.05–2.85 min),  
 50–99%B (2.85–3.55 min), 99%B (3.55–4.00 min)  
 Flow rate: 278  $\mu$ L/min

Temperature: 30°C  
 Detection: ESI-MS  
 Injection: 100 nL  
 Sample: (1) Gemcitabine, (2) Methotrexate, (3) Ifosfamide,  
 (4) Cyclophosphamide, (5) Etoposide, (6) Docetaxel (1  $\mu$ g/mL)  
 Instrument: LC) Shimadzu Nexera Mikros  
 MS) Shimadzu MS 8060

Application data by courtesy of: Tobias Werres, IUTA - Institut für Energie- und Umwelttechnik e.V., Duisburg, Germany.

## Transfer HPLC ↔ UHPLC

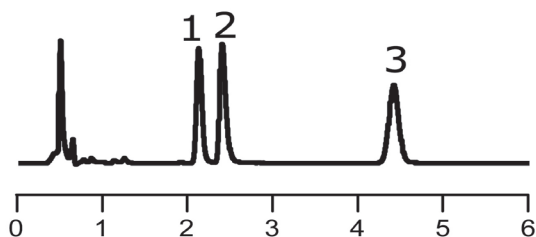
### Secure your method transfer!

Differences in selectivity, retention time, and also peak shapes between different particle sizes of commercially available C18 phases in the same brand (or an alternative as recommended by its manufacturer) have been observed.

### YMC-Triart C18

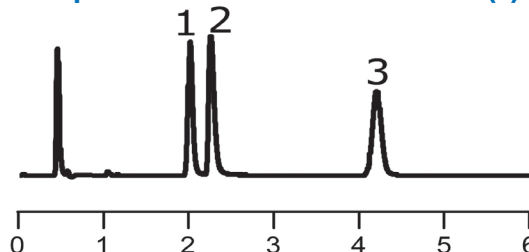
3 μm

TF(2) 1.43



1.9 μm

TF(2) 1.47



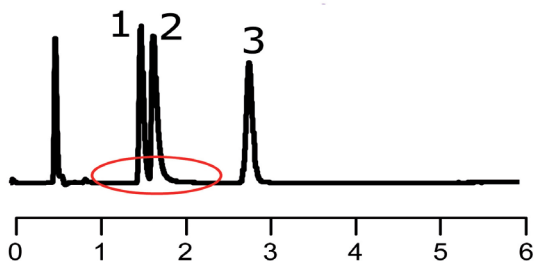
YMC has addressed this issue of method transfer. YMC-Triart columns show identical selectivity and excellent peak shapes for basic compounds for all 3.0 μm to 1.9 μm particle sizes. It allows predictable scale up from UHPLC to conventional HPLC and even to semi-preparative LC, and vice versa.

### Case Studies

#### XBridge BEH C18 and Acquity UPLC BEH C18

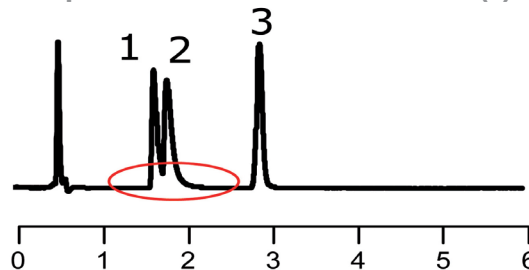
2.5 μm

TF(2) 2.24



1.7 μm

TF(2) 2.35

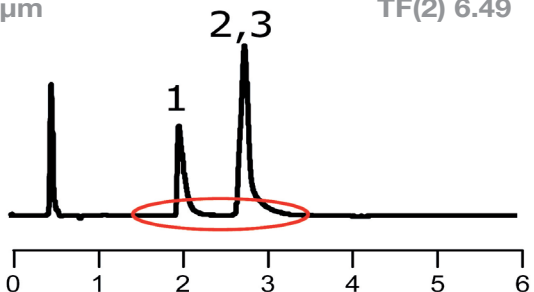


These observations might not be representative for all applications.

#### Kinetex C18

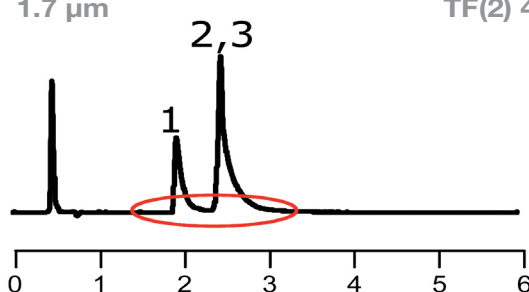
2.6 μm

TF(2) 6.49



1.7 μm

TF(2) 4.94



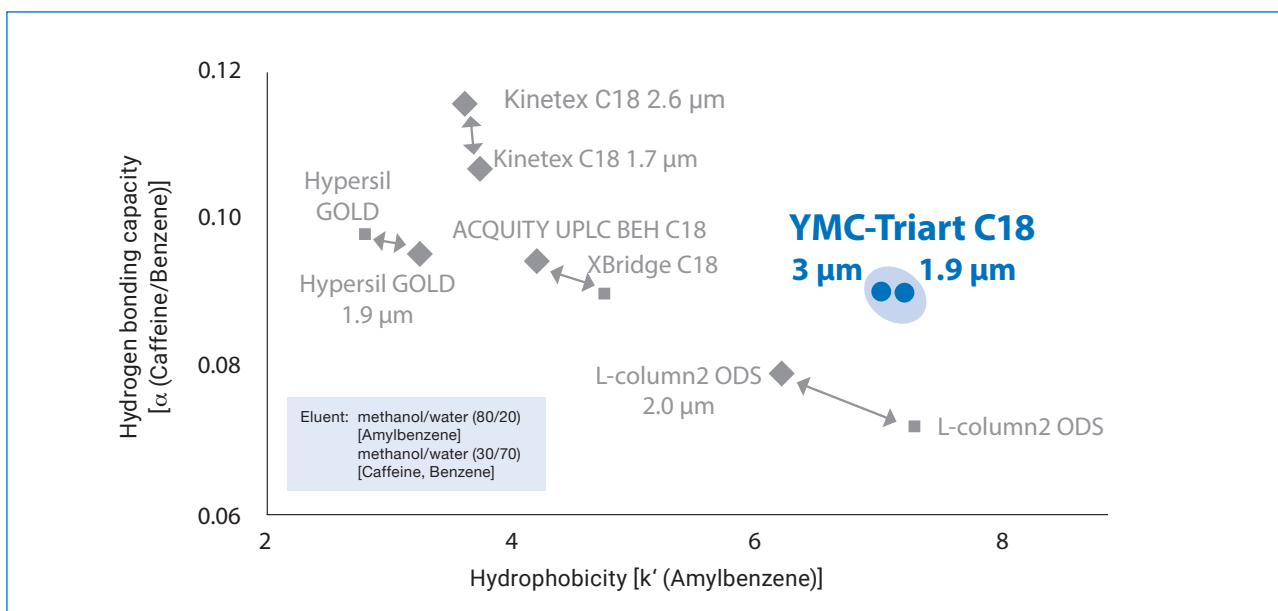
Kinetex C18 columns show significant peak tailing and have limited scalability due to lack of larger particle sizes.

Column: 50 x 2.0 mm ID or 2.1 mm ID  
 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)  
 Temperature: 40 °C  
 Flow rate: 0.2 mL/min  
 Detection: UV at 235 nm

1. Chlorpheniramine (basic)  
 2. Dextromethorphan (basic)  
 3. Propyl paraben (internal standard)

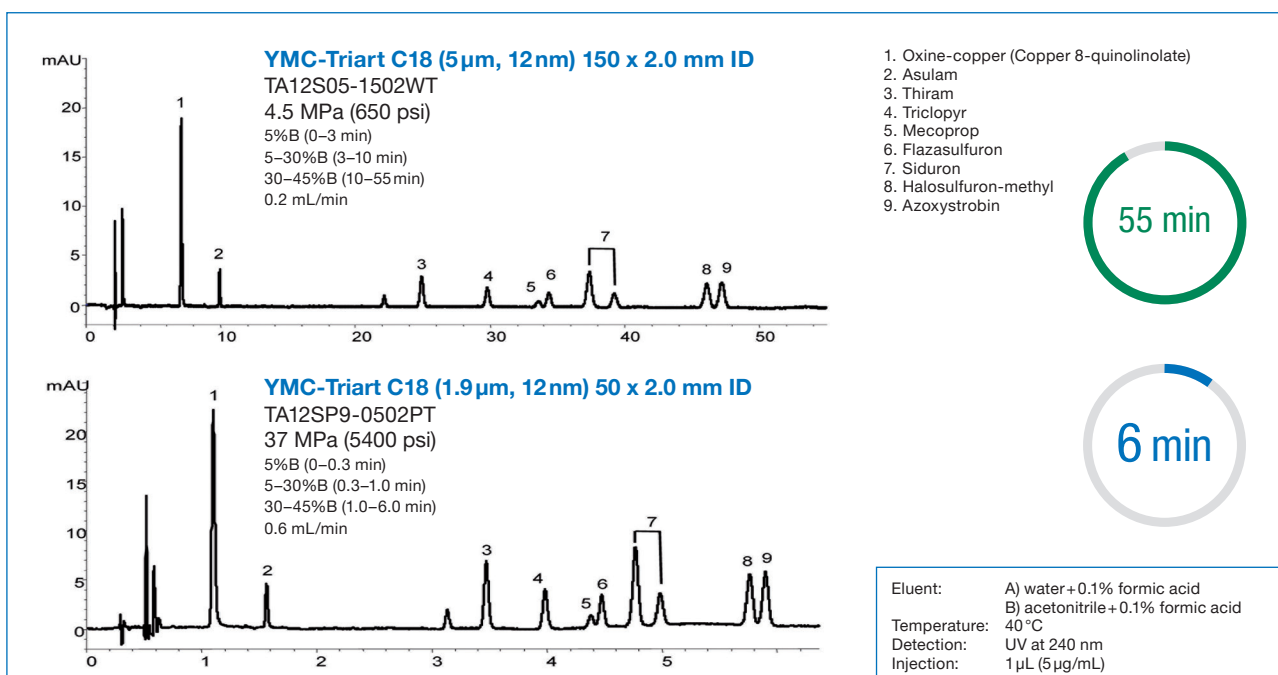
# Transfer HPLC ↔ UHPLC

## Evaluation of method transfer performance!



With the introduction of UHPLC, sub-2-μm particles became necessary. Therefore smaller particles have been added to existing column lines. Consequently, sub-2-μm particles may exhibit differences in chromatographic performance. By introducing YMC-Triart, YMC provides matching chromatographic behaviour for all particles sizes!

## Method transfer HPLC ↔ UHPLC



When transferring the 55 min HPLC method to UHPLC scale, the resolution remains the same although the separation time is reduced to only 6 min.

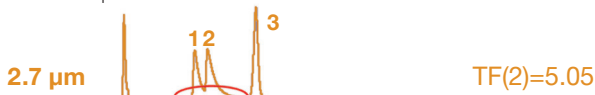
# High UHPLC resolution and performance

Higher resolution and better peak shapes compared to Core-Shell columns

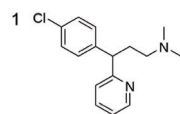
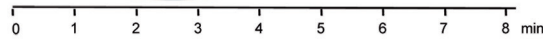
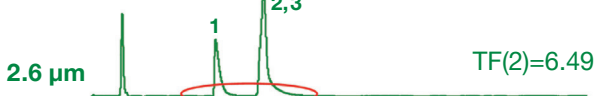
YMC-Triart C18



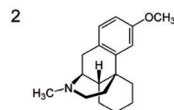
Ascentis Express C18



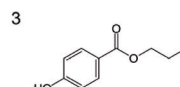
Kinetex C18



Chlorphenamine



Dextromethorphan

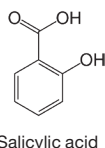


Propyl paraben (I. S.)

Column: 50 x 2.0 or 2.1 mm ID  
 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: 0.2 mL/min  
 Temperature: 40 °C  
 Detection: UV at 235 nm

YMC-Triart C18 always shows the lowest HETP compared to the three Core-Shell products over the range of linear velocity applied.

Symmetrical peaks, higher performance and increased resolution



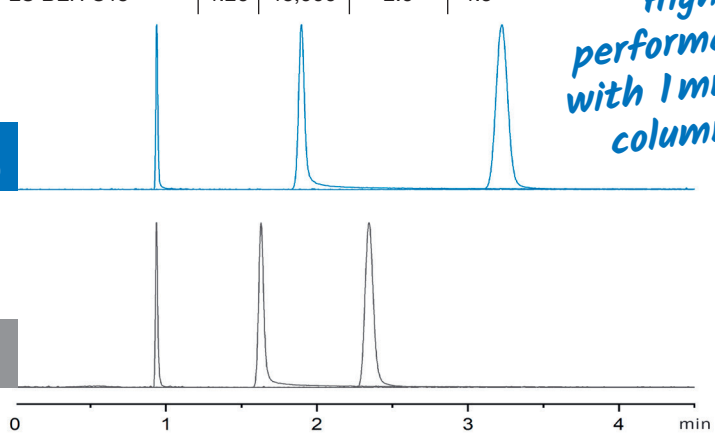
Salicylic acid (Peak 1)	Tf	N	H [µm/N]	h
YMC-Triart C18	1.15	28,613	1.7	0.9
UPLC BEH C18	1.26	18,999	2.6	1.5

1 Salicylic acid  
 2 Methylparaben (I.S.)  
 3 Cinnamic acid

*High performance with 1 mm ID columns*

**YMC-Triart C18**  
 (1.9 µm, 12 nm) 50 x 1 mm ID

**Acquity UPLC BEH C18**  
 (1.7 µm, 13 nm) 50 x 1 mm ID



Column: YMC-Triart C18 (1.9 µm, 12 nm) 50 x 1 mm ID  
 Part No.: TA12SP9-0501WT  
 Eluent: 10 mM CH<sub>3</sub>COOH-CH<sub>3</sub>COONH<sub>4</sub> (pH 4.2)/acetonitrile (75/25)  
 Flow rate: 47 µL/min  
 Temperature: 30 °C  
 Detection: ESI-MS  
 Injection: 100 nL  
 Sample: (1) Salicylic acid  
 (2) Methylparaben (I.S.)  
 (3) Cinnamic acid  
 Instrument: LC) Shimadzu Nexera Mikros  
 MS) Shimadzu MS 8060

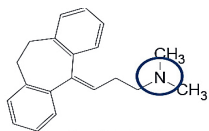
Application data by courtesy of: Tobias Werres, IUTA - Institut für Energie- und Umwelttechnik e.V., Duisburg, Germany.

YMC-Triart phases are synthesised using methodology adapted from micro-reactor technology. This technique ensures a reduction in impurities that contribute to peak tailing during the analysis of some types of acidic compounds.

# Pharmaceuticals – YMC-Triart C18 ExRS

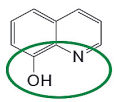
High hydrophobicity & high steric recognition ability

Basic Compound



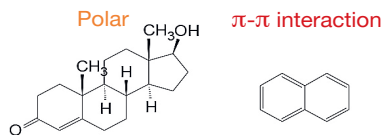
1. Amitriptyline

Coordination Compound



2. 8-Quinololinol

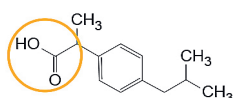
Neutral Compounds



3. Testosterone

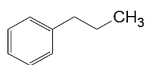
4. Naphthalene

Acidic Compound

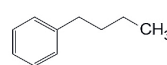


5. Ibuprofen

Hydrophobic

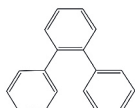


6. *n*-Propylbenzene

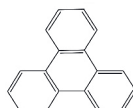


7. *n*-Butylbenzene

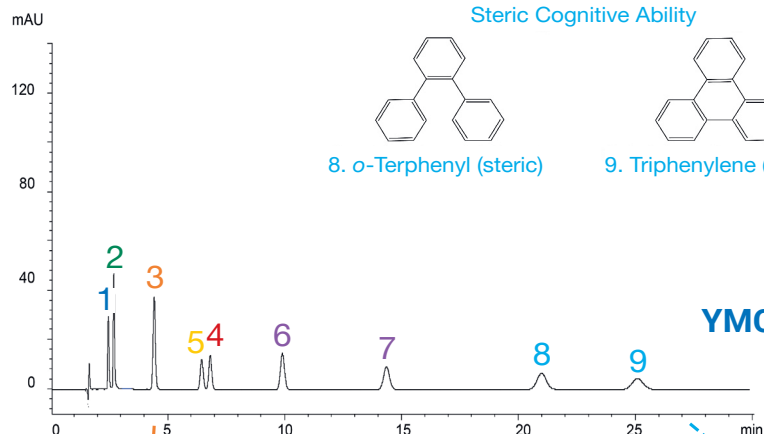
Steric Cognitive Ability



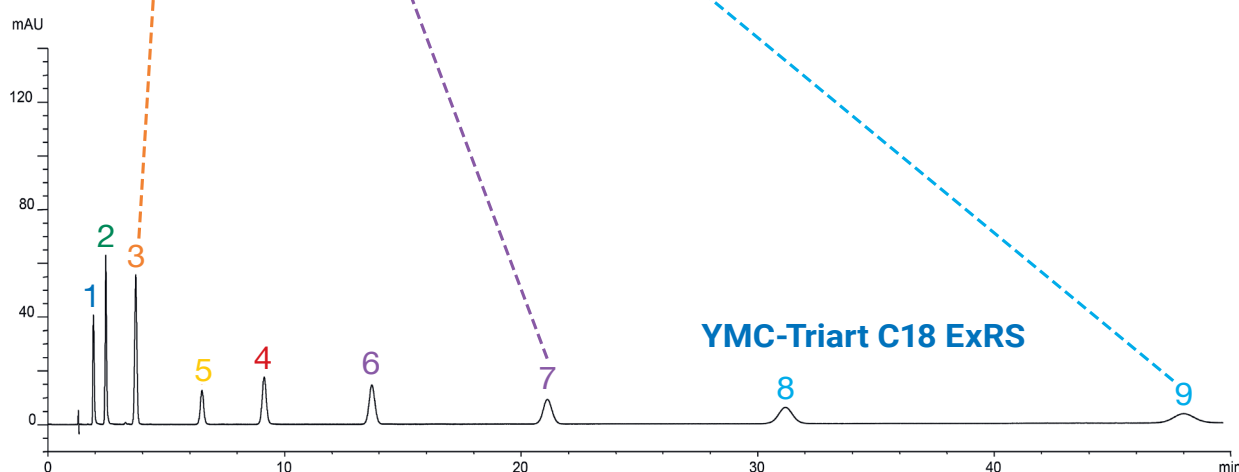
8. *o*-Terphenyl (steric)



9. Triphenylene (planar)



YMC-Triart C18

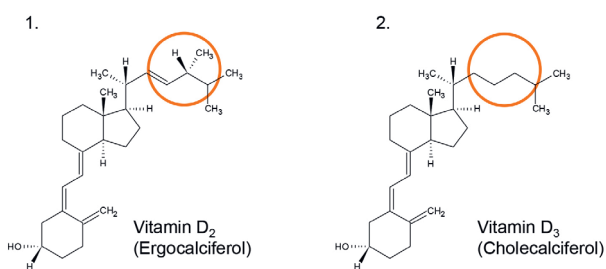
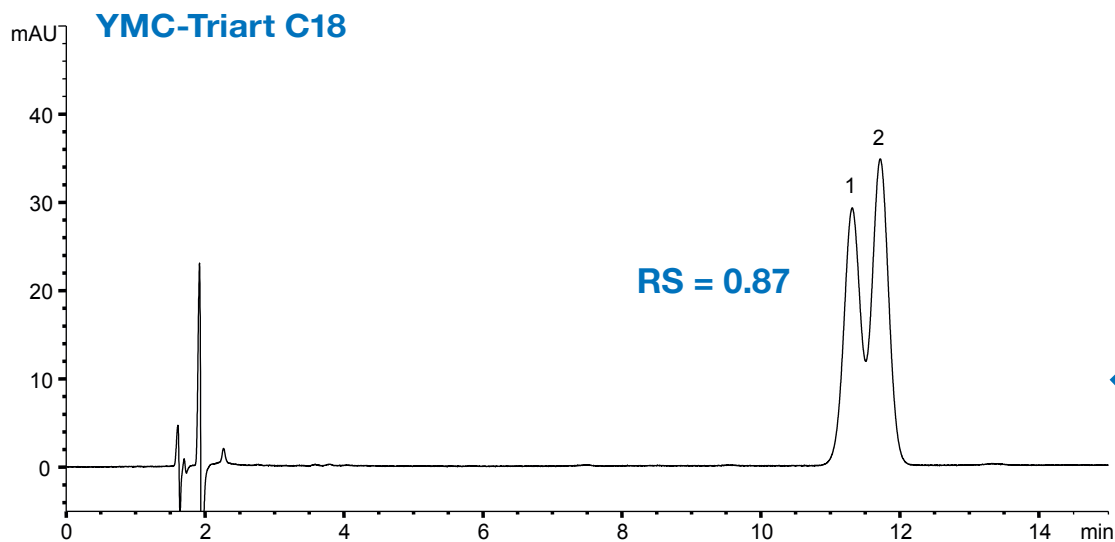


YMC-Triart C18 ExRS

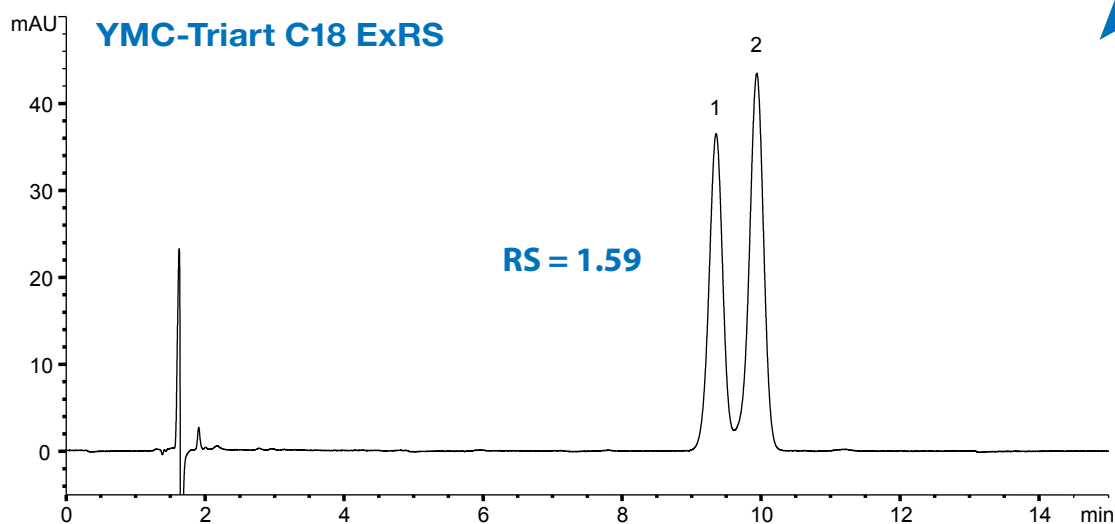
Column: 5  $\mu$ m, 150 x 3.0 mm ID  
 Part Nos.: TA12S05-1503PTH / TAR08S05-1503PTH  
 Eluent: 20 mM HCOOH-HCOONH<sub>4</sub> (pH 4.3)/acetonitrile (90/10)  
 Flow rate: 1.0 mL/min  
 Temperature: 25 °C  
 Detection: UV at 254 nm  
 Injection: 2  $\mu$ L (10  $\mu$ g/mL)

# Pharmaceuticals – YMC-Triart C18 ExRS

## Structural analogues



*Higher Resolution*

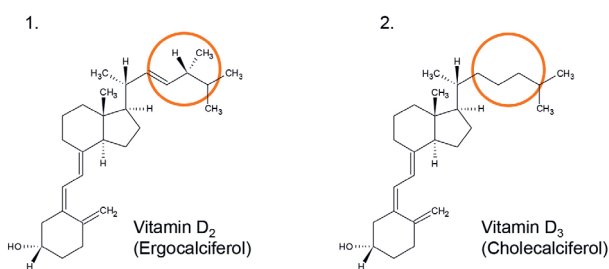
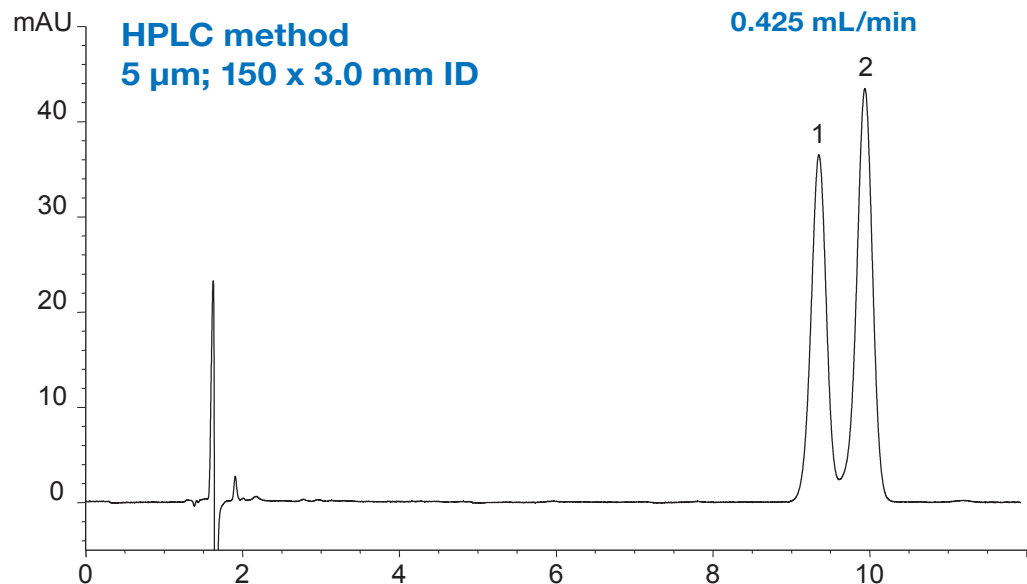


Column: 5  $\mu$ m, 150 x 3.0 mm ID  
 Part Nos.: TA12S05-1503PTH/TAR08S03-1503PTH  
 Eluent: THF/acetonitrile (10/90)  
 Flow rate: 0.425 mL/min  
 Temperature: 30 °C  
 Detection: UV at 265 nm  
 Injection: 4.25  $\mu$ L (10  $\mu$ g/mL)

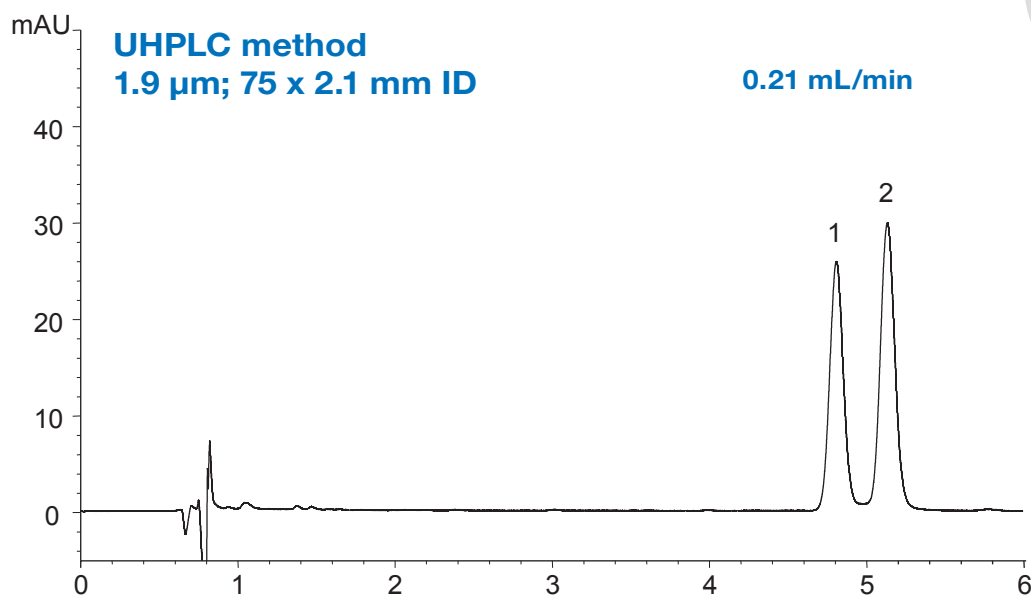


# Pharmaceuticals – YMC-Triart C18 ExRS

Easy transfer HPLC ↔ UHPLC



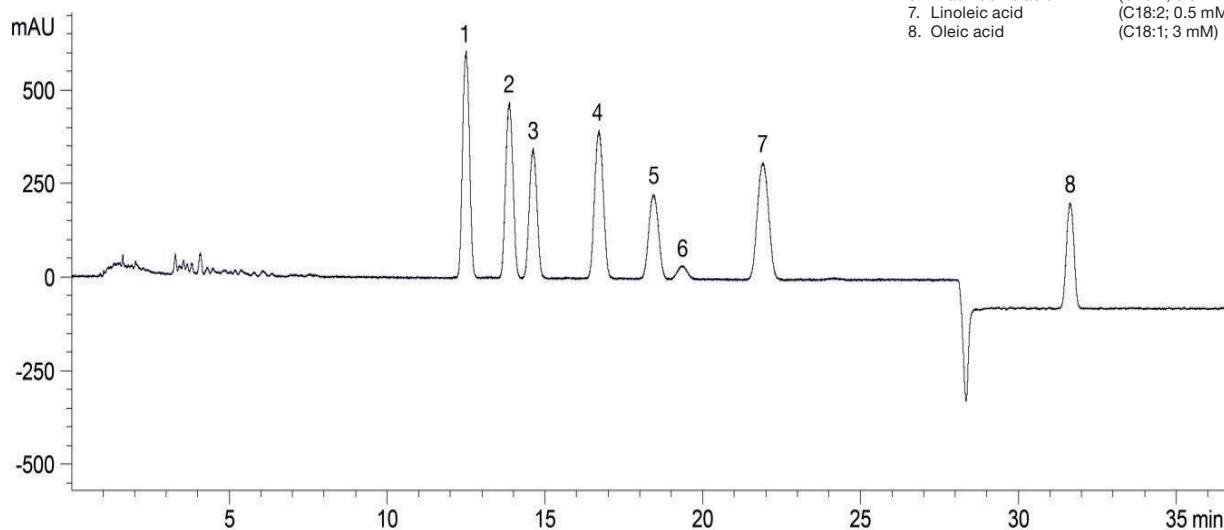
-50%



Part Nos.: TAR08S03-1503PTH/TAR08SP9-L5Q1PT  
 Eluent: THF/acetonitrile (10/90)  
 Temperature: 30 °C  
 Detection: UV at 265 nm

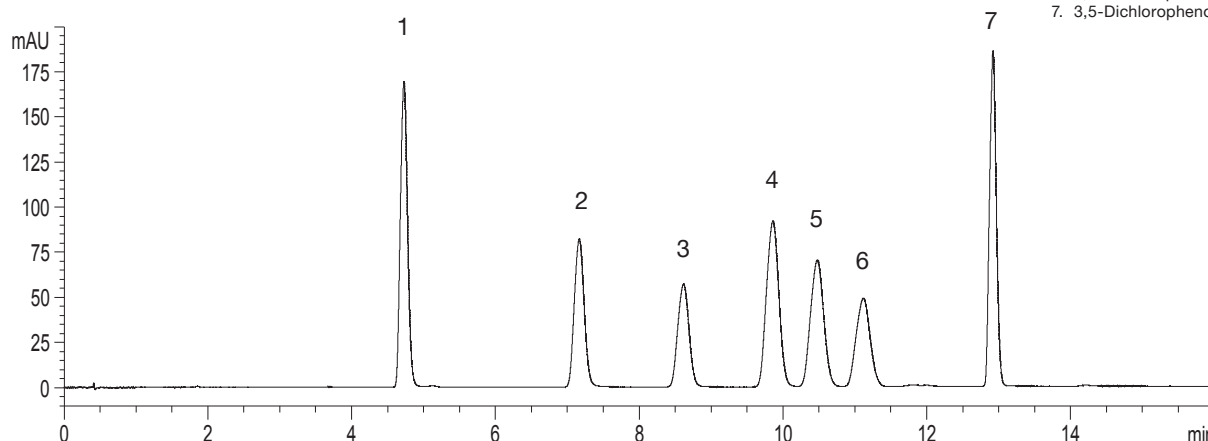
## Pharmaceuticals – YMC-Triart C18 ExRS

### Omega fatty acid isomers



Column: YMC-Triart C18 ExRS (3 μm, 8 nm) 150 × 4.6 mm ID  
 Part No.: TAR08S03-1546PTH  
 Eluent: A) H<sub>2</sub>O + 0.5% H<sub>3</sub>CCOOH  
 B) ACN + 0.5% H<sub>3</sub>CCOOH  
 Gradient: 76.5–78.5%B (0–2 min), 78.5%B (2–27 min), 78.5–90%B (27–27.1 min), 90%B (27.1–55 min)  
 Flow rate: 1.0 mL/min  
 Temperature: 35°C  
 Detection: UV at 254 nm  
 Injection: 20 μL

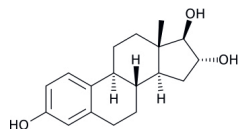
### Outstanding steric selectivity for chlorophenols



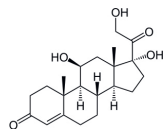
Column: YMC-Triart C18 ExRS (1.9 μm, 8 nm) 75 × 3.0 mm ID  
 Part No.: TAR08SP9-L503PT  
 Eluent: A) water + 0.1% HCOOH  
 B) methanol + 0.1% HCOOH  
 Gradient: 44–50%B (0–8.1 min), 50–51.5%B (8.1–11 min), 51.5–65%B (11–11.1 min), 65%B (11.1–20 min)  
 Flow rate: 0.7 mL/min  
 Temperature: 40°C  
 Detection: UV at 280 nm  
 Injection: 1 μL (0.7 mg/mL)

# Pharmaceuticals – YMC-Triart Phenyl

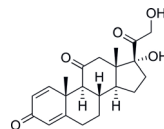
Excellent alternative to C18 phases for steroids



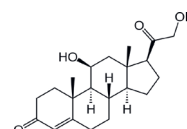
1. Estriol



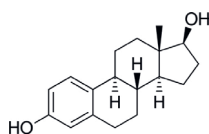
2. Cortisol/Hydrocortison



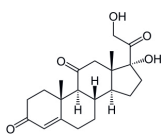
3. Prednisone



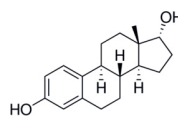
4. Corticosterone



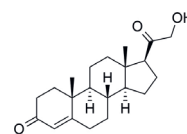
5. Beta-Estradiol



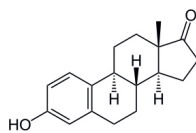
6. Cortisone/Cortison acetate



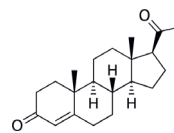
7. Alpha-Estradiol



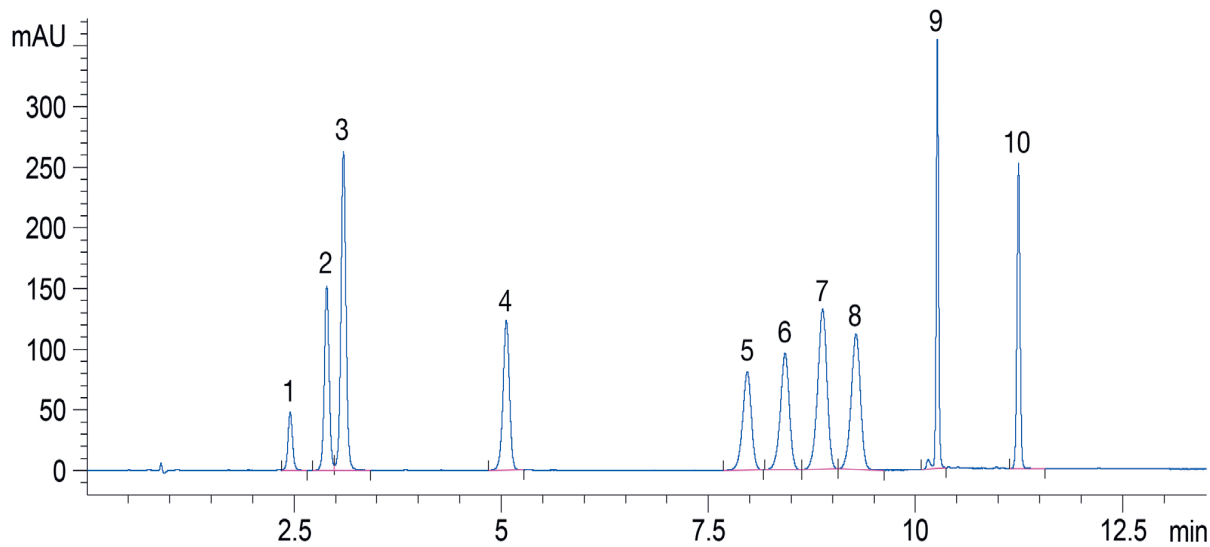
8. 21-Hydroxyprogesterone



9. Estrone



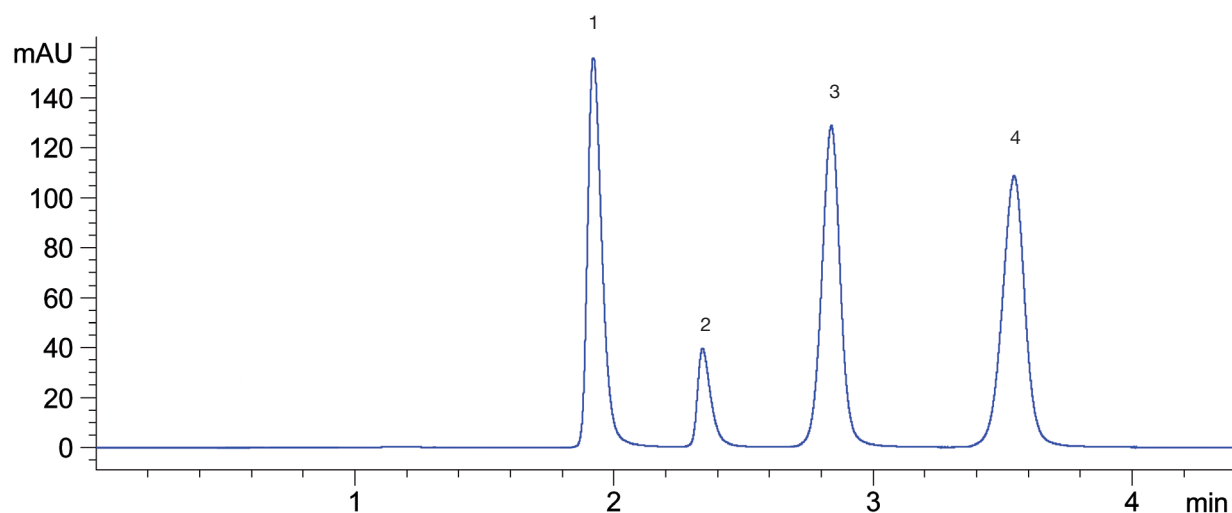
10. Progesterone



Column: YMC-Triart Phenyl (1.9  $\mu$ m, 12 nm) 100 x 2.0 mm ID  
 Part No.: TPH12SP9-1002PT  
 Eluent: A) water  
 B) acetonitrile  
 Gradient: 29–35%B (0–9 min), 35–60%B (9–9.1 min), 60%B (9.1–13.5 min)  
 Flow rate: 0.3 mL/min  
 Temperature: 48°C  
 Detection: UV at 220 nm  
 Injection: 0.5  $\mu$ L

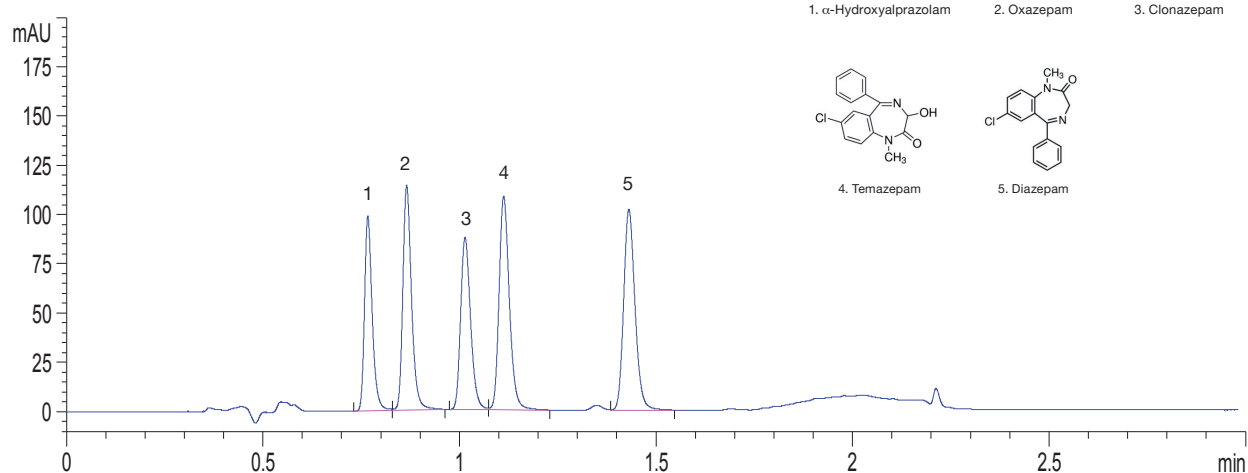
## Pharmaceuticals – YMC-Triart Phenyl

### Antidepressants



Column: YMC-Triart Phenyl (1.9  $\mu$ m, 12 mm) 100 x 2.0 mm ID  
 Part No.: TPH12SP9-1002PT  
 Eluent: methanol/25 mM  $\text{KH}_2\text{PO}_4$  (pH 6.0) (65/35)  
 Flow rate: 0.4 mL/min  
 Temperature: 25°C  
 Detection: UV at 254 nm  
 Injection: 2  $\mu$ L

### UHPLC separation of different benzodiazepines



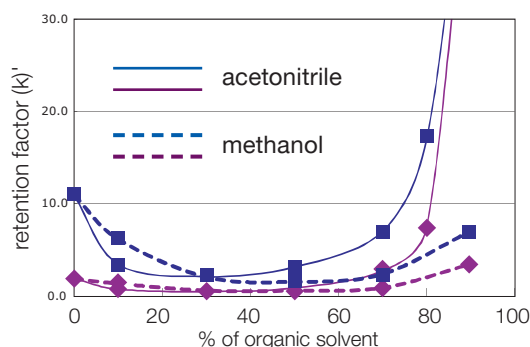
Column: YMC-Triart Phenyl (1.9  $\mu$ m, 12 mm) 100 x 2.0 mm ID  
 Part No.: TPH12SP9-1002PT  
 Eluent: A) water  
 B) acetonitrile  
 Gradient: 52–54%B (0–1.1 min), 54–95%B (1.1–1.2 min), 95%B (1.2–3 min)  
 Flow rate: 0.5 mL/min  
 Temperature: 35°C  
 Detection: UV at 254 nm  
 Injection: 2  $\mu$ L (0.02 mg/mL)

## Pharmaceuticals – YMC-Triart PFP

### Effect of organic solvent concentration on the retention of basic and zwitterionic compounds (under acidic conditions)

**Basic compound (■)**  
5-Hydroxytryptamine HCl (5-HT)  
(Serotonin HCl)

**Zwitterionic compound (◆)**  
Tyrosine (Tyr)



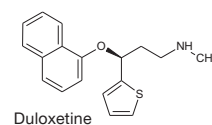
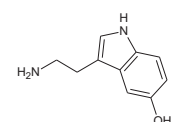
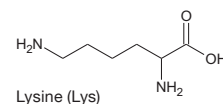
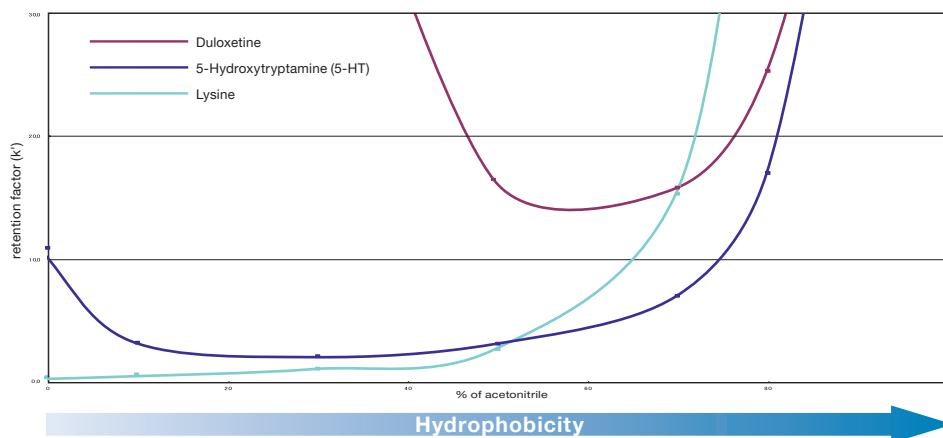
Column: YMC-Triart PFP (5  $\mu$ m, 12 nm) 50 x 4.6 mm ID  
Part No.: TPF12S05-0546PTH  
Eluent: A) water containing 10 mM formic acid  
B) acetonitrile or methanol containing 10 mM formic acid

Flow rate: 1.0 mL/min  
Temperature: 40 °C  
Detection: UV at 280 nm

The retention increases when using both mobile phase conditions containing organic solvent with less than 20% and more than 60% solvent. These RP and HILIC-like retention behaviours on the YMC-Triart PFP column are useful for optimising the separation of samples containing basic or zwitterionic compounds by the simple approach of changing organic solvent content.

Using high organic mobile phase conditions, acetonitrile provides stronger retention than methanol. Methanol may disturb the formation of the water-enriched layer on the surface of stationary phases by replacing water molecules.

### Retention of basic compounds with different hydrophobicity on PFP column



Column: YMC-Triart PFP (5  $\mu$ m, 12 nm) 50 x 4.6 mm ID  
Part No.: TPF12S05-0546PTH  
Eluent: A) water containing 10 mM formic acid  
B) acetonitrile containing 10 mM formic acid

Flow rate: 1.0 mL/min  
Temperature: 40 °C

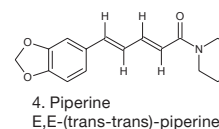
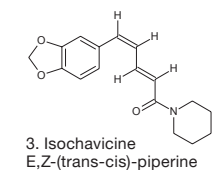
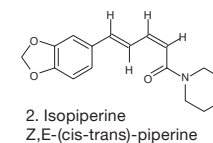
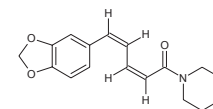
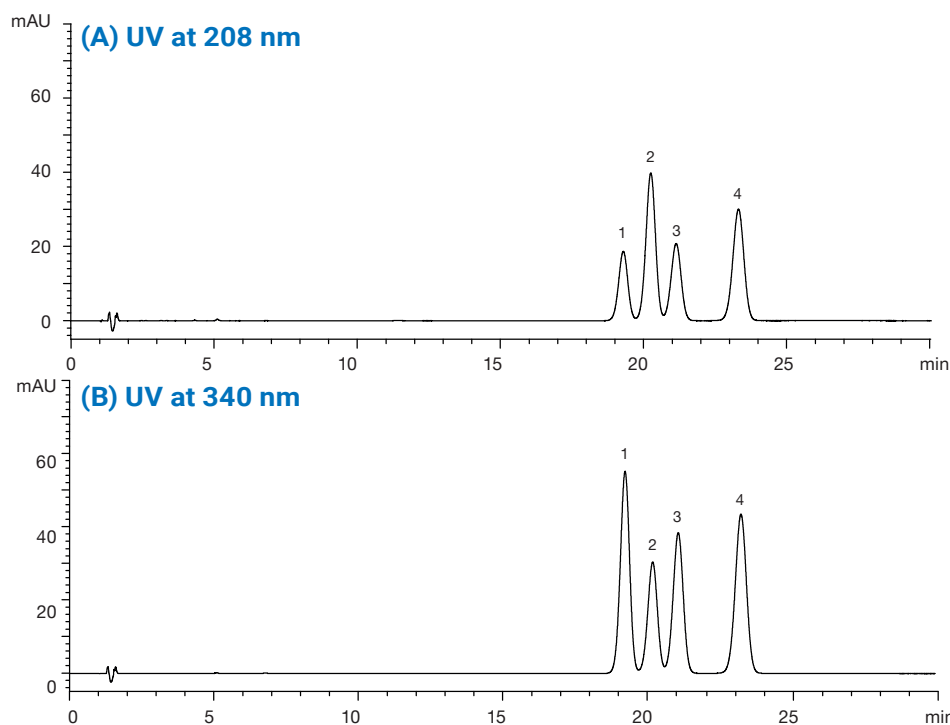
Retention behaviour is strongly dependent on the analyte hydrophobicity. Lysine shows increasing retention when using >50% acetonitrile, while 5-HT shows a similar behaviour, but with higher retention at <10% acetonitrile. Duloxetine can be eluted only between 50–70%, as no elution takes place due to its high hydrophobicity when using 0–30% or >90%.

**TIP**

Using high organic mobile phase conditions, acetonitrile provides stronger retention than methanol. Methanol may disturb the formation of the water-enriched layer on the surface of stationary phases by replacing water molecules.

## Pharmaceuticals – YMC-Triart PFP

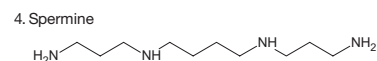
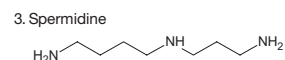
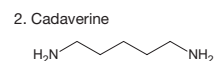
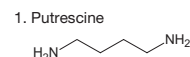
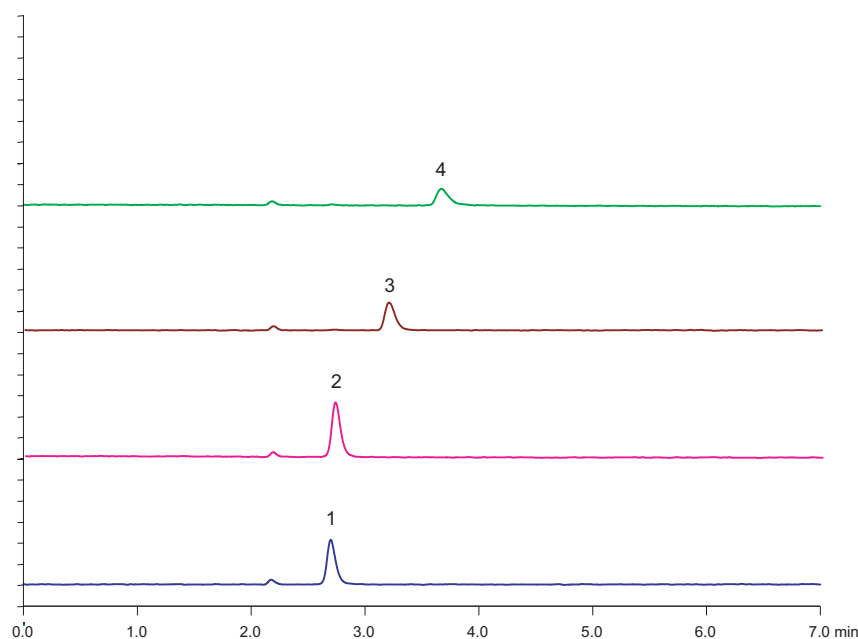
### Piperine and its isomers\*



Column: YMC-Triart PFP (5 µm, 12 nm) 150 x 3.0 mm ID  
Part No.: TPF12S05-1503PTH  
Eluent: 0.1% HCOOH/acetonitrile (60/40)

Flow rate: 0.425 mL/min  
Temperature: 25 °C  
Injection: 4.25 µL

### Biogenic polyamines

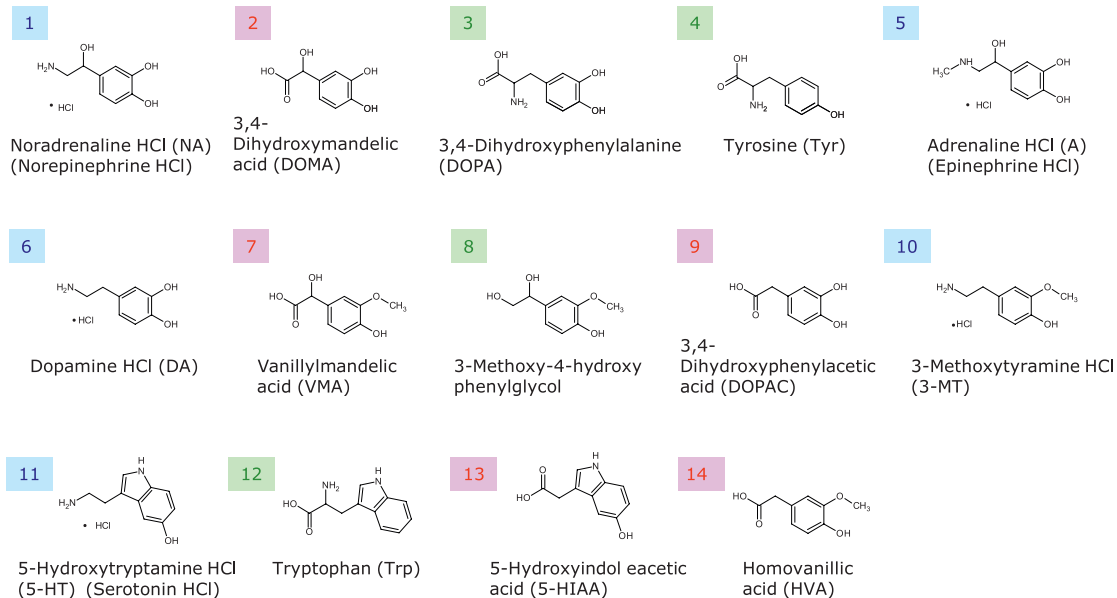


Column: YMC-Triart PFP (5 µm, 12 nm) 150 x 4.6 mm ID  
Part No.: TPF12S05-1546PTH  
Eluent: methanol/water (30/70) containing 10mM formic acid  
Flow rate: 1.0 mL/min

Temperature: 25 °C  
Detection: Corona® CAD® (Charged Aerosol Detector)  
Injection: 1 µL (25 µg/mL)

# Pharmaceuticals – YMC-Triart PFP

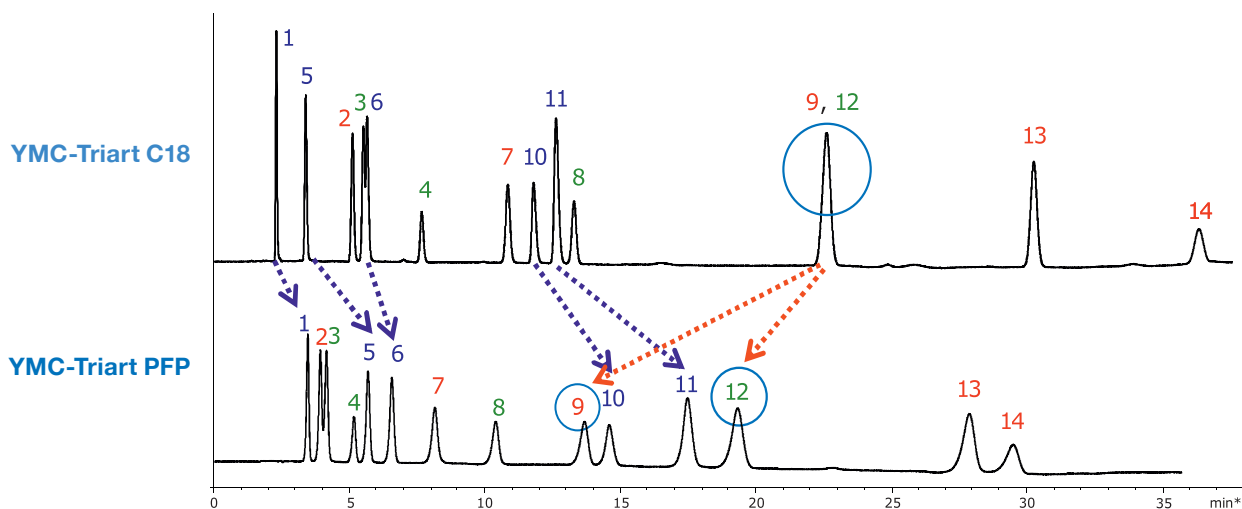
## Separation of catecholamines using YMC-Triart C18 compared to YMC-Triart PFP



acidic compound

neutral and zwitterionic compound

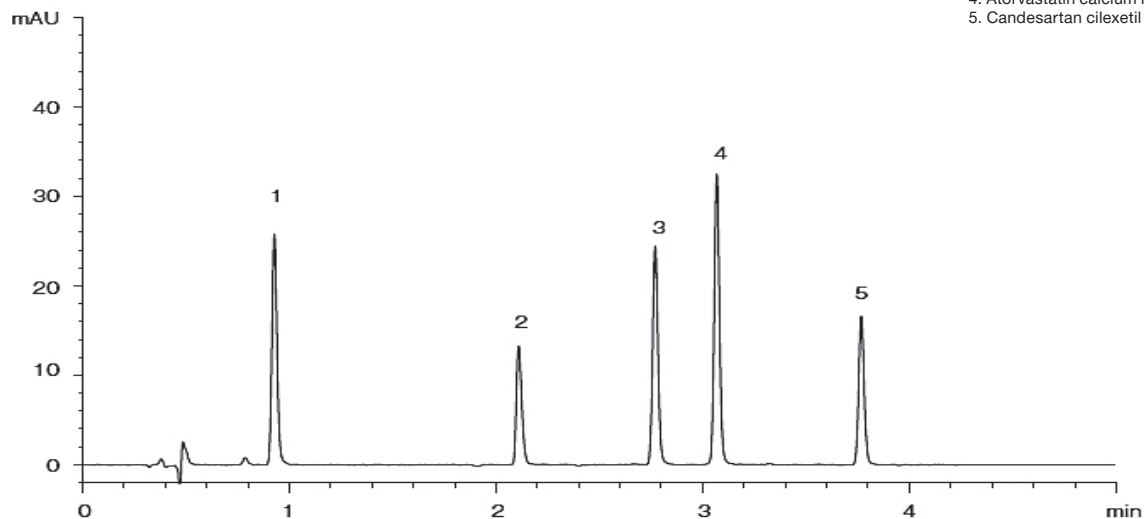
basic compound



Column: YMC-Triart C18 (5  $\mu$ m, 12 nm) 150 x 3 mm ID  
 YMC-Triart PFP (5  $\mu$ m, 12 nm) 150 x 3 mm ID  
 Part Nos.: TA12S05-1503PTH  
 TPF12S05-1503PTH  
 Eluent: A) 10 mM formic acid in water  
 B) 10 mM formic acid in methanol  
 Gradient: 0–20%B (0–30 min), 20%B (30–35 min)  
 Flow rate: 0.425 mL/min  
 Temperature: 25°C  
 Detection: UV at 280 nm

## Pharmaceuticals - YMC-Triart C8

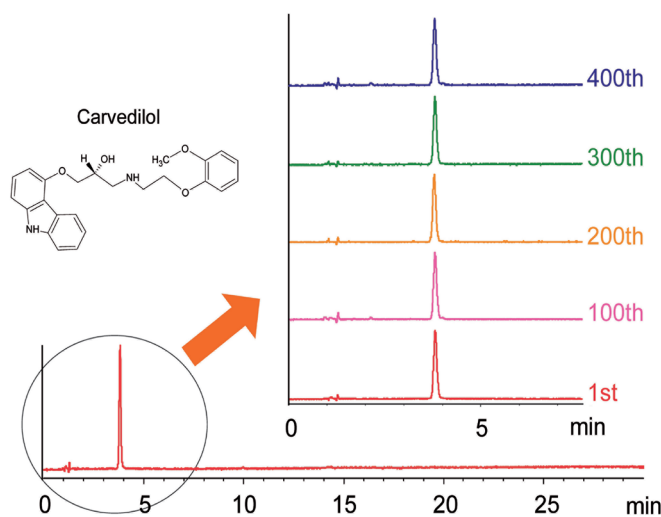
### Basic drugs



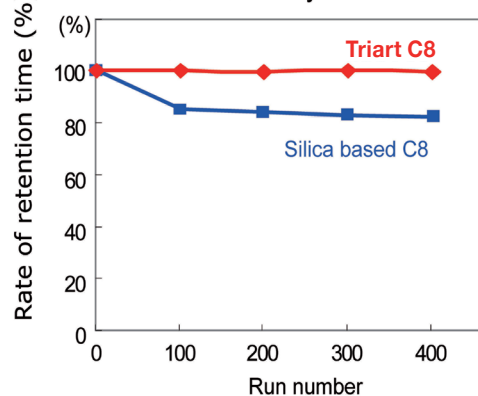
1. Hydrochlorothiazide
2. Amlodipine besilate
3. Valsartan
4. Atorvastatin calcium hydrate
5. Candesartan cilexetil

Column: YMC-Triart C8 (3  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TO12S03-0502WT  
 Eluent: A) water/formic acid (100/0.1)  
 B) acetonitrile/formic acid (100/0.1)  
 Gradient: 10-90%B (0-5 min), 90%B (5-7 min)  
 Flow rate: 0.4 mL/min  
 Temperature: 30°C  
 Detection: UV at 254 nm  
 Injection: 2  $\mu$ L (10-20  $\mu$ g/mL)

### Sequential analysis of Carvedilol



### Retention stability of carvedilol



Column: YMC-Triart C8 (5  $\mu$ m, 12 nm) 150 x 2.0 mm ID  
 Part No.: TO12S05-1502WT  
 Eluent: phosphate buffer (pH 2.0)\* / acetonitrile (65/35)  
 \*Dissolve 2.72 g of  $\text{KH}_2\text{PO}_4$  in 900 mL water, adjust pH 2.0 with  $\text{H}_3\text{PO}_4$  and add water to make 1,000 mL  
 Flow rate: 0.28 mL/min (adjust the flow rate so that the retention time of carvedilol is about 4 min)  
 Temperature: 55°C  
 Detection: UV at 240 nm

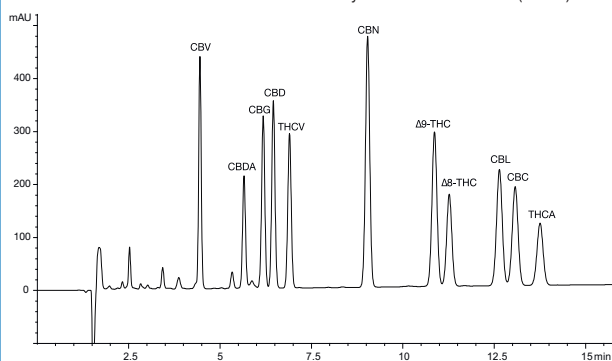
No change in retention time is observed even under a high pH and at an elevated temperature.



## Pharmaceuticals – (U)HPLC

### Separation of 11 cannabinoids

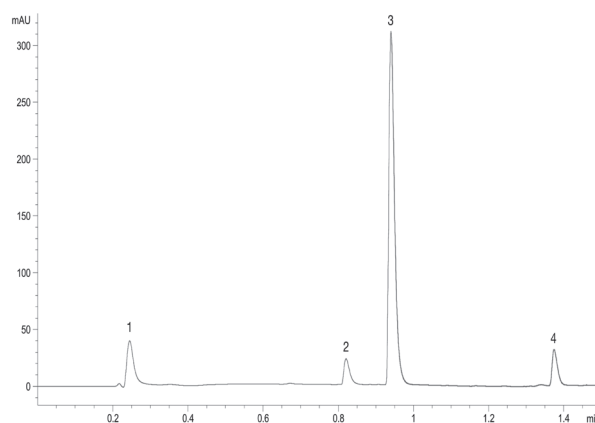
Cannabivarin (CBV)  
 Cannabidiolic acid (CBDA)  
 Cannabigerol (CBG)  
 Cannabidiol (CBD)  
 Tetrahydrocannabivarin (THCV)  
 Cannabinol (CBN)  
 Delta-9-tetrahydrocannabinol ( $\Delta^9$ -THC)  
 Delta-8-tetrahydrocannabinol ( $\Delta^8$ -THC)  
 Cannabicyclol (CBL)  
 Cannabichromene (CBC)  
 Tetrahydrocannabinolic acid (THCA)



Column: YMC-Triart C18 (3  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No: TA12S03-1546PTH  
 Eluent: A) 0.1 % formic acid in water  
 B) 0.1 % formic acid in acetonitrile  
 Gradients: 75–80%B (0–20 min)  
 Flow rate: 1.0 mL/min  
 Temperature: 35 °C  
 Detection: UV at 220 nm  
 Injection: 10  $\mu$ L  
 Sample: 11 Cannabinoids each 0.05 mg/mL diluted with acetonitrile/water (75/25)

### Nasal spray

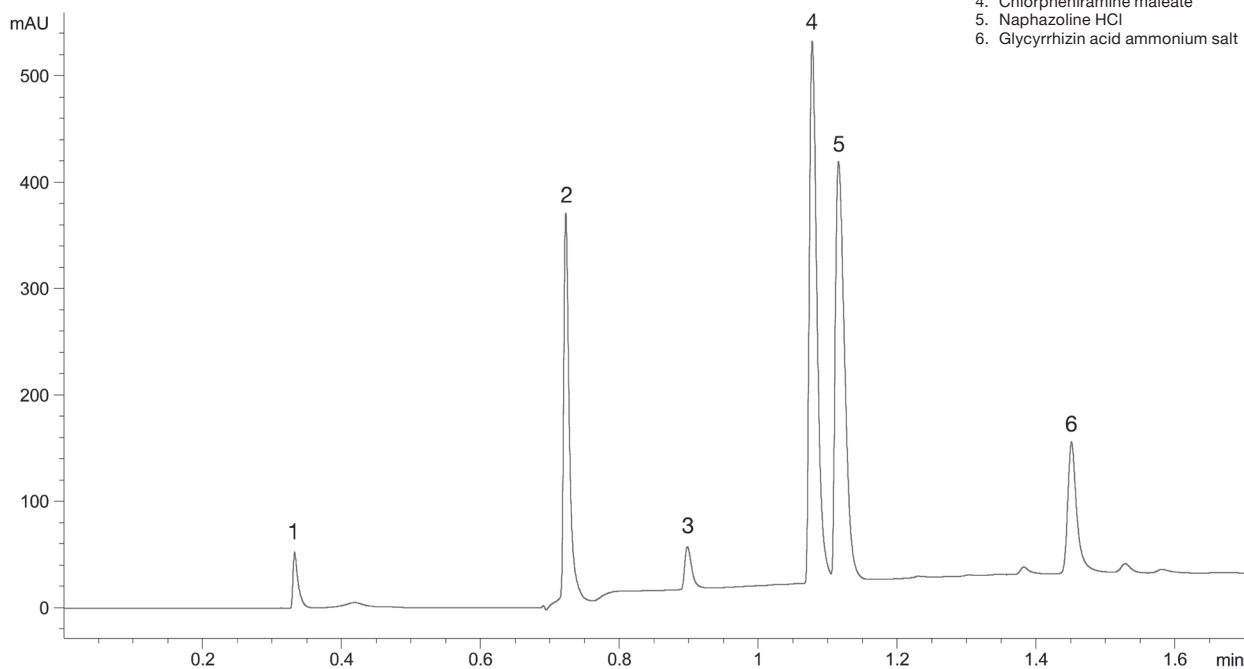
1. Maleic acid sodium salt  
 2. Tetrahydrozoline HCl  
 3. Chlorpheniramine maleate  
 4. Benzethonium chloride



Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: A) water + 0.05% TFA/  
 B) methanol (50/50)  
 Gradient: 20–90%B (0–0.5 min), 90–100%B (0.5–1.2 min)  
 Flow rate: 0.6 mL/min  
 Temperature: 40 °C  
 Detection: UV at 260 nm  
 Injection: 0.2  $\mu$ L

### Eye drop formulation

1. Maleic acid sodium salt  
 2. Pyridoxine  
 3. Neostigmine methylsulfate  
 4. Chlorpheniramine maleate  
 5. Naphazoline HCl  
 6. Glycyrrhizin acid ammonium salt

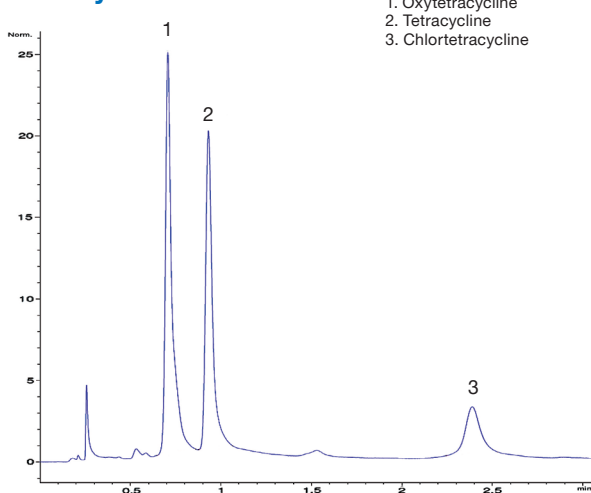


Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: A) water + 0.05% TFA  
 B) acetonitrile  
 Gradient: 0–50%B (0–1 min), 50%B (1–1.5 min), 50–90%B (1.5–1.7 min)

Flow rate: 0.6 mL/min  
 Temperature: 40 °C  
 Detection: UV at 265 nm  
 Injection: 0.5  $\mu$ L

# Pharmaceuticals – UHPLC

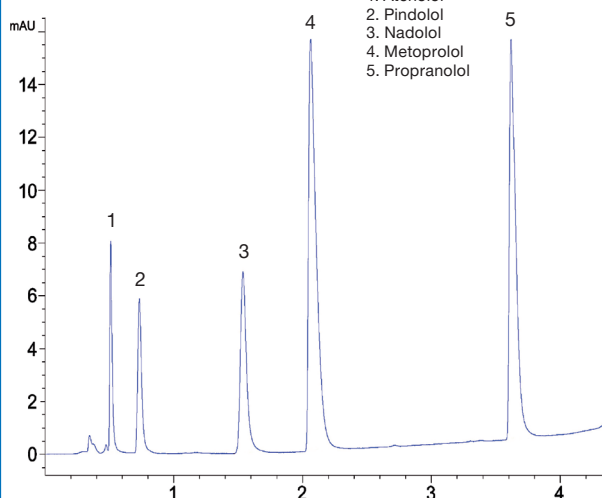
## Tetracycline antibiotics



1. Oxytetracycline
2. Tetracycline
3. Chlortetracycline

Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: 5 mM CH<sub>3</sub>COONH<sub>4</sub> / acetonitrile (87/13)  
 Flow rate: 0.65 mL/min  
 Temperature: 40 °C  
 Detection: UV at 280 nm  
 Injection: 1  $\mu$ L  
 Pressure: 662 bar

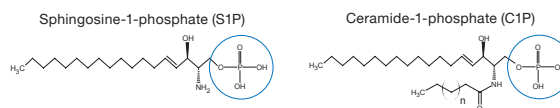
## Betablockers



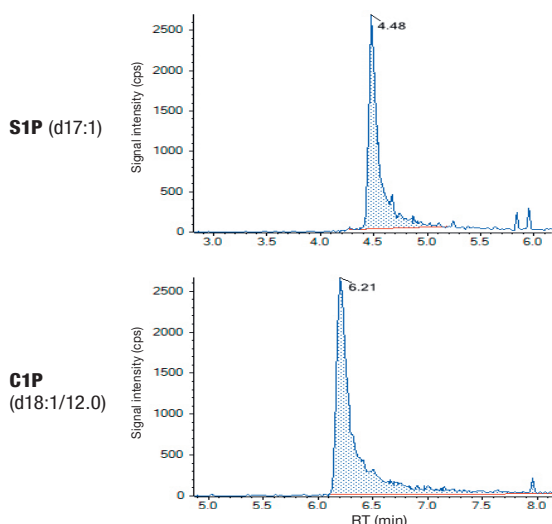
1. Atenolol
2. Pindolol
3. Nadolol
4. Metoprolol
5. Propranolol

Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: A) 20 mM CH<sub>3</sub>COONH<sub>4</sub> + ammonia (pH 9.0)  
           B) acetonitrile  
 Gradient: 25%B (1.0 min); 75%B (1–6 min)  
 Flow rate: 0.35 mL/min  
 Temperature: 40 °C  
 Detection: UV at 254 nm  
 Injection: 1  $\mu$ L  
 Pressure: 450 bar

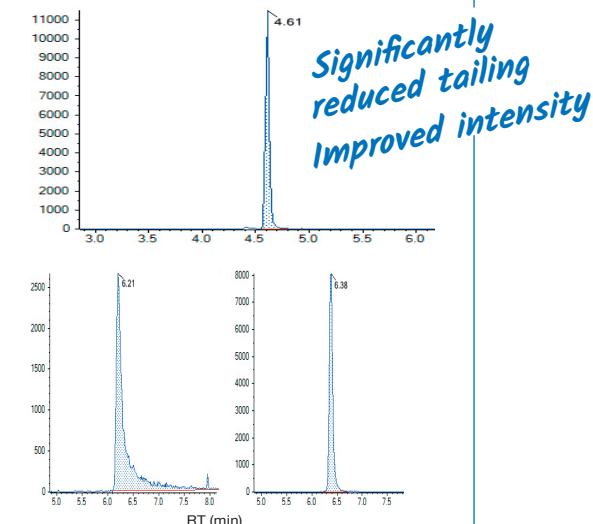
## High sensitivity for sphingophospholipids



Standard C18 column with conventional stainless steel hardware (1.8  $\mu$ m, 50 x 2.1 mm ID)



YMC-Triart C18 metal-free PEEK-lined column (1.9  $\mu$ m, 50 x 2.1 mm ID)



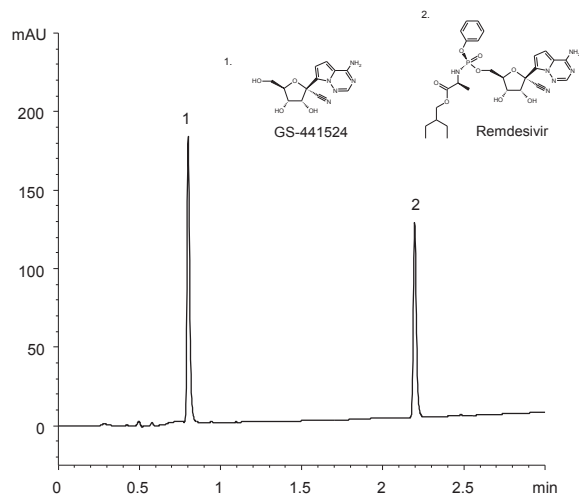
Part No.: TA12SP9-05Q1PTP  
 Eluent: A) methanol/acetonitrile/water (1/1/3) containing X  
           B) 2-propanol containing X  
           X: 5 mM ammonium acetate, 500 nM EDTA and 0.025% NH<sub>3</sub> water  
 Gradient: 0%B (0–1 min), 0–50%B (1–5 min), 50–64%B (5–11 min),  
 64–95%B (11–13 min), 95%B (13–15 min), 0%B (15–20 min)

Flow rate: 0.25 mL/min  
 Temp.: 40 °C  
 Detection: ESI, positive  
 Injection: 1  $\mu$ L  
 Instrument: LC) Waters ACQUITY UPLC H-class system  
 MS) AB Sciex QTRAP 6500

Reference: Siddabasave Gowda B. Gowda, Kazutaka Ikeda, Makoto Arita, Facile determination of sphingolipids under alkali condition using metal-free column by LC-MS/MS, Analytical and Bioanalytical Chemistry, 410 (20): 4793-4803 AUG 2018

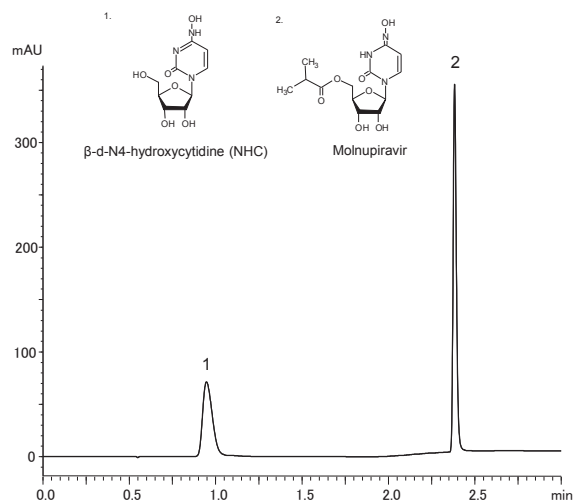
# Pharmaceuticals – UHPLC

## SARS-CoV-2 drug remdesivir and active metabolite



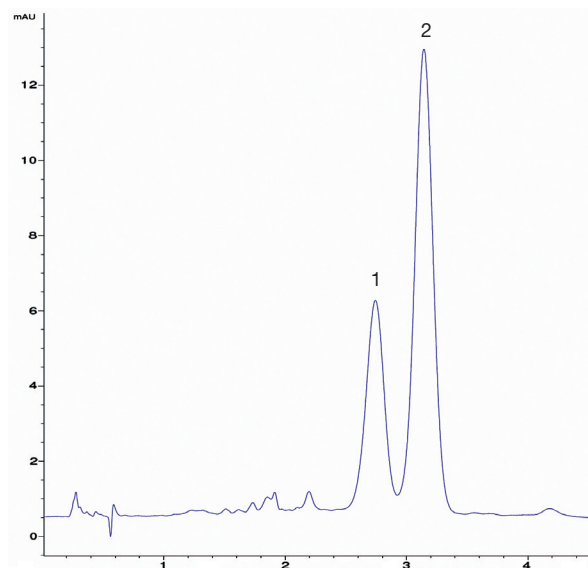
Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.1 mm ID  
 Part no.: TA12SP9-05Q1PT  
 Eluent: A) water/formic acid (100/0.1)  
 B) acetonitrile/formic acid (100/0.1)  
 Gradient: 5–90%B (0–3 min)  
 Flow rate: 0.4 mL/min  
 Temperature: 40 °C  
 Detection: UV at 254 nm  
 Injection: 2  $\mu$ L (0.025 mg/mL, 0.05 mg/mL)

## COVID-19 agent molnupiravir



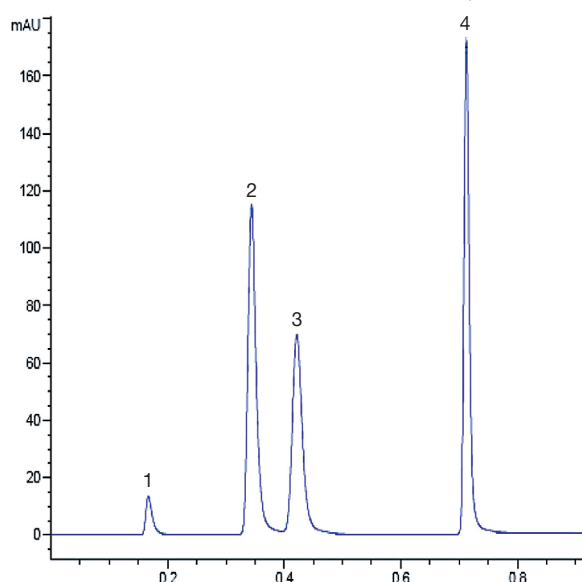
Column: YMC Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.1 mm ID  
 Part No.: TA12SP9-05Q1PT  
 Eluent: A) 10 mM HCOONH<sub>4</sub>-HCOOH (pH 4.3)  
 B) 100 mM HCOONH<sub>4</sub>-HCOOH (pH 4.3)/acetonitrile (10/90)  
 Gradient: 0–30%B (0–0.6 min), 30%B (0.6–2.6 min)  
 Flow rate: 0.4 mL/min  
 Temperature: 40 °C  
 Detection: UV at 250 nm  
 Injection: 1  $\mu$ L (0.05mg/mL, 0.1 mg/mL)

## Macrolide antibiotics



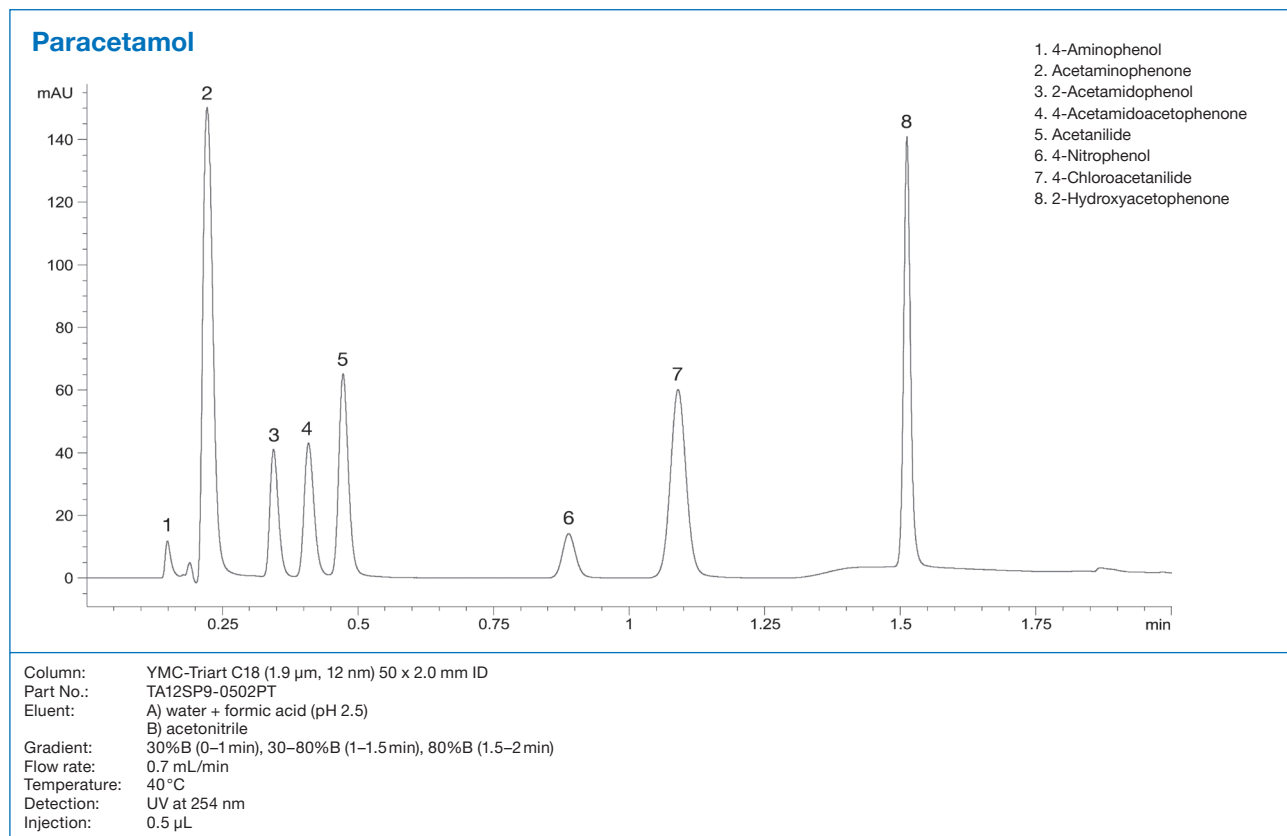
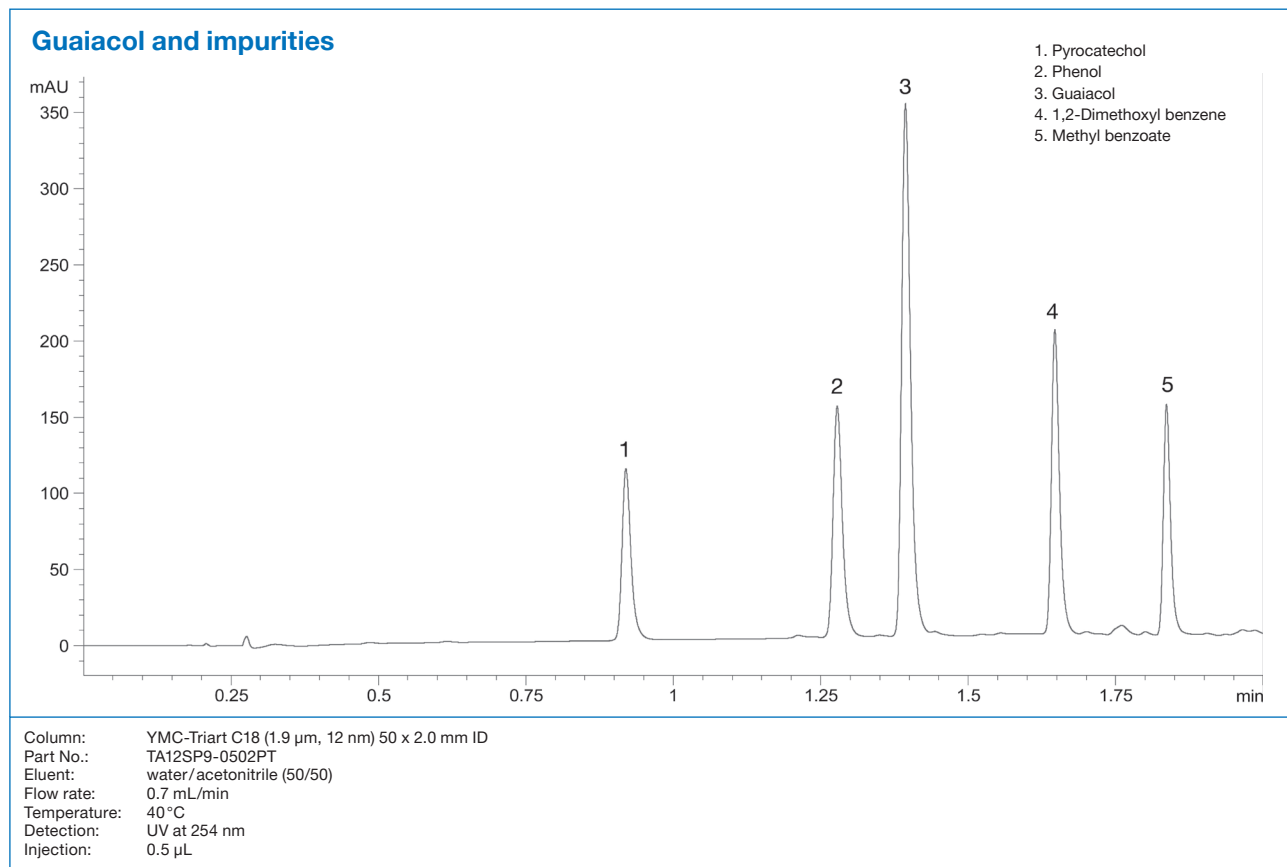
Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: A) 20 mM K<sub>2</sub>HPO<sub>4</sub> + 20 mM KH<sub>2</sub>PO<sub>4</sub> (pH 7.9)  
 B) acetonitrile  
 Gradient: 60%B (0.5 min); 60–70%B (0.5–1.5 min); 70%B (3.5 min)  
 Flow rate: 0.45 mL/min  
 Temperature: 50 °C  
 Detection: UV at 210 nm  
 Injection: 1  $\mu$ L  
 Pressure: 520 bar

## Sulpha drugs



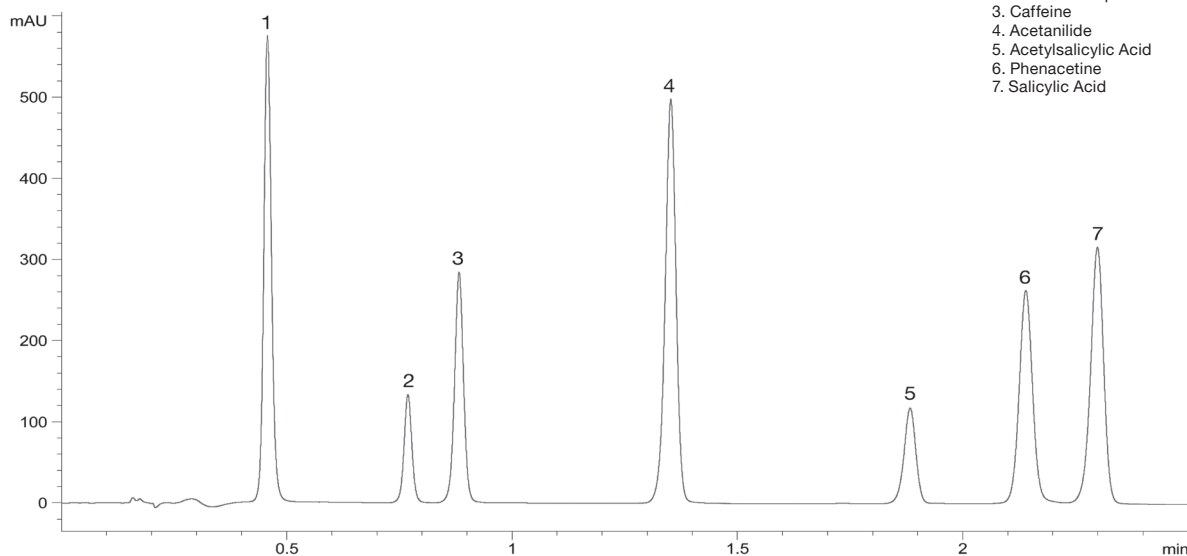
Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: H<sub>2</sub>O + formic acid (pH 2.5)/acetonitrile (75/25)  
 Flow rate: 0.75 mL/min  
 Temperature: 50 °C  
 Detection: UV at 280 nm  
 Injection: 0.5  $\mu$ L  
 Pressure: 740 bar

# Pharmaceuticals – UHPLC



# Pharmaceuticals – UHPLC

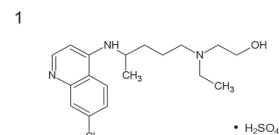
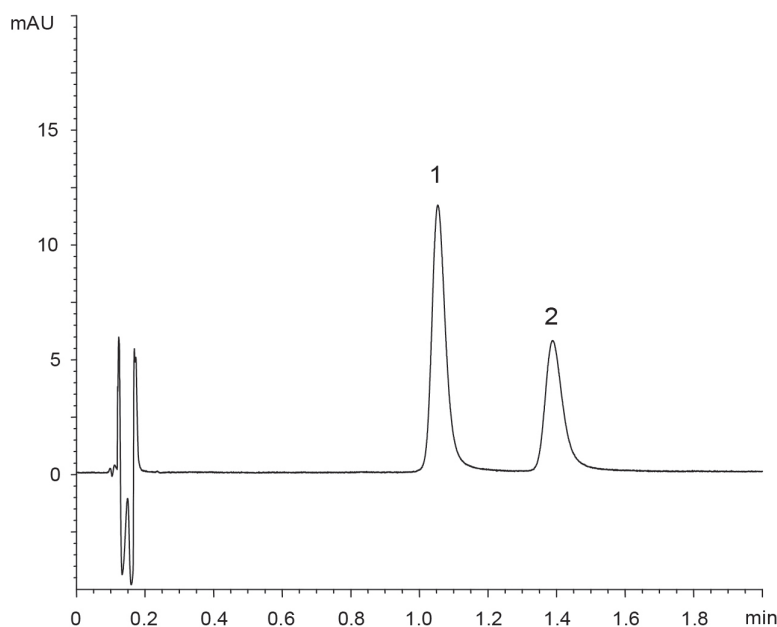
## 7 Analgesics



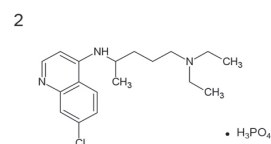
- 1. Acetaminophene
- 2. 2-Acetamidophenol
- 3. Caffeine
- 4. Acetanilide
- 5. Acetylsalicylic Acid
- 6. Phenacetine
- 7. Salicylic Acid

Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: water + formic acid (pH 2.5)/acetonitrile (50/50)  
 Flow rate: 0.8 mL/min  
 Temperature: 40 °C  
 Detection: UV at 240 nm  
 Injection: 1  $\mu$ L

## Hydroxychloroquine and chloroquine



Hydroxychloroquine sulfate



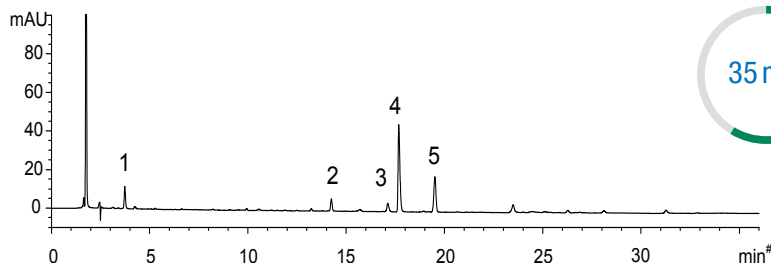
Chloroquine phosphate

Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: 20 mM HCOOH-HCOONH<sub>4</sub> (pH 4.3)/acetonitrile (90/10)  
 Flow rate: 1.0 mL/min  
 Temperature: 25 °C  
 Detection: UV at 254 nm  
 Injection: 2  $\mu$ L (10  $\mu$ g/mL)

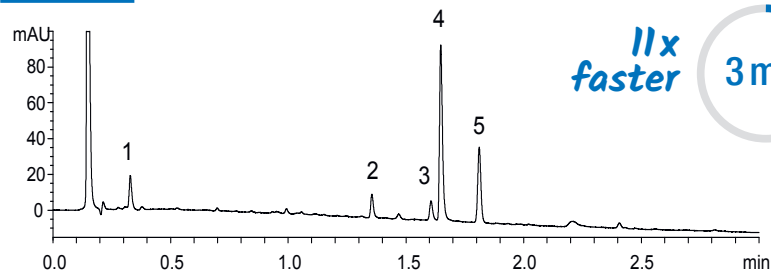
# Pharmaceuticals/Environmental – UHPLC

## Duloxetine and its degradation products

**HPLC** 5 μm, 150 x 3.0 mm ID



**UHPLC** 1.9 μm, 50 x 2.0 mm ID

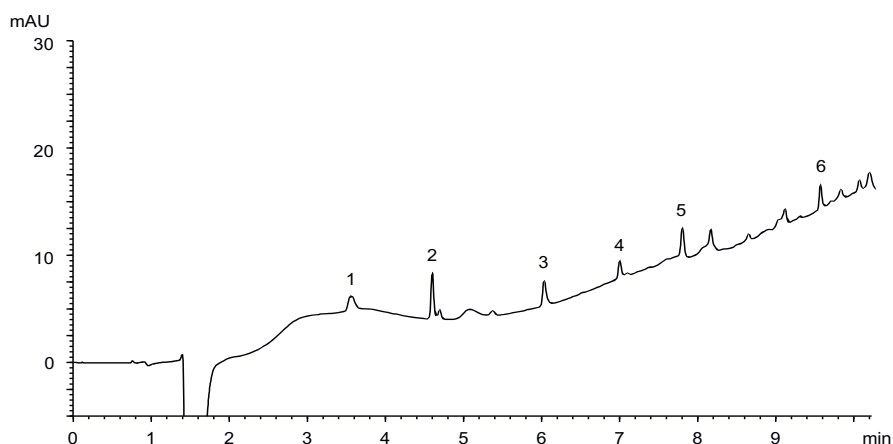


1.   
Amino alcohol  
(3-Methylamino-1-thiophen-2-yl-propan-1-ol)
2.   
Para isomer  
(4-(3-Methylamino-1-thiophen-2-yl-propyl)-naphthalen-1-ol)
3.   
Ortho isomer  
(2-(3-Methylamino-1-thiophen-2-yl-propyl)-naphthalen-1-ol)
4.   
Duloxetine hydrochloride
5.   
α-Naphthol

Column: YMC-Triart C18  
 Part Nos.: TA12S05-1503PTH / TA12SP9-0502PT  
 Flow rate: 0.425 mL/min / 0.8 mL/min  
 Gradient: 10–90%B (0–36 min) / 10–90%B (0–3 min)  
 Injection: 6 μL / 1 μL  
 Eluent: A) 10 mM CH<sub>3</sub>COONH<sub>4</sub> (pH 6.0)  
 B) acetonitrile  
 Temperature: 30 °C  
 Detection: UV at 230nm  
 Sample: Oxidative degradation products of duloxetine hydrochloride\*

\* Sample preparation was performed as described by Veera Reddy. Arava et al. Der Pharma Chemica, 2012 4 (4): 1735-1741

## 6 common nitrosamines

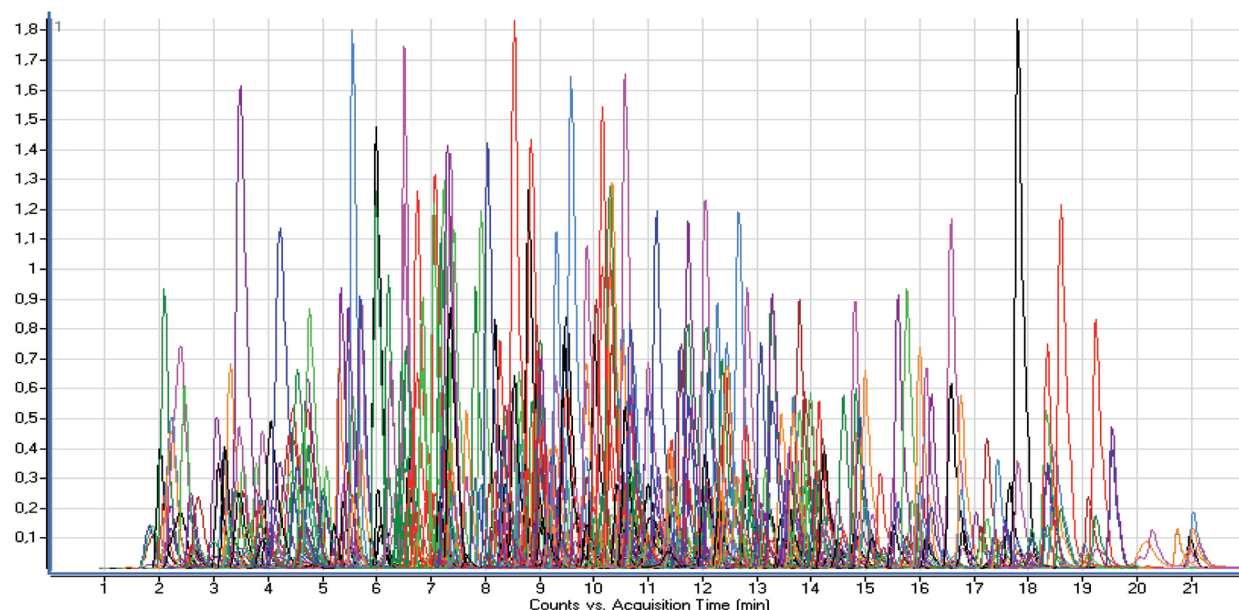


1. N-Nitrosodimethylamine (NDMA)
2. N-Nitroso-N-methyl-4-aminobutyric acid (NMBA)
3. N-Nitrosodiethylamine (NDEA)
4. N-Nitrosoisopropylethylamine (NIPEA)
5. N-Nitrosodiisopropylamine (NDIPA)
6. N-Nitrosodibutylamine (NDBA)

Column: YMC-Triart C18 (1.9 μm, 12 nm) 100 x 2.0 mm ID  
 Part no.: TA12SP9-1002PT  
 Eluent: A) water/formic acid (100/0.1)  
 B) methanol/formic acid (100/0.05)  
 Gradient: 0–95%B (0–10 min)

Flow rate: 0.2 mL/min  
 Temperature: 40 °C  
 Detection: UV at 245 nm  
 Injection: 40 μL (10 ng/mL)

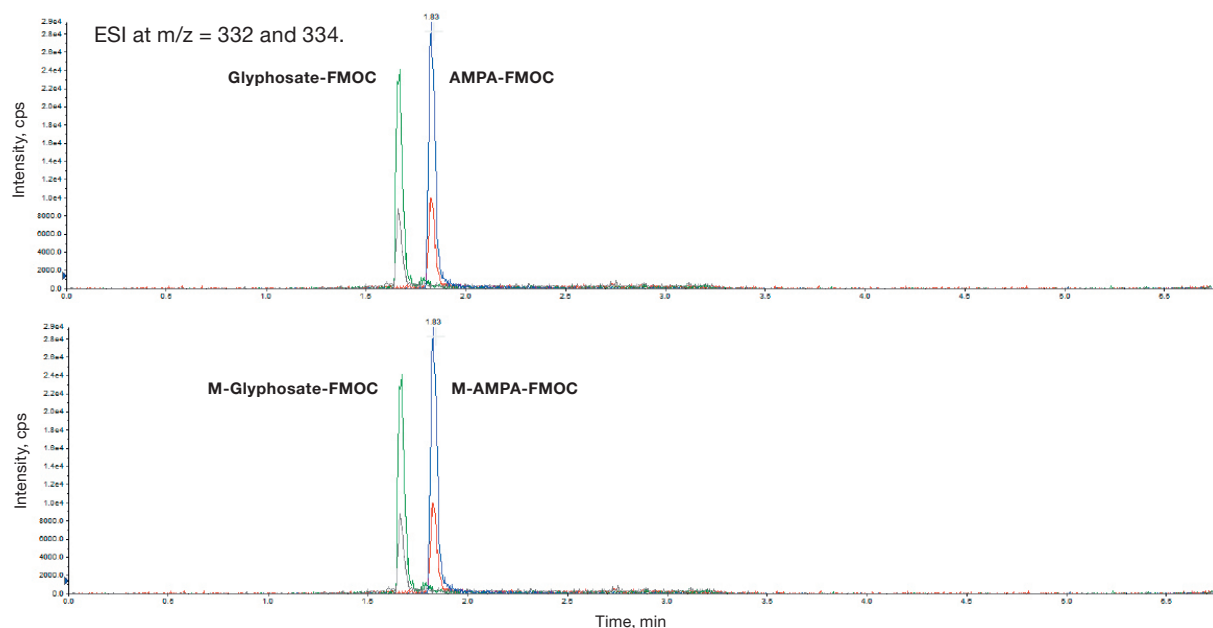
## Analysis of 360 pesticides in a single run



Column:	YMC-Triart C18 (3 $\mu$ m, 12nm) 100 x 2.0 mm ID	Total run time:	30 min
Part No.:	TA12S03-1002WT	Flow rate:	0.25 mL/min
Eluent:	A) 5 mM ammonium formate/water B) 5 mM ammonium formate/methanol	Temperature:	45 °C
Gradient:	30-50%B (0-0.1 min), 50-100%B (0.1-18 min), 100%B (18-21 min), 100-30%B (21-21.01 min), 30%B (21.01-29 min)	Detection:	ESI-MS
		Injection:	5 $\mu$ L
		Sample:	100 ng/mL pesticide mix in acetonitrile

Application data by courtesy of: József László  
WIREC, WESSLING International Research and Educational Centre Nonprofit Co. (Hungary)

## Glyphosate and AMPA according to DIN ISO 16308

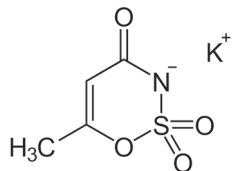


Column:	YMC-Triart C18 (1.9 $\mu$ m, 12nm) 75 x 2.1 mm ID	Flow rate:	0.4 mL/min
Part No.:	TA12SP9-L5Q1PT	Temperature:	40 °C
Eluent:	A) 0.1% triethylamine in H <sub>2</sub> O (adjusted to pH 9.5 with glacial acetic acid) B) acetonitrile	Detection:	MS (ABSciex QTrap 6500+) in negative MRM mode
Gradient:	5%B (0-2.1 min), 5-65%B (2.1-4 min), 65-95%B (4-4.8 min), 95-5%B (4.8-5 min), 5%B (5-10 min)	Injection:	20 $\mu$ L (800 ng/L)

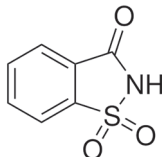
Application data by courtesy of: Dr. Dirk Skutlarek, Universitätsklinikum Bonn, Institut für Hygiene und Öffentliche Gesundheit, Bonn, Germany.

# Food – LC/MS

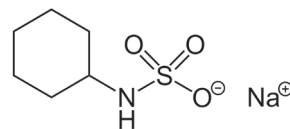
## Determination of artificial sweeteners using LC-MS/MS



Acesulfame (K salt)

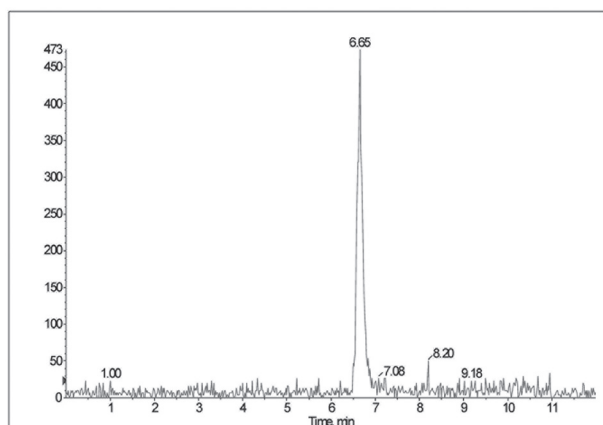


Saccharin

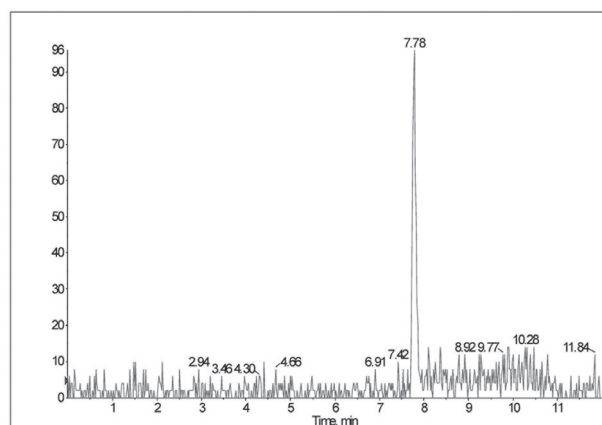


Cyclamate Na

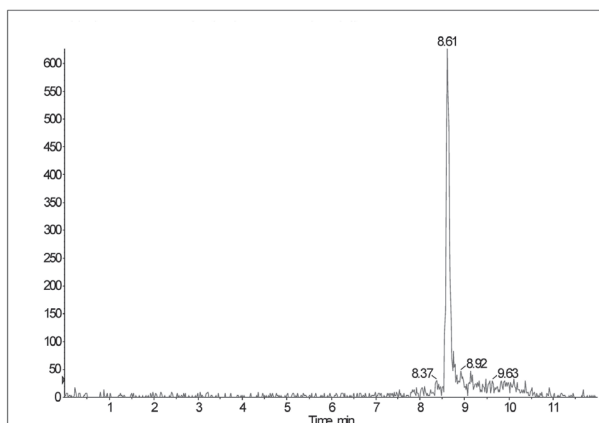
### → Non biological markers of wastewater entries in ground and surface water



Extracted Ion Chromatogram (XIC) of Acesulfame K, 0.1 µg/L



Extracted Ion Chromatogram (XIC) of Saccharin, 0.1 µg/L



Extracted Ion Chromatogram (XIC) of Cyclamate Na, 0.1 µg/L

Column: YMC-Triart C18 (1.9 µm, 12 nm) 100 x 3.0 mm ID  
 Part-No.: TA12SP9-1003PT  
 LC-System: Agilent 1100 HPLC system and CTC Analytics  
 HTC-Pal Autosampler

MS/MS System: Applied Biosystems MDS Sciex API 4000,  
 ESI negative

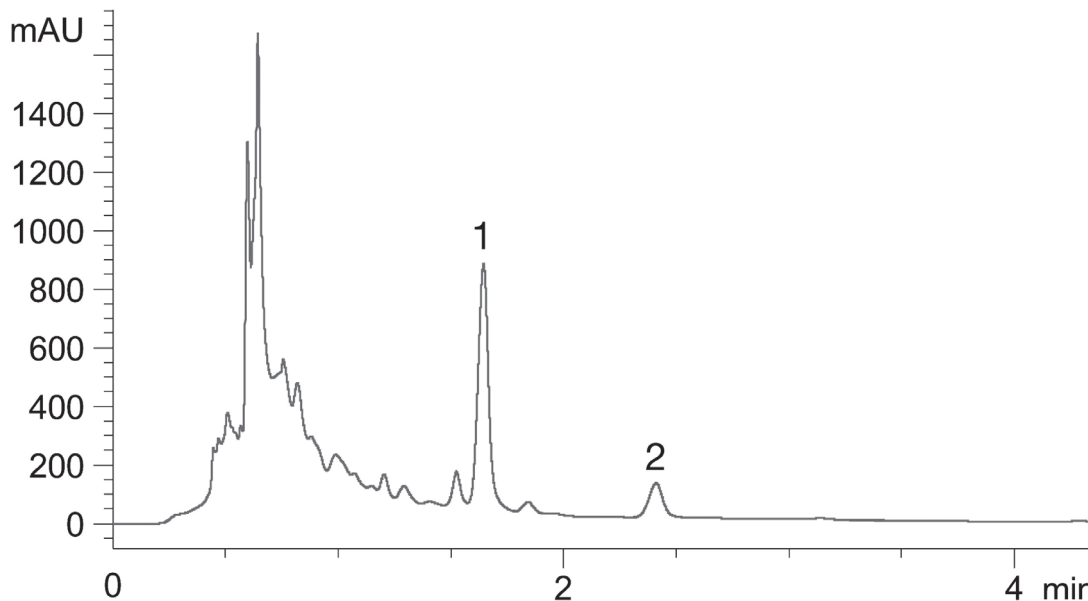
Temperature: 35 °C  
 Flow: 0.3 mL/min  
 Injection: 40 µL, direct injection  
 Eluent: A) water (containing 10 mmol NH<sub>4</sub> formate)  
 B) methanol (containing 10 mmol NH<sub>4</sub> formate)  
 Gradient: 2–75%B (0–6 min), 75–2%B (6–6.1 min), 2%B (6.1–12 min)

Application data by courtesy of: Thomas Class, Sandro Jooß, PTRL Europe, Helmholtzstraße 22, Science Park I, D-89081 Ulm



**Stevia leaves**

- 1. Stevioside hydrate
- 2. Rebaudioside A

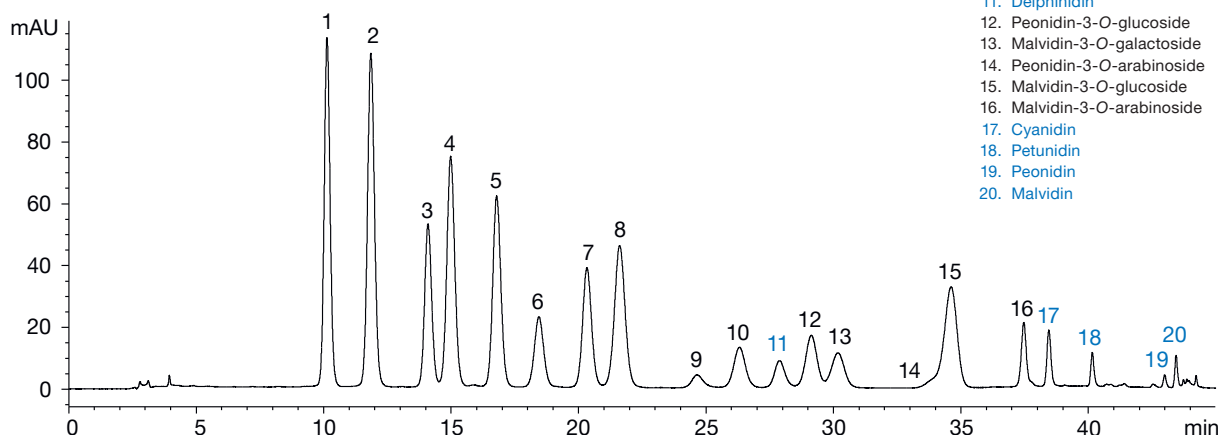


Column: YMC-Triart Diol-HILIC (1.9 μm, 12 nm) 100 x 3.0 mm ID  
 Part No.: TDH12SP9-1003PT  
 Eluent: acetonitrile/water (85/15)  
 Flow rate: 1.0 mL/min  
 Temperature: 30 °C  
 Detection: UV at 200 nm  
 Injection: 2 μL

**Analysis of anthocyanins and anthocyanidins**

**Anthocyanins:** Indicated in black  
**Anthocyanidins:** Indicated in blue

- 1. Delphinidin-3-O-galactoside
- 2. Delphinidin-3-O-glucoside
- 3. Cyanidin-3-O-galactoside
- 4. Delphinidin-3-O-arabinoside
- 5. Cyanidin-3-O-glucoside
- 6. Petunidin-3-O-galactoside
- 7. Cyanidin-3-O-arabinoside
- 8. Petunidin-3-O-glucoside
- 9. Peonidin-3-O-galactoside
- 10. Petunidin-3-O-arabinoside
- 11. Delphinidin
- 12. Peonidin-3-O-glucoside
- 13. Malvidin-3-O-galactoside
- 14. Peonidin-3-O-arabinoside
- 15. Malvidin-3-O-glucoside
- 16. Malvidin-3-O-arabinoside
- 17. Cyanidin
- 18. Petunidin
- 19. Peonidin
- 20. Malvidin

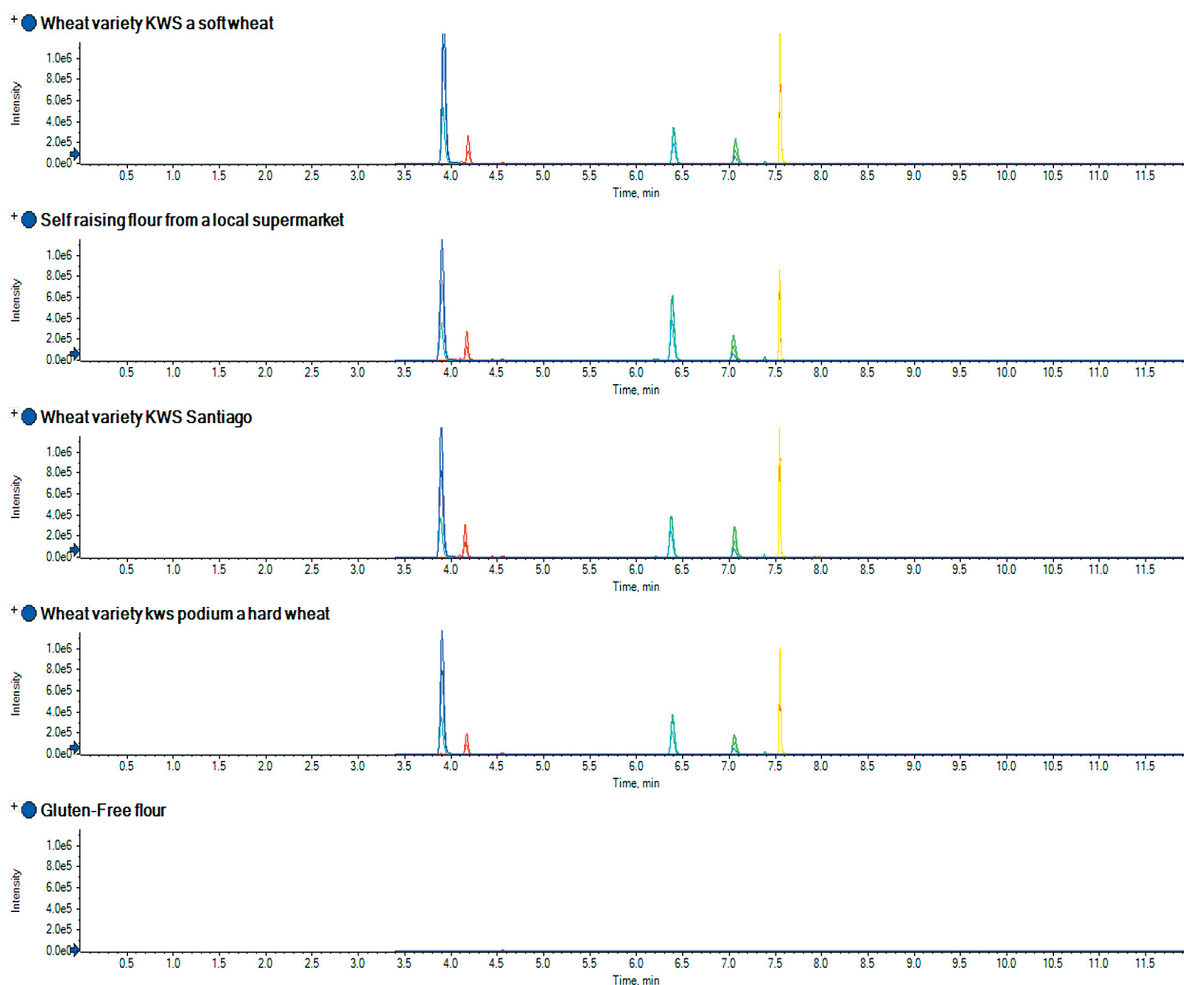


Column: YMC-Triart C18 (5 μm, 12 nm) 250 x 4.6 mm ID  
 Part No.: TA12S05-2546PTH  
 Eluent: A) water/formic acid (90/10)  
 B) acetonitrile/methanol/water/formic acid (22.5/22.5/40/10)  
 Gradient: 20–28%B (0–30 min),  
 28–70%B (30–40 min),  
 100%B (40–45 min)

Flow rate: 1.0 mL/min  
 Temperature: 25 °C  
 Detection: UV/VIS at 535 nm  
 Sample: commercial bilberry powder  
 (1.25 mg/mL)

# Food – MicroLC

## MicroLC-MS/MS analysis of gluten markers in flour



Column: YMC-Triart C18 (12 nm, 3  $\mu$ m) 100 x 0.5 mm ID, 1/32" end fittings  
 Part No.: TA12S03-10J0RU  
 Eluent: A) H<sub>2</sub>O + 0.1% formic acid  
           B) acetonitrile + 0.1% formic acid  
 Gradient: 5%B (0–1 min), 25%B (6 min), 95%B (8–9 min), 5%B (9.2–12 min)  
 Flow rate: 25  $\mu$ L/min  
 Temperature: 40  $^{\circ}$ C  
 Detection: SCIEX 5500 QTRAP, ESI  
 Injection: 10  $\mu$ L  
 LC system: Eksigent ekspert MicroLC 200

Application data by courtesy of: Stephen Lock, SCIEX, Warrington (UK)



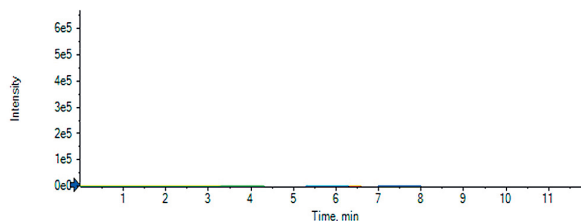
# Food – MicroLC

## MicroLC-MS/MS analysis of wheat or oat markers for gluten in cookies

+ ● Gluten-Free cake mix - MRMs for wheat markers



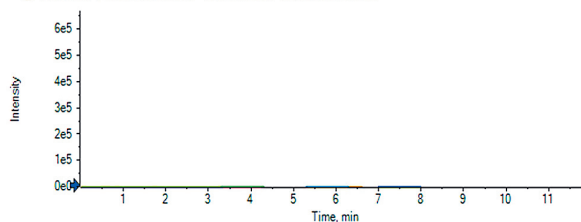
+ ● Gluten-Free cake mix - MRMs for oats markers



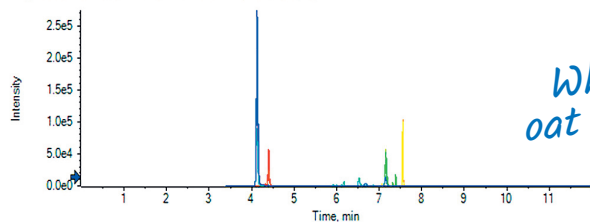
+ ● Gluten-Free cookies - MRMs for wheat markers



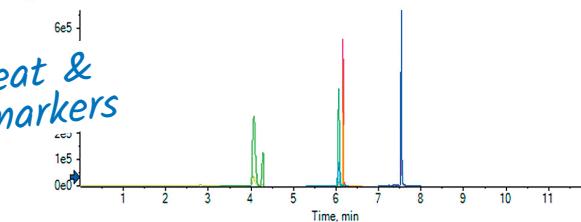
+ ● Gluten-Free cookies - MRMs for oats markers



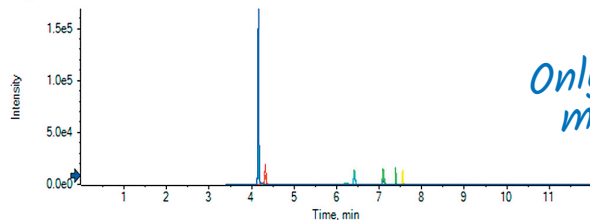
+ ● Oat cookies - MRMs for wheat markers



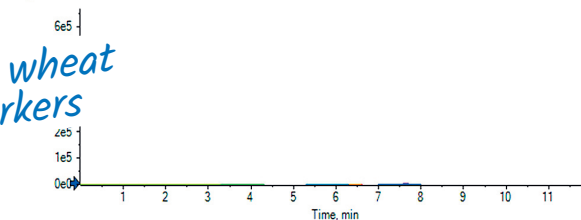
+ ● Oat cookies - MRMs for oats markers



+ ● Wheat cookies - MRMs for wheat markers



+ ● Wheat cookies - MRMs for oats markers



Column: YMC-Triart C18 (12 nm, 3 μm) 100 x 0.5 mm ID, 1/32" end fittings  
 Part No.: TA12S03-10J0RU  
 Eluent: A) H<sub>2</sub>O + 0.1% formic acid  
 B) acetonitrile + 0.1% formic acid  
 Gradient: 5%B (0–1 min), 25%B (6 min), 95%B (8–9 min), 5%B (9.2–12 min)

Flow rate: 25 μL/min  
 Temperature: 40°C  
 Detection: SCIEX 5500 QTRAP, ESI  
 Injection: 10 μL  
 LC system: Eksigent ekspert MicroLC 200

Application data by courtesy of: Stephen Lock, SCIEX, Warrington (UK)

“

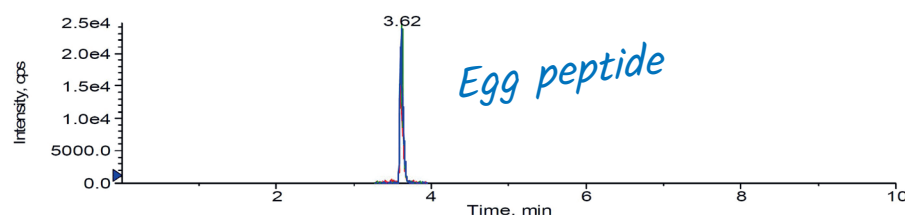
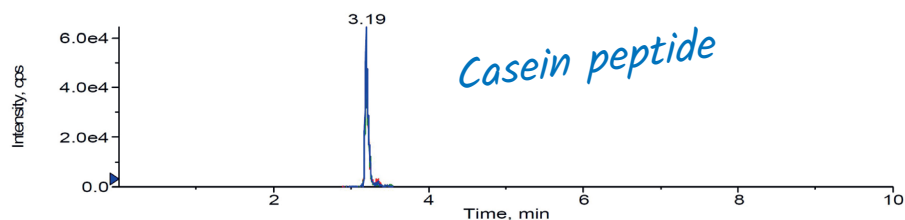
“Column of choice for fast and reproducible micro and nano scale separations.  
 Excellent pH and temperature stability, compatibility with 100% water allows  
 enrichment by large injection volumes.”

Tobias Werres, Institute for Energy- and Environmental Technology e. V. (IUTA, DE)

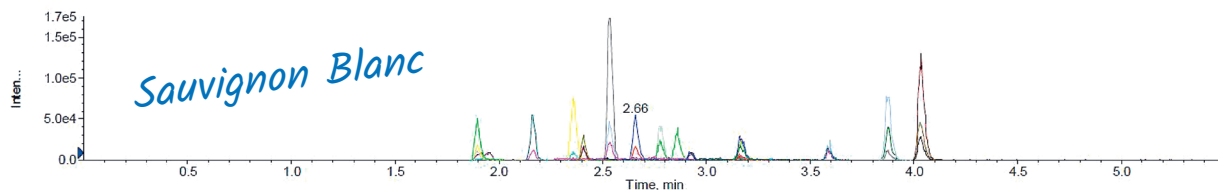
”

# Food – MicroLC

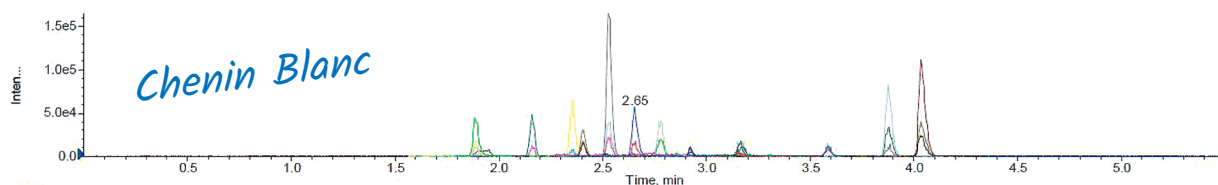
## Screening of allergens in white wine by MicroLC-MS/MS



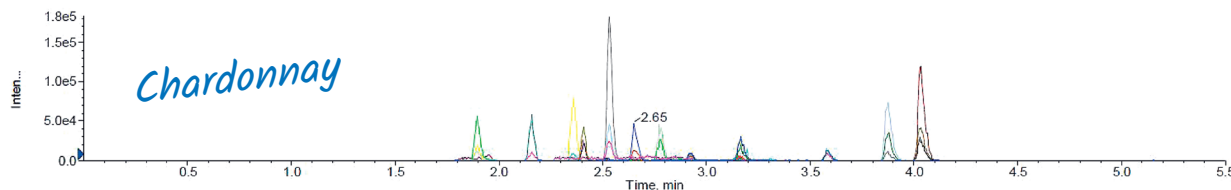
■ XIC of +MRM (47 pairs): 348.660/421.160 amu Expected RT: 2.7 ID: Alpha-lact Lactose B.ALC[MSH]SEK.2/b4 from Sample 3 (sauvignon blan... Max. 5.5e4 cps.



■ XIC of +MRM (47 pairs): 348.660/421.160 amu Expected RT: 2.7 ID: Alpha-lact Lactose B.ALC[MSH]SEK.2/b4 from Sample 2 (chenin blanc 0... Max. 5.7e4 cps.



■ XIC of +MRM (47 pairs): 348.660/421.160 amu Expected RT: 2.7 ID: Alpha-lact Lactose B.ALC[MSH]SEK.2/b4 from Sample 4 (chardonnay 0.5... Max. 4.7e4 cps.

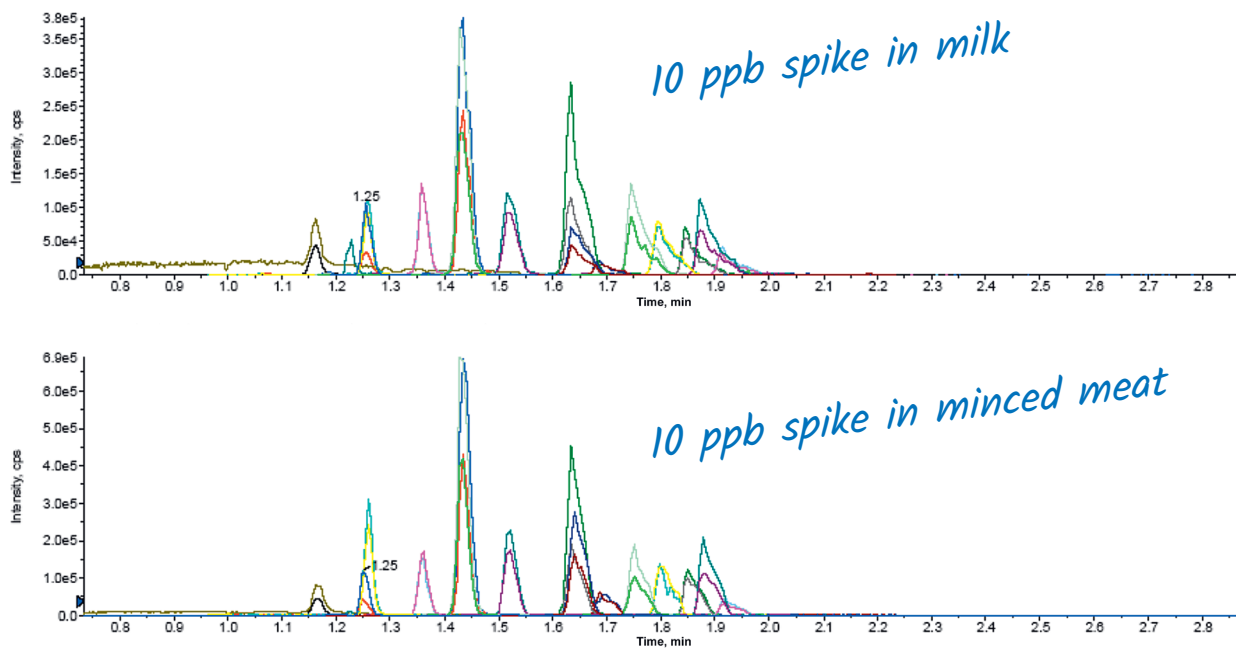


Column: YMC-Triart C18 (12 nm, 3 µm) 50 x 0.5 mm ID, 1/32" end fittings  
 Part No.: TA12S03-05J0RU  
 Eluent: A) H<sub>2</sub>O + 0.1% formic acid  
 B) acetonitrile + 0.1% formic acid  
 Gradient: 2%B (0–0.3 min), 40%B (4 min), 95%B (4.1–4.3 min), 2%B (4.4–5.5 min)  
 Flow rate: 25 µL/min  
 Temperature: 40 °C  
 Detection: SCIEX 5500 QTRAP, ESI  
 Injection: 10 µL  
 Sample: spiked white with 0.5 ppm milk/egg proteins  
 LC system: Eksigent ekspert MicroLC 200

Application data by courtesy of: Stephen Lock, SCIEX, Warrington (UK)

## Food – MicroLC

### MicroLC-MS/MS analysis of 15 different veterinary drugs in milk and meat



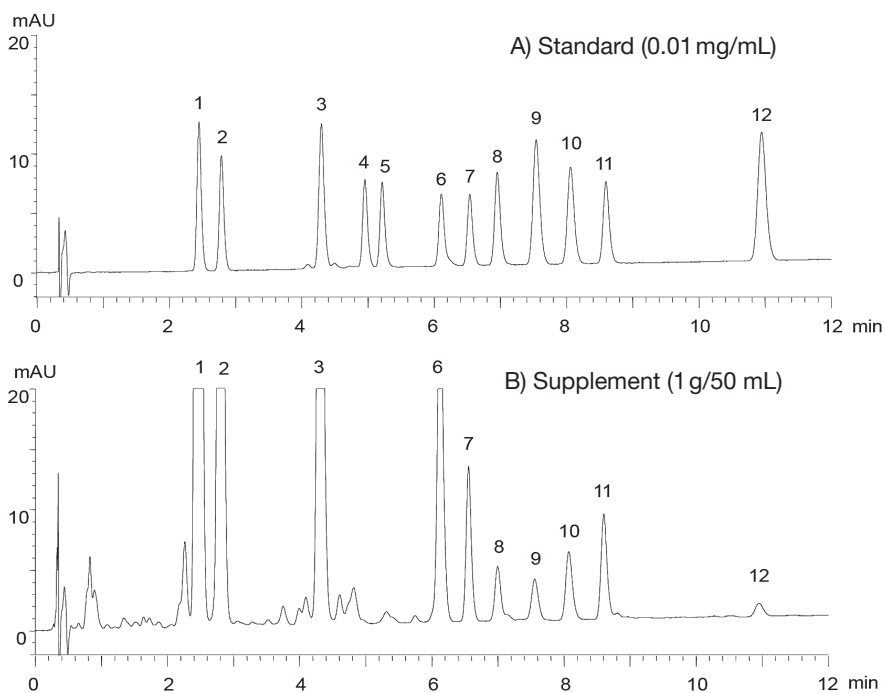
Column: YMC-Triart C18 (12 nm, 3  $\mu$ m) 50 x 0.5 mm ID, 1/32" end fittings  
 Part No.: TA12S03-05J0RU  
 Eluent: A) H<sub>2</sub>O + 0.1% formic acid  
           B) acetonitrile + 0.1% formic acid  
 Gradient: 2%B (0–0.5 min), 65%B (1.7 min), 100%B (1.8–2.3 min), 2%B (2.4–3.5 min)  
 Flow rate: 30  $\mu$ L/min  
 Temperature: 60°C  
 Detection: SCIEX 5500 QTRAP, ESI  
 Injection: 10  $\mu$ L  
 LC system: Eksigent ekspert MicroLC 200

Application data by courtesy of: Stephen Lock, SCIEX, Warrington (UK)



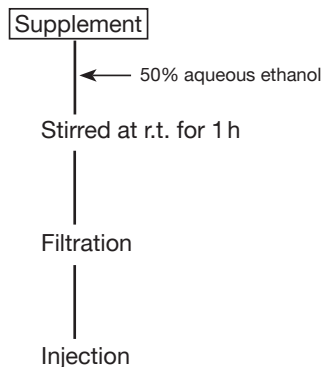
# Food

## Soy isoflavones in supplement



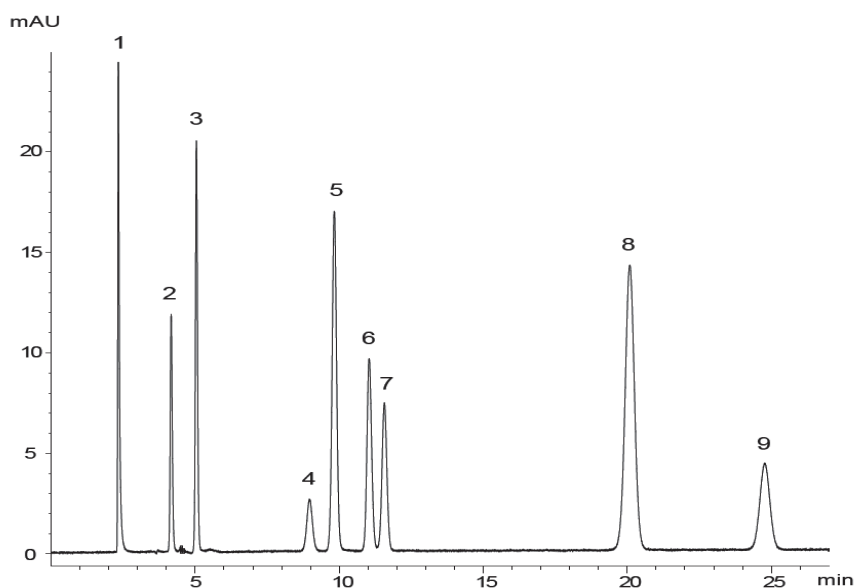
1. Daidzin
2. Glycitin
3. Genistin
4. 6"-O-Malonyldaidzin
5. 6"-O-Malonylglycitin
6. 6"-O-Acetyldaidzin
7. 6"-O-Acetylglycitin
8. 6"-O-Malonylgenistin
9. Daidzein
10. Glycitein
11. 6"-O-Acetylgenistin
12. Genistein

### Sample preparation method



Column:	YMC-Triart C18 (3 µm, 12 nm) 50 x 2.0 mm ID	Flow rate:	0.4 mL/min
Part No.:	TA12S03-0502WT	Temperature:	25°C
Eluent:	A) acetonitrile/ water/HCOOH (10/90/0.1)	Detection:	UV at 254 nm
	B) acetonitrile/ water/HCOOH (60/40/0.1)	Injection:	2 µL
Gradient:	5-40%B (0-12 min)		

## Separation of water-soluble vitamins

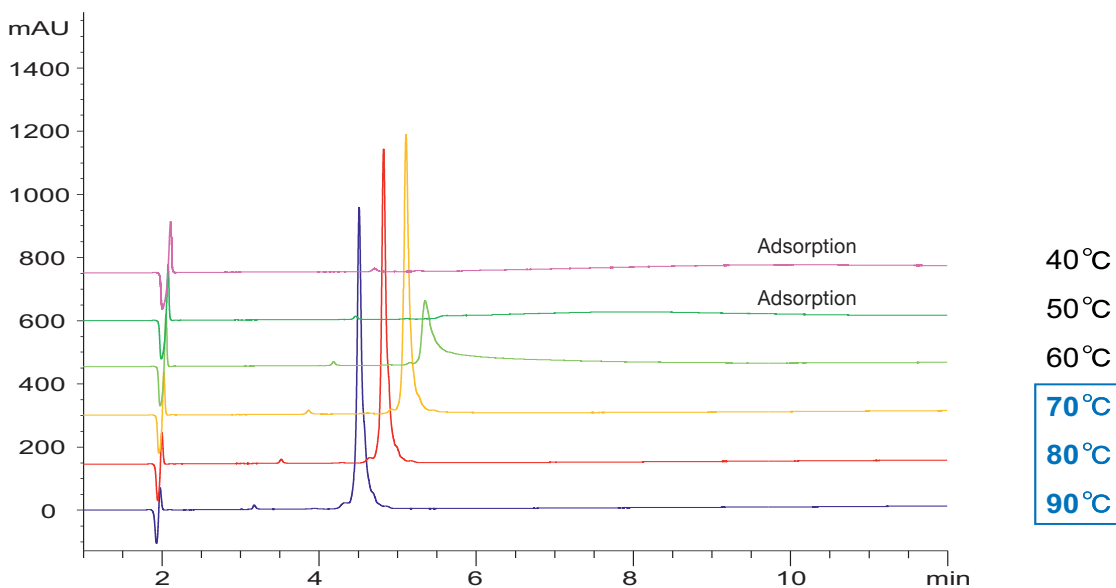


1. Thiamine HCl (Vitamin B<sub>1</sub>)
2. Pyridoxine HCl (Vitamin B<sub>6</sub>)
3. Nicotinamide
4. Cyanocobalamin (Vitamin B<sub>12</sub>)
5. L-Ascorbic acid 2-glucoside
6. L-Ascorbic acid (Vitamin C)
7. Erythorbic acid
8. Riboflavin (Vitamin B<sub>2</sub>)
9. Nicotinic acid (Vitamin B<sub>3</sub>)

Column:	YMC-Triart C18 (5 µm, 12 nm) 250 x 4.6 mm ID	Flow rate:	0.8 mL/min
Part No.:	TA12S05-2546PTH	Temperature:	40°C
Eluent:	phosphate buffer*/ acetonitrile (90/10)	Detection:	UV at 260 nm
	* Dissolve 1.4 g KH <sub>2</sub> PO <sub>4</sub> in 800 mL water	Injection:	10 µL (5 µg/mL)
	→ add 26 mL 10% TBA-OH		
	→ adjust pH 5.2 by 20% H <sub>3</sub> PO <sub>4</sub>		
	→ add water to make 1,000 mL		

## Life Science – Antibodies

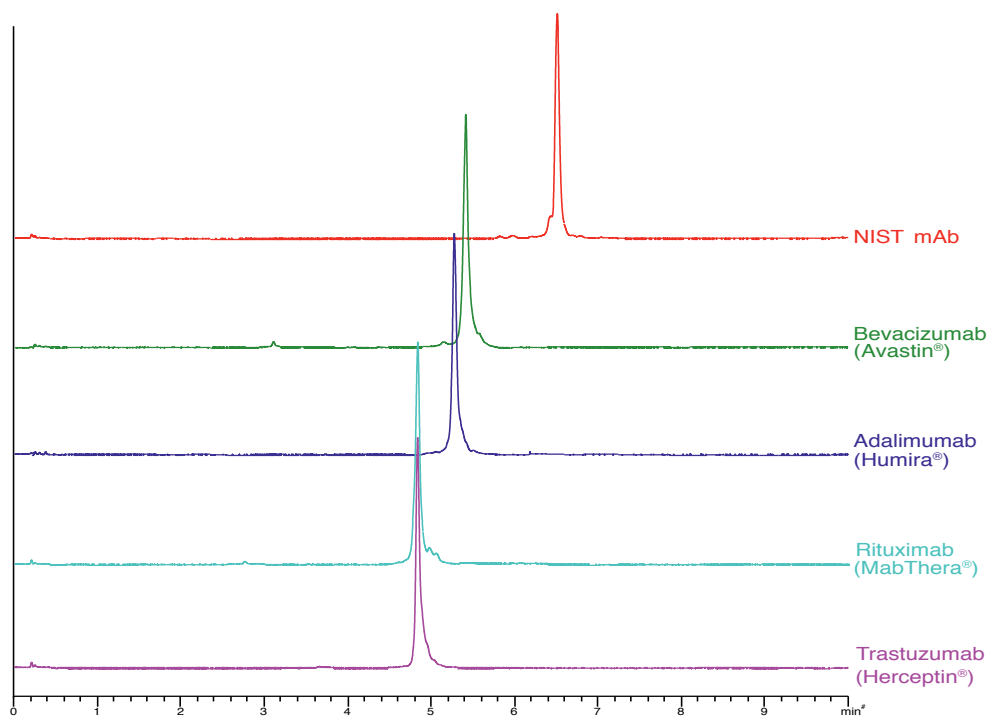
### Bevacizumab (Avastin®, MW: ca. 148 kDa)



Column: YMC-Triart Bio C4 (3  $\mu$ m, 30 nm) 150 x 3.0 mm ID  
 Part No.: TB30S03-1503PTH  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.1)

Gradient: 30–60%B (0–15 min), 90%B (15–30 min),  
 Flow rate: 0.4 mL/min  
 Detection: UV at 220 nm  
 Injection: 4  $\mu$ L (0.5 mg/mL)

### RP analysis of different monoclonal antibodies using YMC-Triart Bio C4



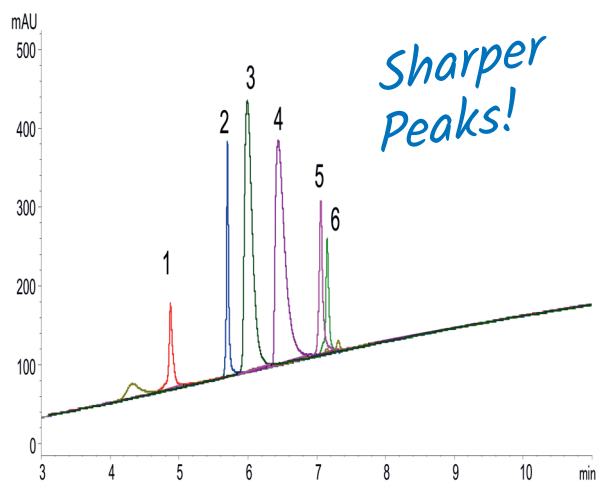
Column: YMC-Triart Bio C4 (1.9  $\mu$ m, 30 nm) 50 x 2.1 mm ID  
 Part No.: TB30SP9-05Q1PT  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.1)  
 Gradient: 25–45%B (0–10 min)

Flow rate: 0.4 mL/min  
 Temperature: 80°C  
 Detection: UV at 280 nm (0.13s, 40Hz)  
 Injection: 2  $\mu$ L (0.5 mg/mL)

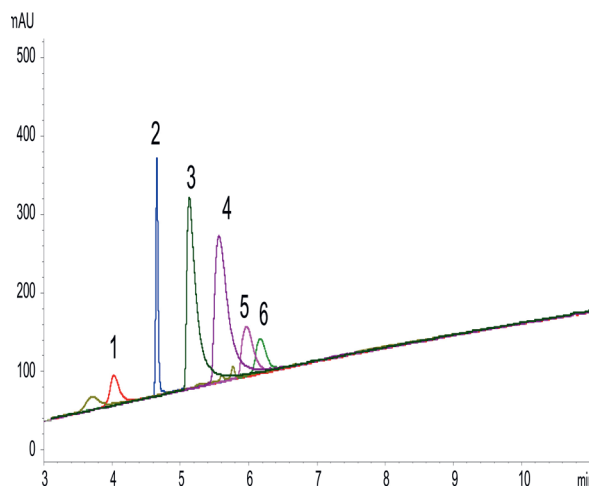
# Life Science – Proteins/Peptides

High sensitivity and sharp peaks under LC/MS compatible conditions

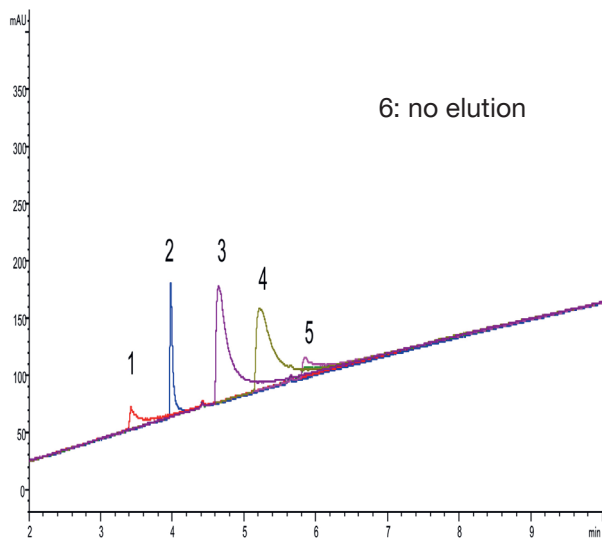
YMC-Triart Bio C4 (3 μm, 30 nm)



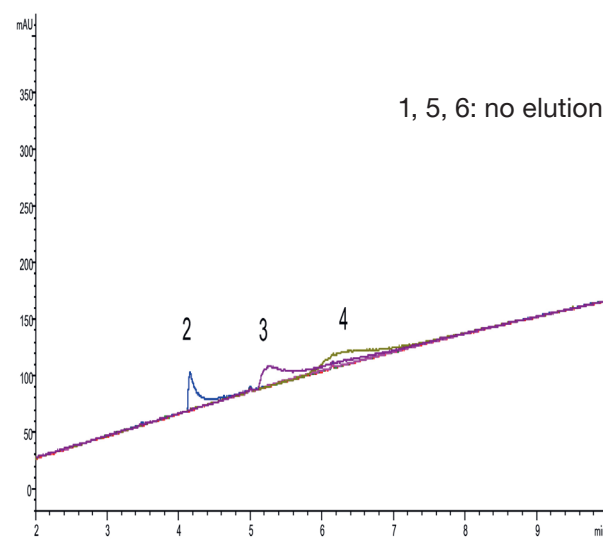
XBridge Protein BEH C4 (3.5 μm, 30 nm)



AdvanceBio RP-mAb C4 (3.5 μm, 45 nm)



Aeris widepore C4 (3.6 μm, 20 nm)



Column: 150 x 3.0 mm ID  
 Eluent: A) water/formic acid (100/0.1)  
 B) acetonitrile/formic acid (100/0.1)  
 Gradient: 10–95%B (0–15 min)  
 Flow rate: 0.4 mL/min (for 3.0 mm ID)  
 1.0 mL/min (for 4.6 mm ID)  
 Temperature: 40°C  
 Detection: UV at 220 nm

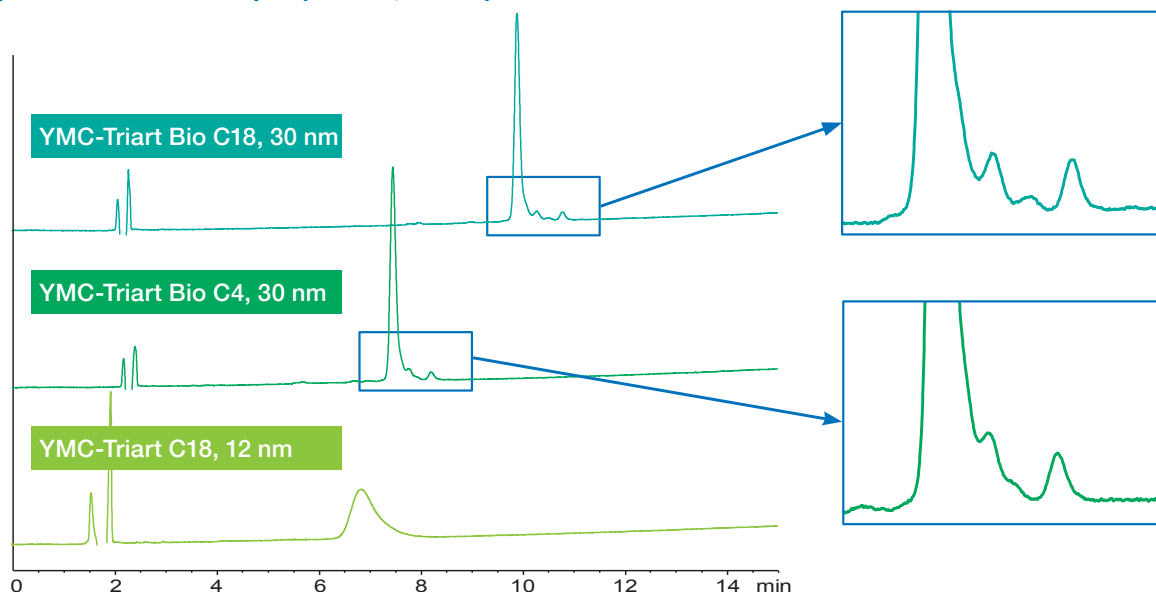
Sample:  
 1. Cytochrome-C (Horse heart)  
 2. Insulin (Bovine pancreas)  
 3. Transferrin (Human)  
 4. BSA  
 5. β-Lactoglobulin (Bovine)  
 6. α-Chymotrypsinogen A (Bovine pancreas)

YMC-Triart Bio C4 shows better peak shape and recovery with a mobile phase containing formic acid, which is commonly used for LC/MS analysis. Therefore, YMC-Triart Bio C4 is ideal for highly sensitive analysis of proteins.



## Life Science – Proteins/Peptides

### Separation of Somatropin (MW 22,125 Da)

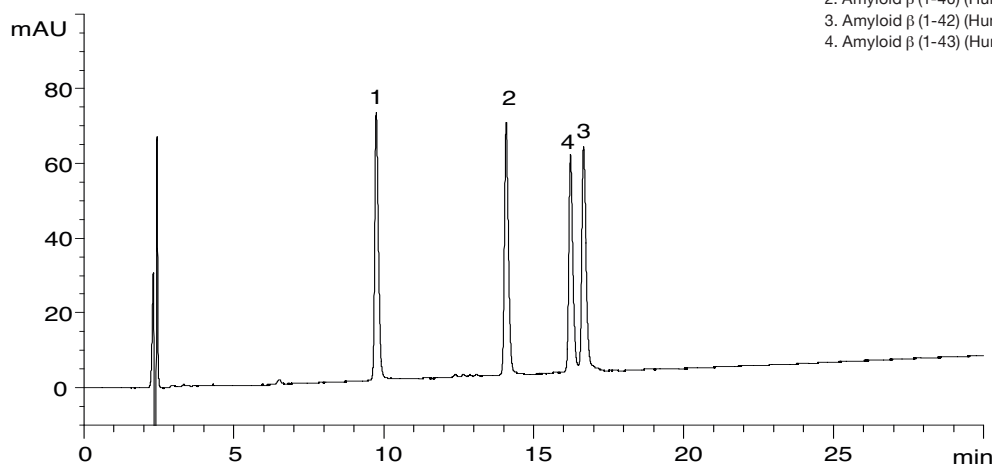


Columns: 150 x 3.0 mm ID (3  $\mu$ m)  
 Part Nos.: TA30S03-1503PTH  
 TB30S03-1503PTH  
 TA12S03-1503PTH  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.08)

Gradient: 50–70%B (0–15 min)  
 Flow rate: 0.425 mL/min  
 Temperature: 40°C  
 Detection: UV at 220 nm  
 Injection: 4  $\mu$ L  
 Sample: Somatropin (0.1 mg/mL)

In this example of somatropin, a peptide of 22,125 Da, good peak shape can be obtained with the widepore columns YMC-Triart Bio C18 and YMC-Triart Bio C4. Excellent separation was achieved using YMC-Triart Bio C18 with longer alkyl chains in its bonded phase.

### Amyloid $\beta$ -peptides



1. Amyloid  $\beta$  (1-38) (Human) (MW 4,132)
2. Amyloid  $\beta$  (1-40) (Human) (MW 4,330)
3. Amyloid  $\beta$  (1-42) (Human) (MW 4,514)
4. Amyloid  $\beta$  (1-43) (Human) (MW 4,615)

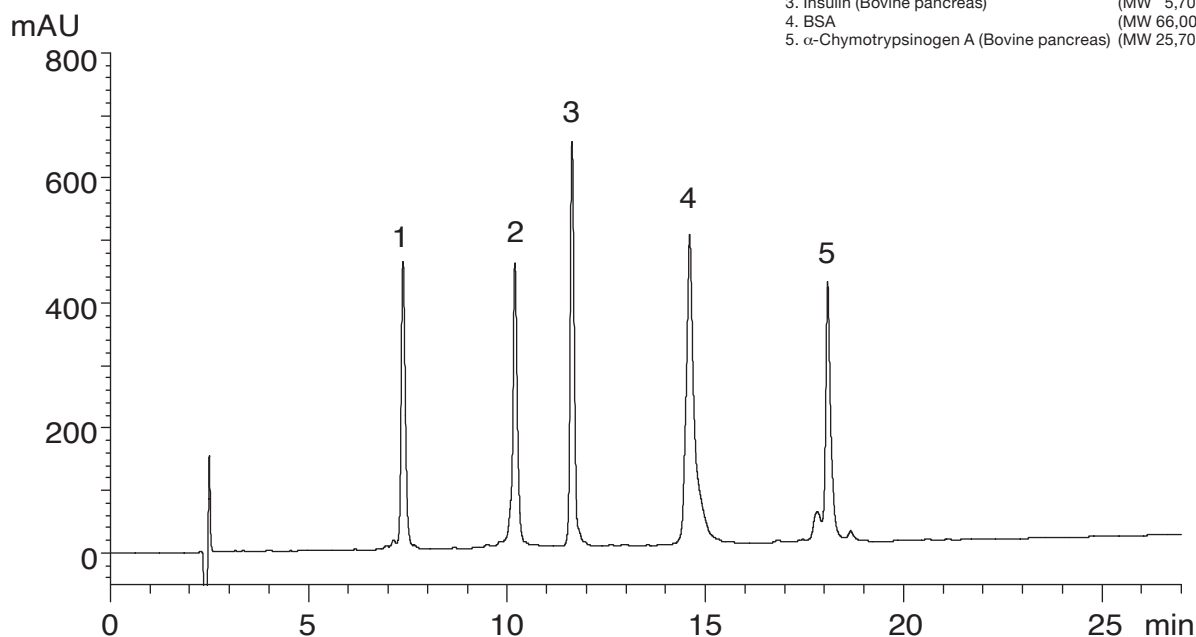
Amyloid  $\beta$  (1-43) : Asp-Ala-Glu-Phe-Arg-His-Asp-Ser-Gly-Tyr-Glu-Val-His-His-Gln-Lys-Leu-Val-Phe-Phe-Ala-Glu-Asp-Val-Gly-Ser-Asn-Lys-Gly-Ala-Ile-Ile-Gly-Leu-Met-Val-Gly-Gly-Val-Val-Ile-Ala-Thr

Column: YMC-Triart Bio C4 (3  $\mu$ m, 30 nm) 150 x 3.0 mm ID  
 Part No.: TB30S03-1503PTH  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.1)  
 Gradient: 25–40%B (0–30 min), 90%B (30–40 min)

Flow rate: 0.4 mL/min  
 Temperature: 70°C  
 Detection: UV at 220 nm  
 Injection: 4  $\mu$ L (each 0.1 mg/mL)

## Life Science – Proteins/Peptides

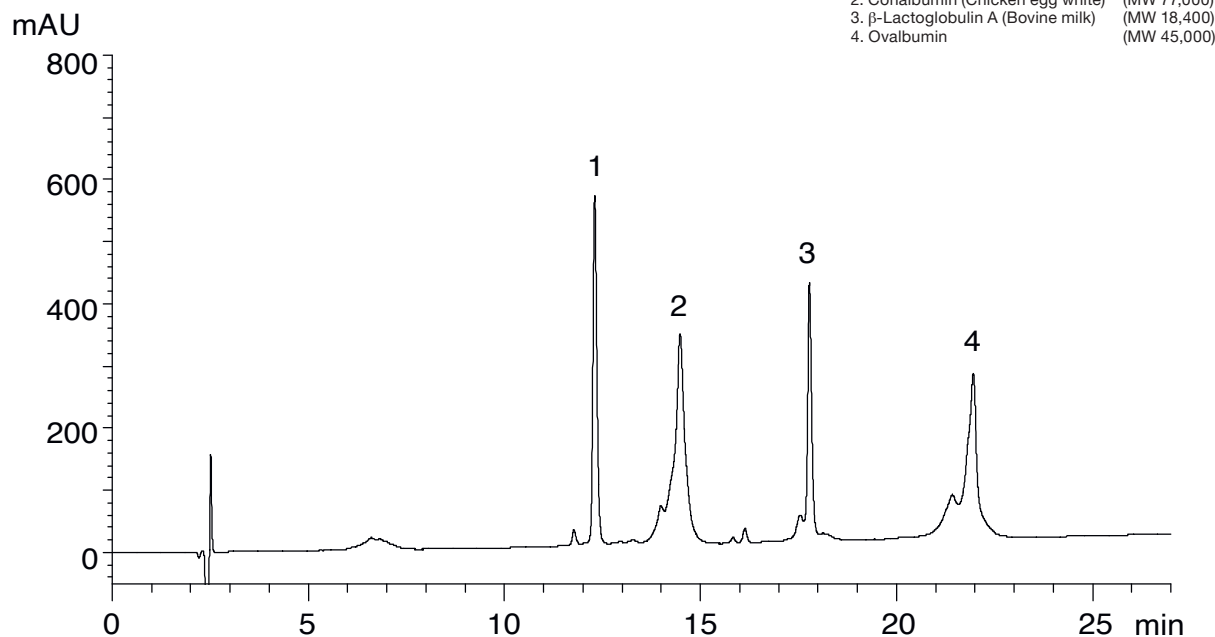
### Proteins (MW 5,700 ~ 66,000)



Column: YMC-Triart Bio C4 (5  $\mu$ m, 30 nm) 150 x 3.0 mm ID  
 Part No.: TB30S03-1503PTH  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.1)  
 Gradient: 20–60%B (0–27 min), 90%B (27–35 min)

Flow rate: 0.4 mL/min  
 Temperature: 70°C  
 Detection: UV at 220 nm  
 Injection: 10  $\mu$ L (0.25 ~ 0.50 mg/mL)

### Proteins (MW 14,300 ~ 77,000)



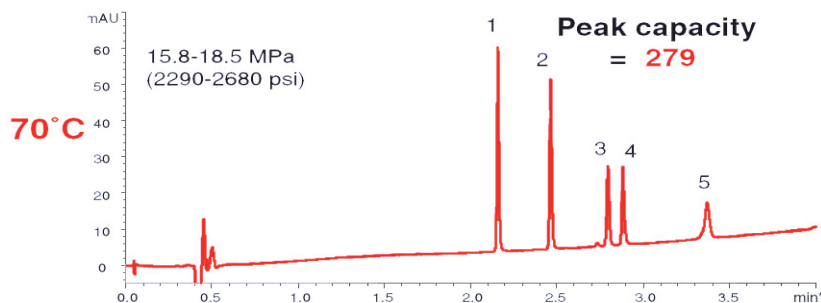
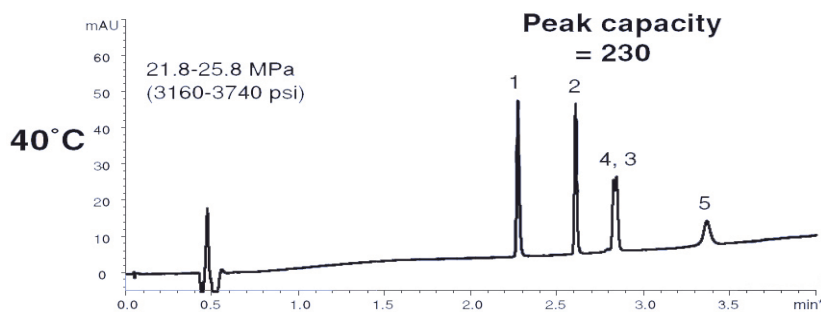
Column: YMC-Triart Bio C4 (5  $\mu$ m, 30 nm) 150 x 3.0 mm ID  
 Part No.: TB30S03-1503PTH  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.1)  
 Gradient: 20–60%B (0–27 min), 90%B (27–35 min)

Flow rate: 0.4 mL/min  
 Temperature: 70°C  
 Detection: UV at 220 nm  
 Injection: 10  $\mu$ L (0.25 ~ 0.50 mg/mL)

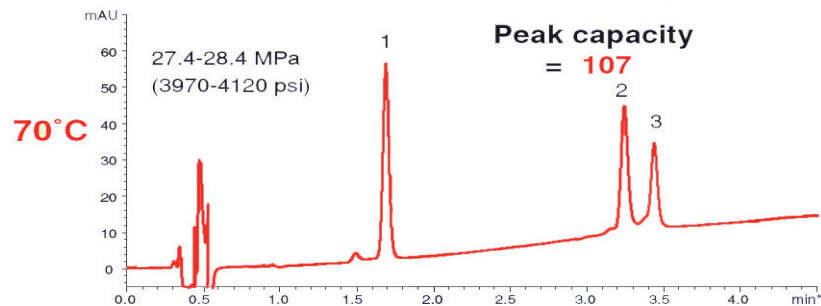
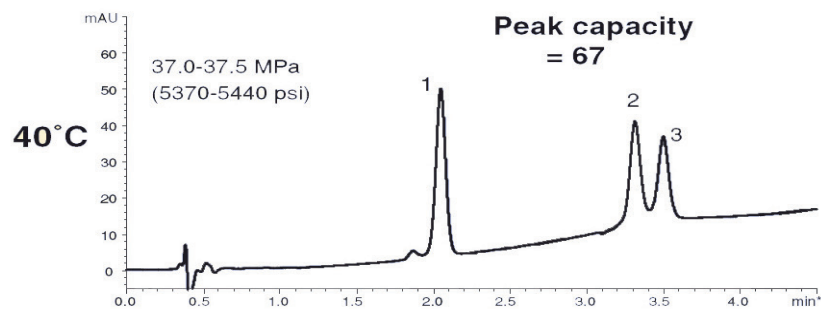
# Life Science – Proteins/Peptides

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

### Mixture A (MW 500–18,400)



### Mixture B (MW 14,300–25,700)



Analytes	MW	Peak width 1/2 (min)	
		40°C	70°C
<b>Mixture A</b>			
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
<b>Mixture B</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, 12 nm) 50 x 2.0 mm ID  
 Part-No.: TA12SP9-0502PT  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.1) - mixture A  
 B) acetonitrile/2-propanol/TFA (50/50/0.1) - mixture B  
 Gradient: 10–80%B (0–5 min) - mixture A  
 30–60%B (0–5 min) - mixture B

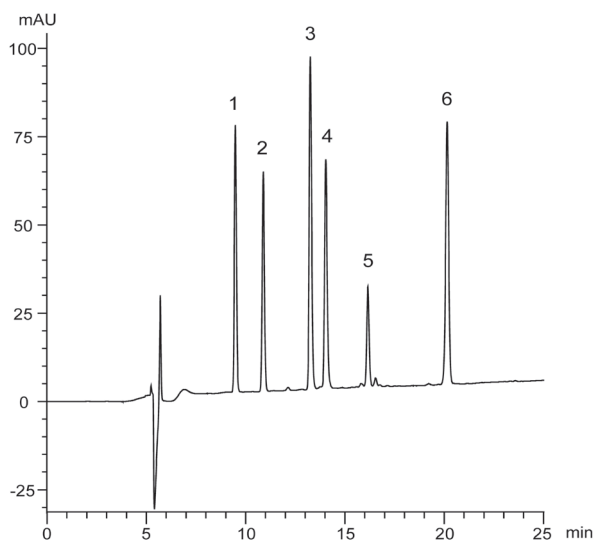
Flow rate: 0.4 mL/min  
 Detection: UV at 220 nm  
 Injection: 1 μL (50 μg/mL) - condition A  
 1 μL (250 μg/mL) - condition B  
 System: Agilent 1200SL

PC (peak capacity) = 1 + (gradient time/peak width\*)  
 \*peak width = 2W<sub>0.5h</sub> average

## Life Science – Proteins/Peptides

### Peptides (MW 556 - 3,465)

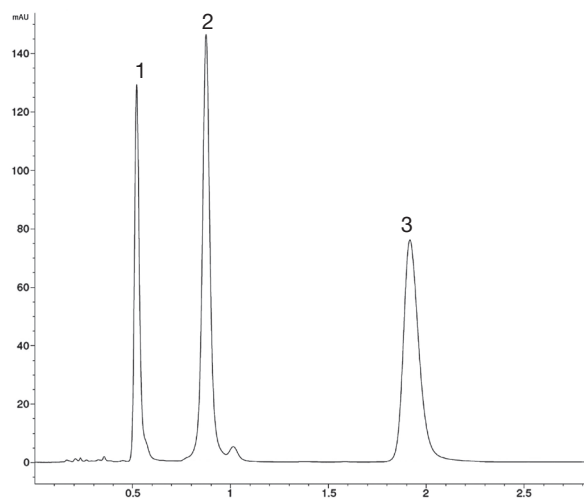
1. Oxytocin (MW 1,007)
2. Met-Enkephalin (MW 574)
3. Leu-Enkephalin (MW 556)
4. Neurotensin (MW 1,673)
5.  $\gamma$ -Endorphin (MW 1,859)
6.  $\beta$ -Endorphin (MW 3,465)



Column: YMC-Triart C18 (5  $\mu$ m, 12 nm) 150 x 2.0 mm ID  
 Part No.: TA12S05-1502WT  
 Eluent: A) water + 0.1% TFA  
 B) acetonitrile + 0.1% TFA  
 Gradient: 20–45%B (0–25 min)  
 Flow rate: 0.2 mL/min  
 Temperature: 37 °C  
 Detection: UV at 220 nm  
 Injection: 2  $\mu$ L (0.075–0.25 mg/mL)

### Angiotensin I, II and III

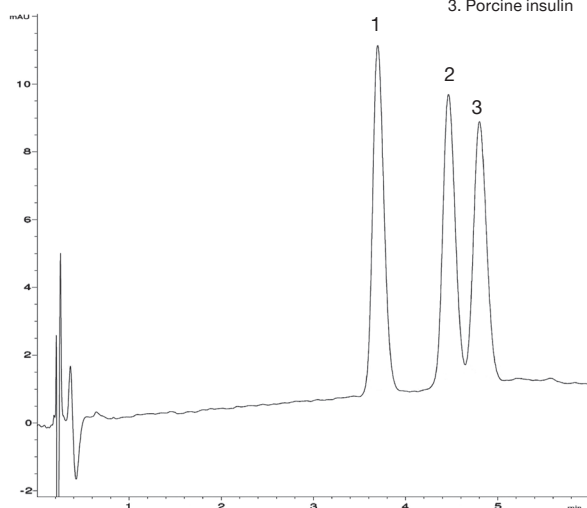
1. Angiotensin I
2. Angiotensin II
3. Angiotensin III



Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: 20 mM  $\text{KH}_2\text{PO}_4$  +  $\text{K}_2\text{HPO}_4$  (pH 7.9)/acetonitrile (22/78)  
 Flow rate: 0.7 mL/min  
 Temperature: 40 °C  
 Detection: UV at 220 nm  
 Injection: 0.5  $\mu$ L  
 Pressure: 720 bar

### Insulin

1. Bovine insulin
2. Human insulin
3. Porcine insulin



Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 50 x 2.0 mm ID  
 Part No.: TA12SP9-0502PT  
 Eluent: A)  $\text{H}_2\text{O}$  + 0.1% TFA  
 B) acetonitrile + 0.1% TFA  
 Gradient: 30%B (0 min); 30–32%B (0–5 min); 32%B (5.5 min)  
 Flow rate: 0.6 mL/min  
 Temperature: 30 °C  
 Detection: UV at 220 nm  
 Injection: 0.5  $\mu$ L  
 Pressure: 611 bar

“

**“Great column family”**

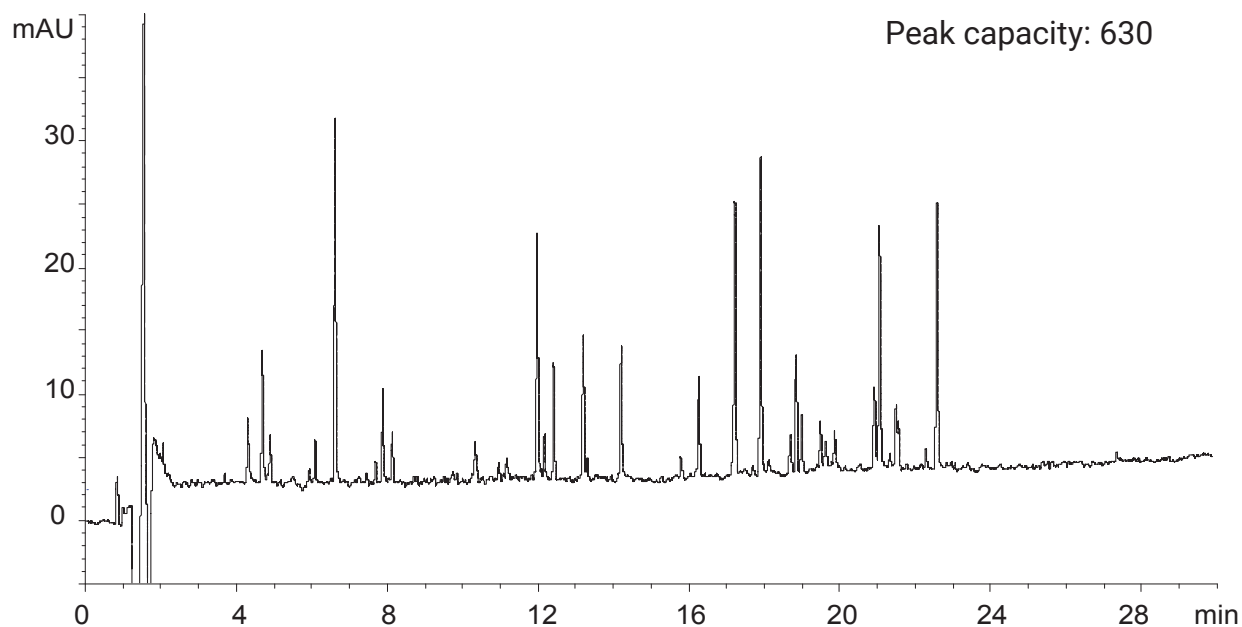
“Excellent column, easy to scale up from 1 mm ID to 2.1 mm ID without any issue. [...]”

Arnold Demailly, Novartis (CH)

”

## Life Science – Proteins/Peptides

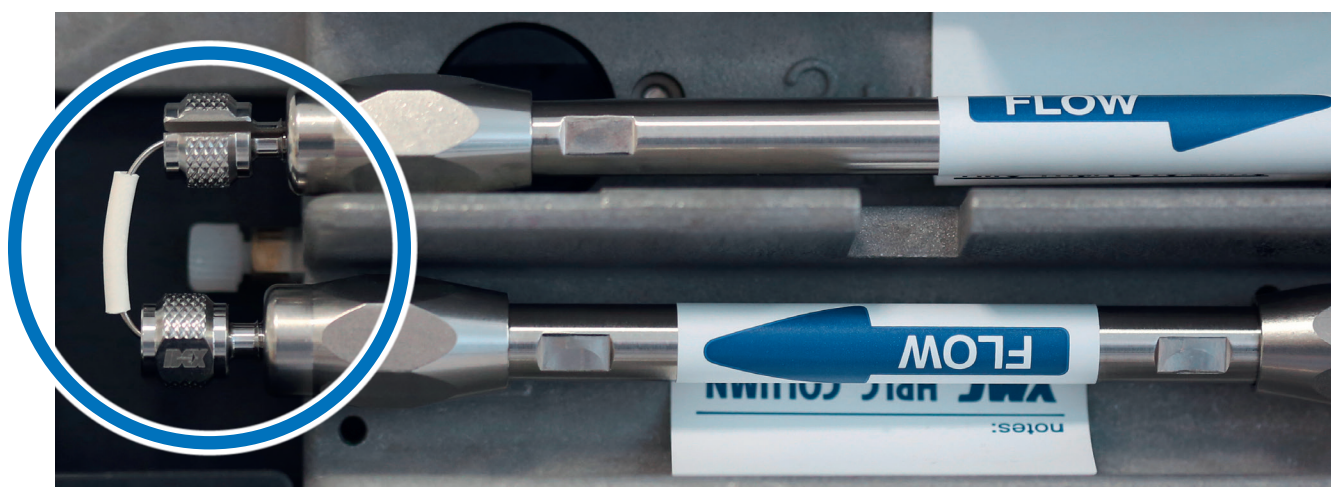
### Peptide mapping



$$PC \text{ (peak capacity)} = 1 + (\text{gradient time} / \text{peak width}^*)$$

\*peak width =  $2W_{0.5h}$  average

Column: YMC-Triart C18 (1.9  $\mu\text{m}$ , 12 nm) 200 x 2.0 mm ID (Two coupled 100 x 2.0 mm ID)  
 Part No.: TA12SP9-1002PT (2x)  
 Eluent: A) water/TFA (100/0.1)  
 B) acetonitrile/TFA (100/0.08)  
 Gradient: 5–40%B (0–30 min)  
 Flow rate: 0.4 mL/min  
 Temperature: 70°C  
 Detection: UV at 220 nm  
 Injection: 20  $\mu\text{L}$   
 Sample: Tryptic digest of Bovine Hemoglobin (2.5 nmol/mL)  
 Pressure: 58.1–61.6 MPa (8,430–8,930 psi)

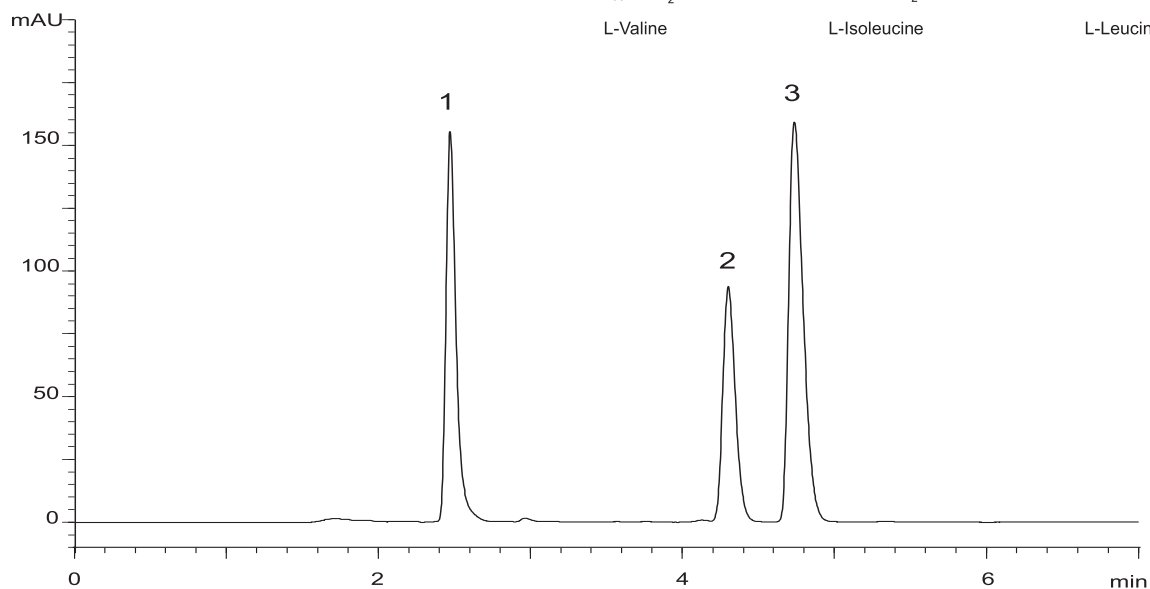
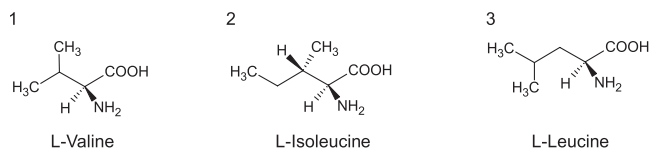


Coupling of two YMC-Triart UHPLC columns using the dead volume free MarvelX™ connector.

# Life Science – Amino Acids

## Hydrophobic amino acids

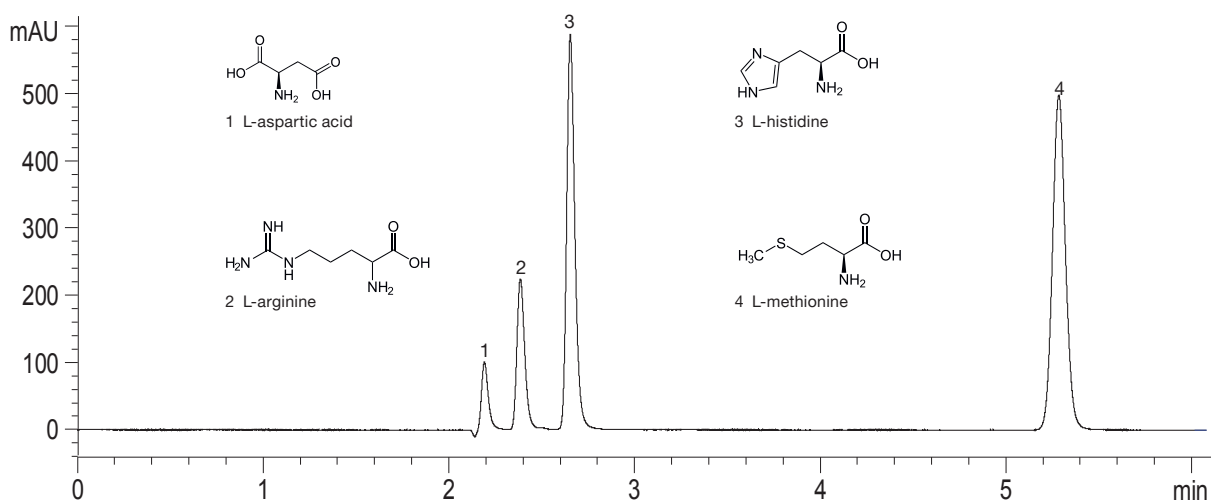
Standard solution  
(1.10 mg/mL L-Valine, 0.92 mg/mL L-Isoleucine, 1.84 mg/mL L-Leucine)



Column: YMC-Triart C18 (3  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TA12S03-1546PTH  
 Eluent: phosphate buffer (pH 2.8)/acetonitrile (97/3)  
 (\*Dissolve 31.2 g of  $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$  in 1,000 mL of water and adjust pH 2.8 with  $\text{H}_3\text{PO}_4$ )  
 Flow rate: 0.9 mL/min (adjust the flow rate so that the retention time of L-Valine is about 2.5 min)  
 Temperature: 40°C  
 Detection: UV at 210 nm  
 Injection: 20  $\mu$ L

The Japanese Pharmacopoeia 16th; Identification

## Amino acids with 100% aqueous phase

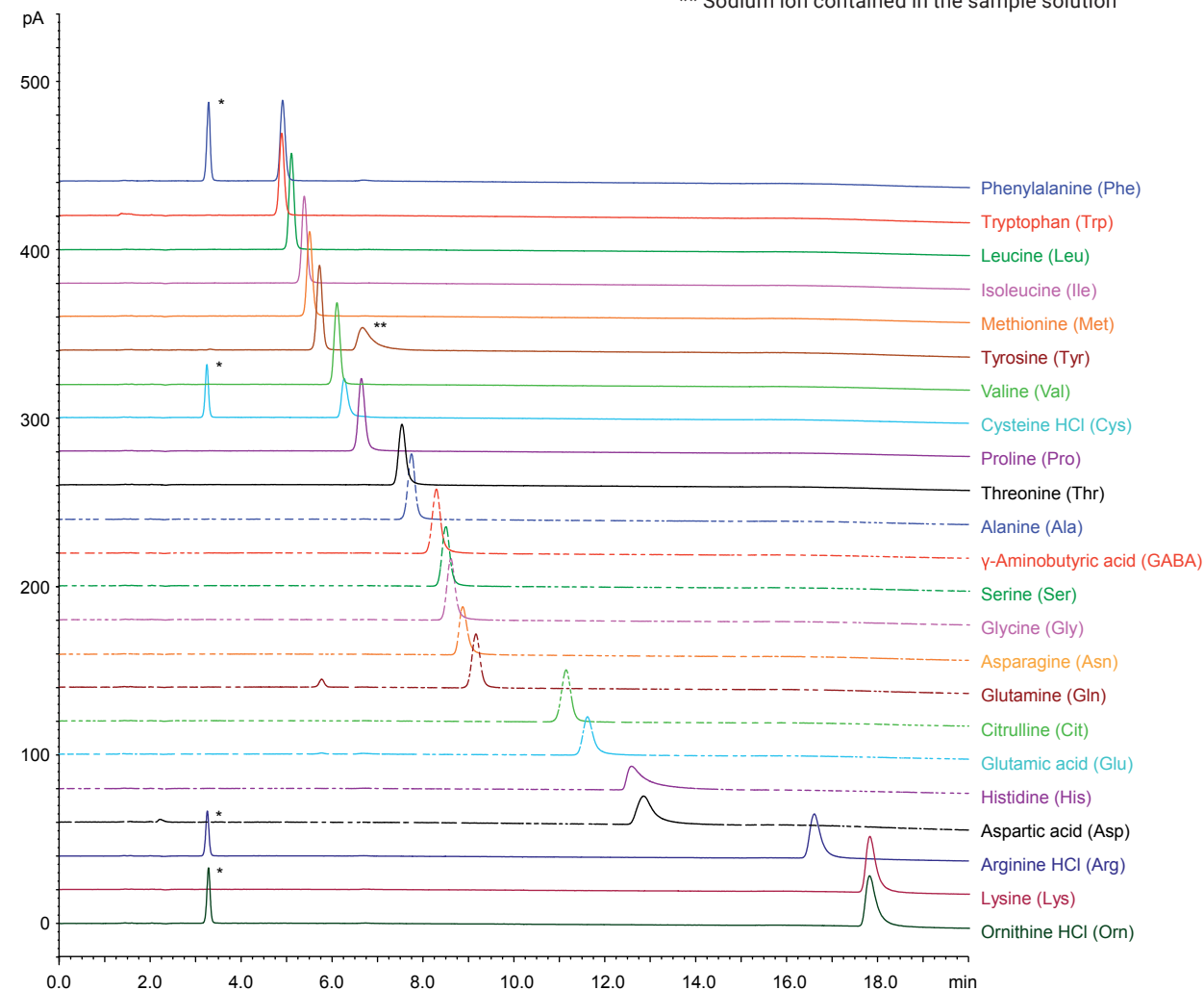


Column: YMC-Triart C18 (1.9  $\mu$ m, 12 nm) 150 x 3.0 mm ID  
 Part No.: TA12SP9-1503PT  
 Eluent: 40 mM  $\text{K}_2\text{HPO}_4$  (pH 7.0)  
 Flow rate: 0.3 mL/min  
 Temperature: 20°C  
 Detection: UV at 210 nm  
 Injection: 2  $\mu$ L (1 mg/mL)

# Life Science – Amino Acids

## Free amino acids in HILIC mode

\* Chloride ion contained in the sample solution  
 \*\* Sodium ion contained in the sample solution



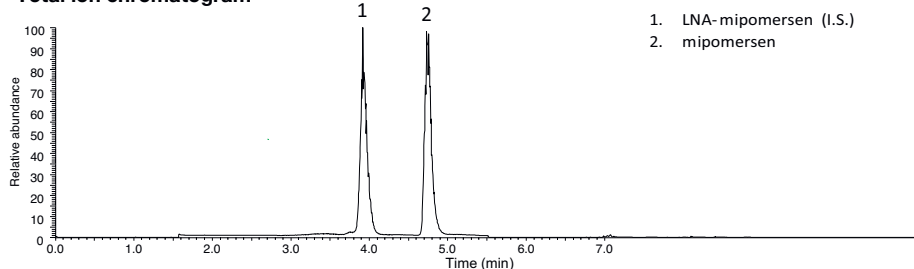
Column: YMC-Triart Diol-HILIC (5  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TDH12S05-1546PTH  
 Eluent: A) 100 mM HCOOH-HCOONH<sub>4</sub> (pH 3.6)  
 B) acetonitrile  
 Gradient: 83–80%B (0–12 min), 80–68%B (12–20 min)  
 Flow rate: 1.0 mL/min  
 Temperature: 40°C  
 Detection: Corona® CAD® (Charged Aerosol Detector)  
 Injection: 10  $\mu$ L (0.1 mg/mL)

Corona and CAD are trademarks of Thermo Fisher Scientific.

# Life Science – Oligonucleotides

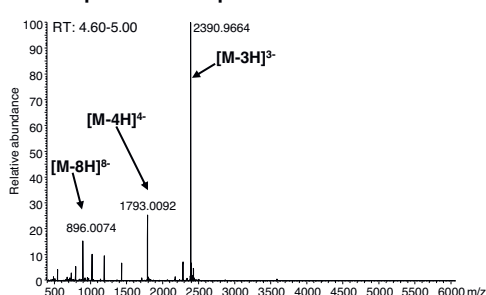
## LC-HRMS analysis of the antisense oligonucleotide Mipomersen (Kynamro®)

Total ion chromatogram

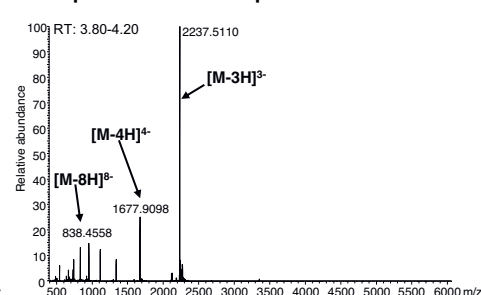


1. LNA-mipomersen (I.S.)
2. mipomersen

Mass spectrum of mipomersen



Mass spectrum of LNA-mipomersen



Column: YMC-Triart C8 metal-free PEEK-lined (1.9 µm, 12 nm)<sup>†</sup> 100 x 2.1 mm ID  
 Part No.: TO12SP9-10Q1PTP  
 Eluent: A) water/triethylamine/HFIP<sup>2</sup> (100/0.4/2; triethylamine 28.0 mM, HFIP 135.8 mM)  
 B) methanol/triethylamine/HFIP (100/0.4/2)  
 Gradient: [Sample separation step] 10–40%B (0–5.0 min)

[Column wash steps]  
 40–70%B (5.0–5.1 min), 70%B (5.1–7.0 min), 70–10%B (7.0–7.1 min),  
 10%B (7.1–8.0 min), 10–90%B (8.0–8.1 min), 90%B (8.1–9.0 min),  
 90–10%B (9.0–9.1 min), 10%B (9.1–10.0 min),  
 10–90%B (10.0–10.1 min), 90%B (10.1–11.0 min),  
 90–10%B (11.0–11.1 min)  
 Flow rate: 0.3 mL/min  
 Temperature: 50 °C  
 Injection: 10 µL (1,000 ng/mL)  
 System: LC) Vanquish Binary Pump H system  
 HRMS) Orbitrap HRMS Q Exactive Plus

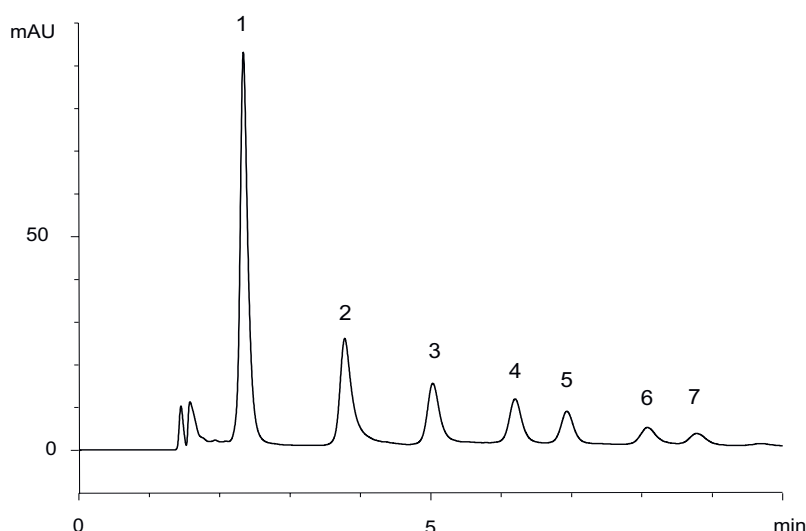
Courtesy of Y. Sun, National Institute of Health Sciences

\*1 Prewash the column prior to the first use with water/methanol/phosphoric acid (70/30/0.1) for 1 hour

\*2 1,1,1,3,3,3-hexafluoro-2-propanol

Reference: Y. Sun et al, Development of a bioanalytical method for an antisense therapeutic using high-resolution mass spectrometry, *Bioanalysis*, 2020 NOV 26, doi: 10.4155/bio-2020-0225.

## RNA marker with high sensitivity from the 1<sup>st</sup> injection



1. 100 bases
2. 200 bases
3. 300 bases
4. 400 bases
5. 500 bases
6. 750 bases
7. 1,000 bases

Column: YMC Accura Triart Bio C4 (1.9 µm, 30 nm) 100 x 2.1 mm ID  
 Part No.: TA30SP9-10Q1PTC  
 Eluent: A) 50 mM TEAA\* (pH 7.0)/acetonitrile (95/5)  
 B) 50 mM TEAA (pH 7.0)/acetonitrile (50/50)  
 Gradient: 9–14%B (0–10 min), 80%B (10–15 min)

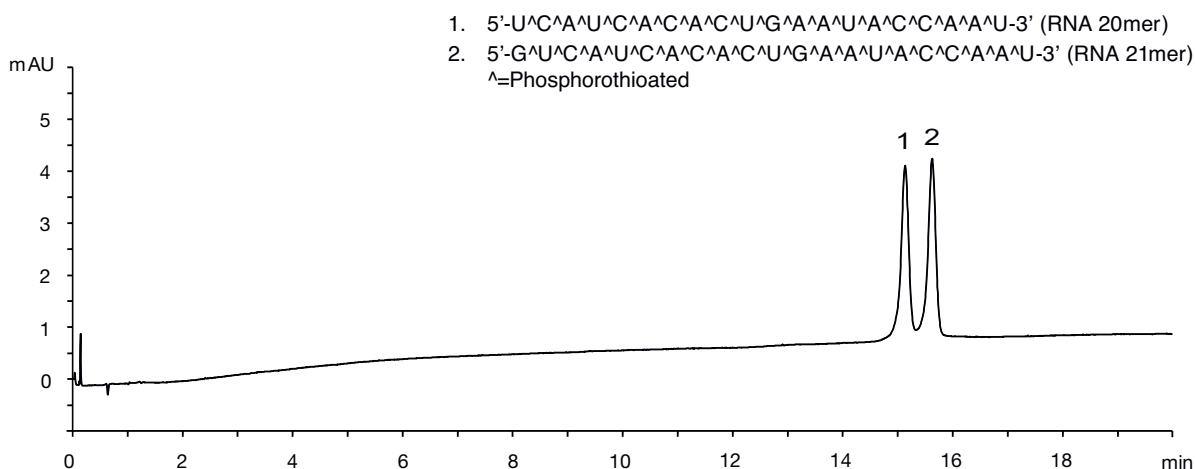
Flow rate: 0.2 mL/min  
 Temperature: 80 °C  
 Detection: UV at 254 nm  
 Injection: 1 µL (0.25 mg/mL)  
 Sample: 100–1,000 bases (Century™-Plus RNA Markers)

\* Triethylammonium acetate



## Life Science – Oligonucleotides

### Challenging phosphorothioate oligonucleotides

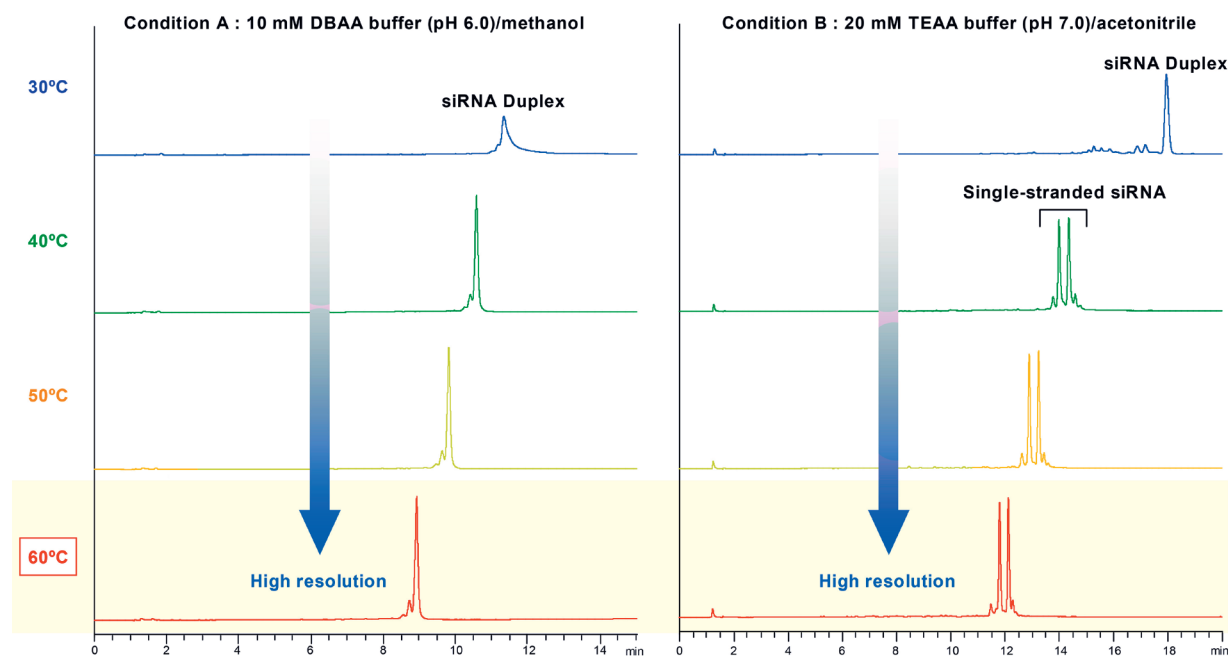


Column: YMC-Triart C8 metal-free PEEK-lined (1.9 μm, 12 nm) 100 x 2.1 mm ID  
 Part no.: TO12SP9-10Q1PTP  
 Eluent: A) 15 mM triethylamine-400 mM HFIP\*  
 B) methanol  
 Gradient: 10–20%B (0–20 min)

Flow rate: 0.42 mL/min  
 Temperature: 70 °C  
 Detection: UV at 260 nm  
 Injection: 1 μL (each 1.25 nmol/mL)

\*1,1,1,3,3,3-hexafluoro-2-propanol

### Effect of mobile phase and column temperature on separation of siRNA duplex



Crude synthetic siRNA duplex (19 bp):

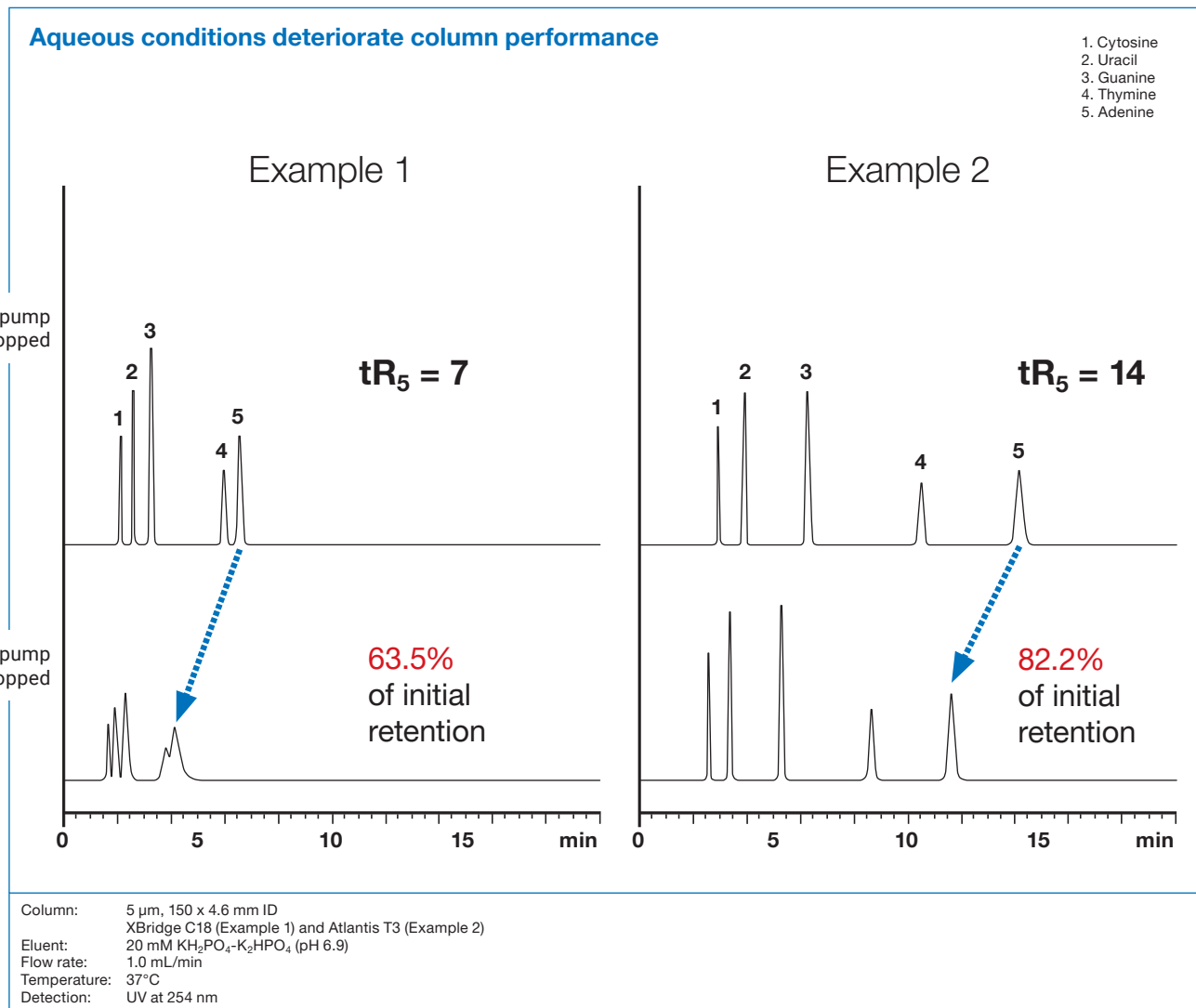
5'-CGU ACG CGG AAU ACU UCG AdTdT-3'  
 3'-dTdTGCA UGC GCC UUA UGA AGC U-5'

Column: YMC-Triart C18 (1.9 μm, 12 nm) 100 x 2.0 mm ID  
 Part No.: TA12SP9-1002PT  
 Flow rate: 0.2 mL/min  
 Detection: UV at 269 nm  
 Injection: 1 μL (5 nmol/mL)  
 System: Agilent 1290

Condition A Eluent: A) 10 mM di-n-butylamine-acetic acid (pH 6.0)  
 B) methanol  
 Gradient: 35–60%B (0–15 min)  
 Condition B Eluent: A) 20 mM triethylamine-acetic acid (pH 7.0)  
 B) acetonitrile  
 Gradient: 5–12%B (0–20 min)

# YMC-Triart "AQ" | YMC-Triart C18 for polar compounds

## Problem with conventional C18 columns



## Why?

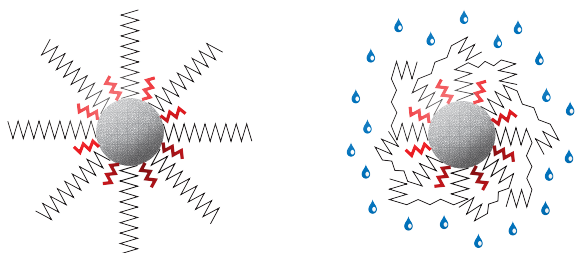


Image of C18 surface hydration

The columns used for applications involving 100% aqueous buffers provide shorter retention times after the flow was stopped between analyses. This behaviour is caused by poor hydration of the phase. Polar compounds cannot easily distribute between the mobile phase and the stationary phase.

## YMC-Triart "AQ" | YMC-Triart C18 for polar compounds

**Solution with YMC-Triart C18: Reproducible and stable performance!**

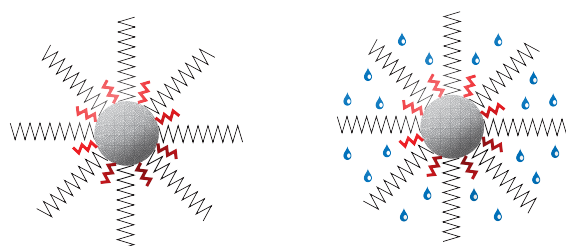
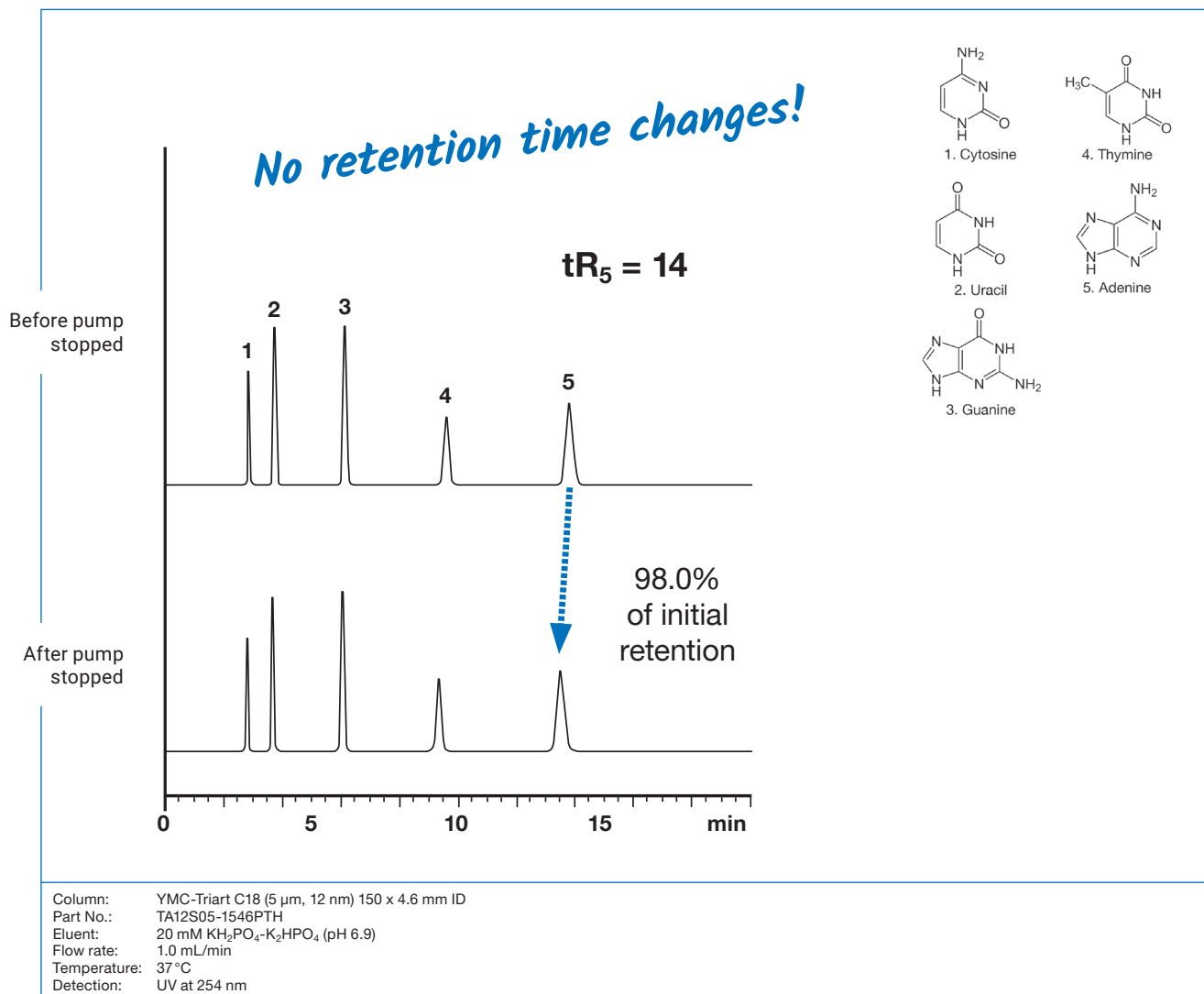
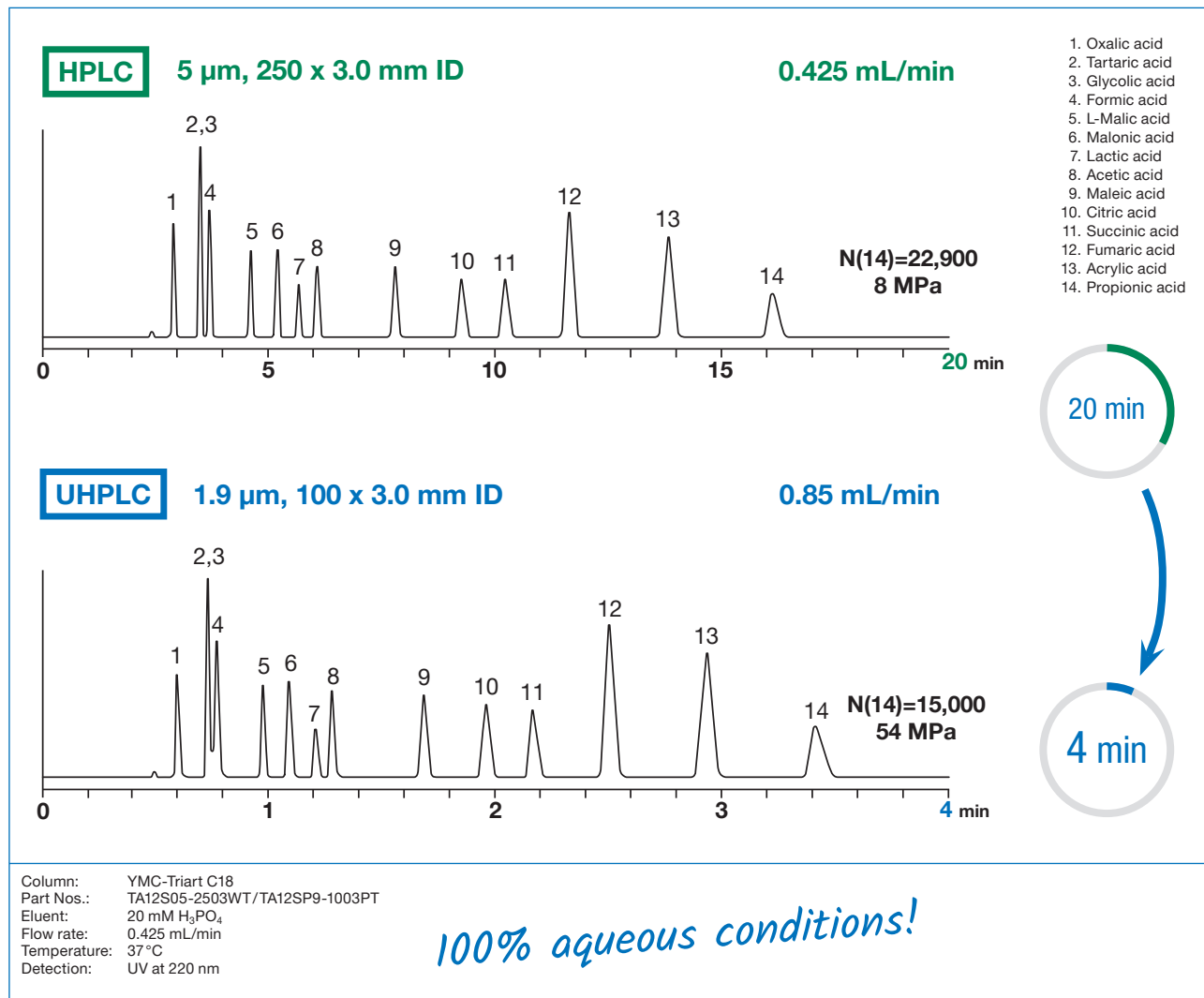


Image of C18 surface hydration

**W**hen YMC-Triart C18 columns are used for applications involving 100% aqueous buffers, the retention times are unchanged after the flow was stopped between analyses. This is due to the improved hydration of the phase. Polar compounds can easily distribute between the mobile phase and the stationary phase.

## YMC-Triart "AQ" | YMC-Triart C18 for polar compounds

From the inventors of AQ-columns: YMC-Triart C18 "validated" for AQ-conditions!



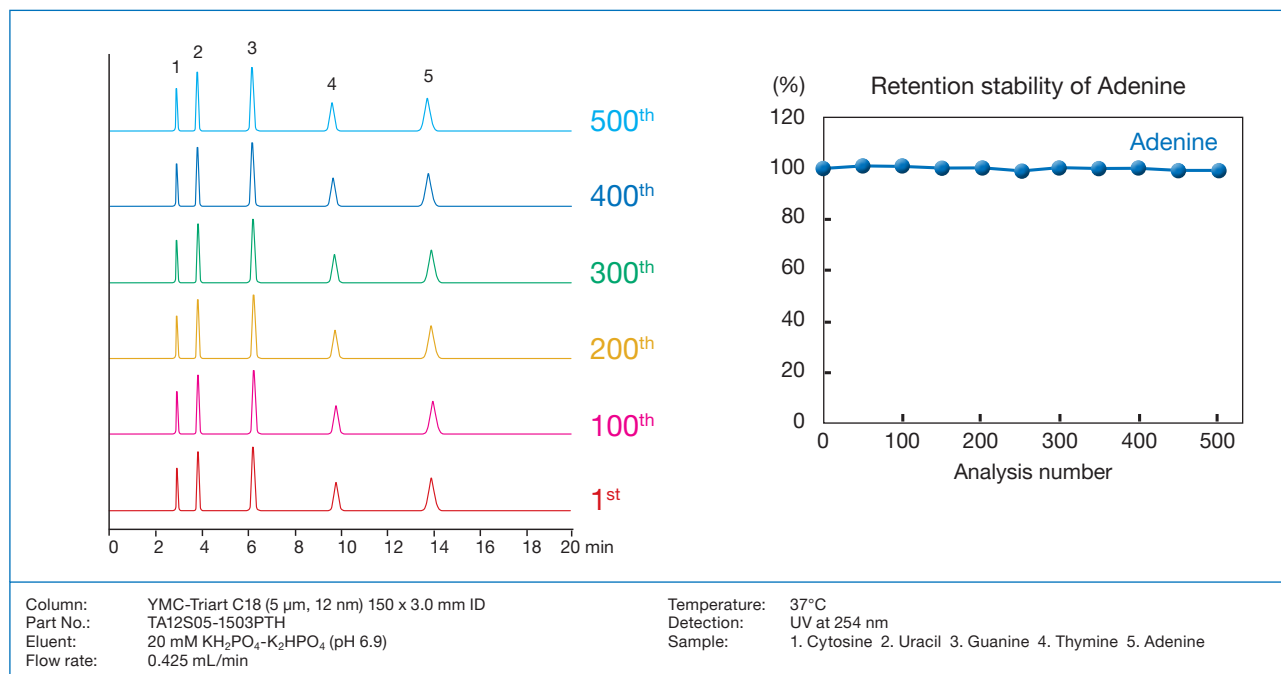
Stable under harsh conditions: pH 1–12 and temperature up to 90°C.

Stable retention times with 100% aqueous eluents!

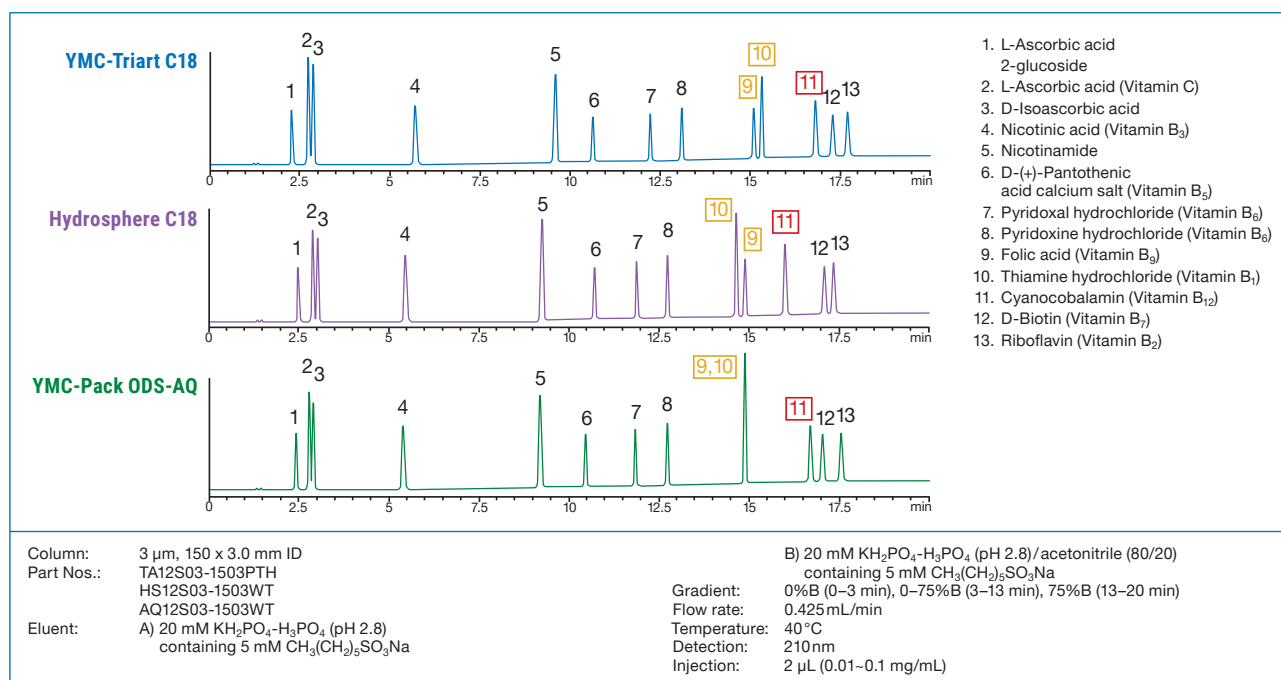
Reproducible results day-after-day, column-to-column and lab-to-lab!

## YMC-Triart "AQ" | YMC-Triart C18 for polar compounds

### Proven reliability



No change is found in the separation parameters including retention times, even after 500 injections when using YMC-Triart C18.

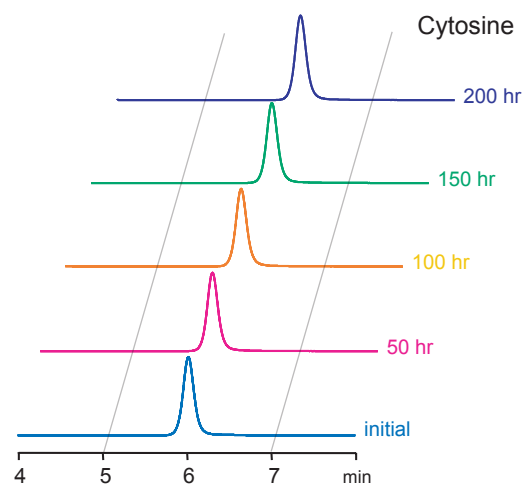
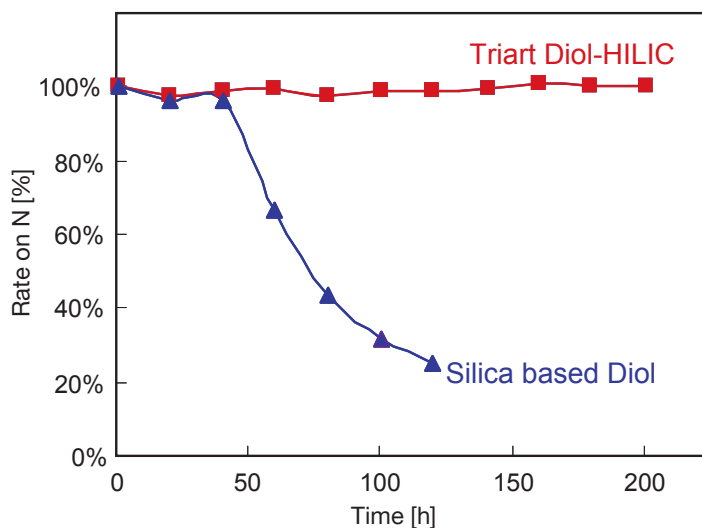


Retention behaviour of water-soluble vitamins on three YMC ODS phases which can be used with 100% aqueous mobile phases is compared. The retention times and peak elution order for folic acid (peak 9), thiamine hydrochloride (peak 10) and cyanocobalamin (peak 11) are different for the three phases due to the balance of hydrophobicity and hydrogen bonding capacity differing between the three phases.

# HILIC

## Great stability and reproducibility at high pH

Stability at high pH (pH 11, 50 °C)\*

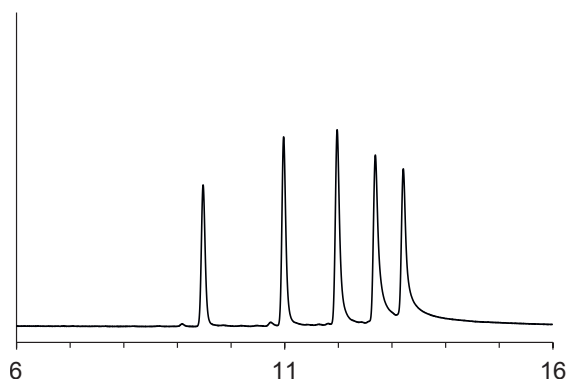


\* pH ≤ 10 is recommended for regular use

Column: 5 μm, 150 x 4.6 mm ID  
 Part No.: TDH12S05-1546PTH  
 Eluent: acetonitrile/water/NH<sub>3</sub> (90/10/0.1) pH 11.3  
 Flow rate: 1.0 mL/min  
 Temperature: 50 °C  
 Sample: Cytosine

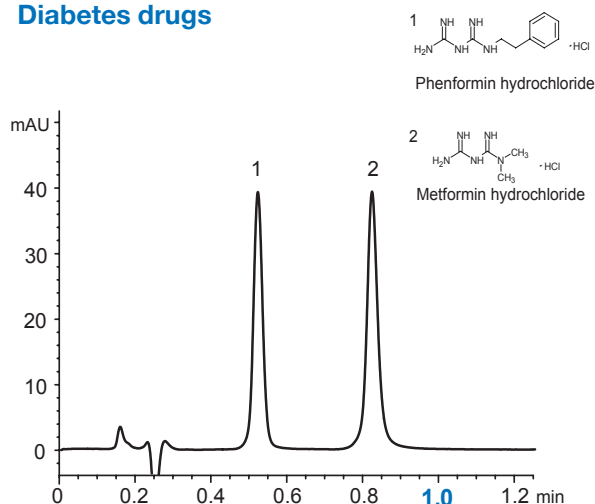
YMC-Triart Diol-HILIC offers highly reproducible separations even at high pH and high temperature. The lifetime of YMC-Triart Diol-HILIC is much longer than that of conventional silica-based Diol columns.

### Oligonucleotides



Column: YMC Accura Triart Diol HILIC (1.9 μm, 12 nm) 150 x 2.1 mm ID  
 Part No.: TDH12SP9-15Q1PTC  
 Eluent: A) 50 mM ammonium acetate (pH 6.9)  
 B) acetonitrile  
 Gradient: 75–45%B (0–30 min)  
 Flow rate: 0.3 mL/min  
 Temperature: 40 °C  
 Detection: UV at 260 nm  
 Injection: 2 μL  
 Sample: dT15-35 (2 μM)

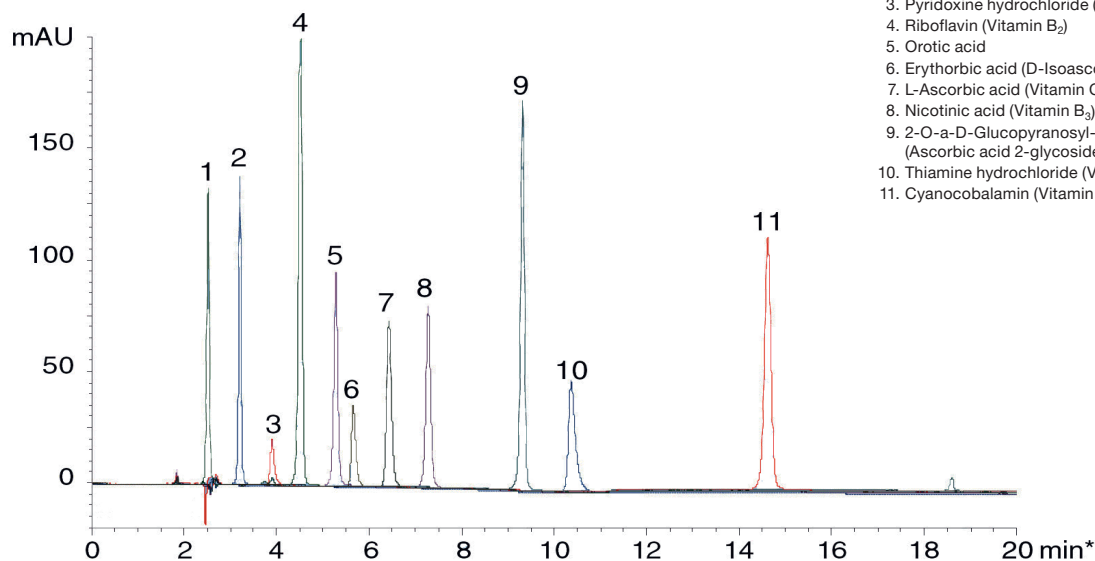
### Diabetes drugs



Column: YMC-Triart Diol-HILIC (1.9 μm, 12 nm) 50 x 2.0 mm ID  
 Part No.: TDH12SP9-0502PT  
 Eluent: 100 mM HCOOH-HCOONH<sub>4</sub> (pH 3.7)/acetonitrile (10/90)  
 Flow rate: 0.8 mL/min  
 Temperature: 25 °C  
 Detection: UV at 235 nm  
 Injection: 2 μL (10 μg/mL)

by courtesy of University of Geneva, School of Pharmaceutical Sciences, Department of Analytical Pharmaceutical Chemistry

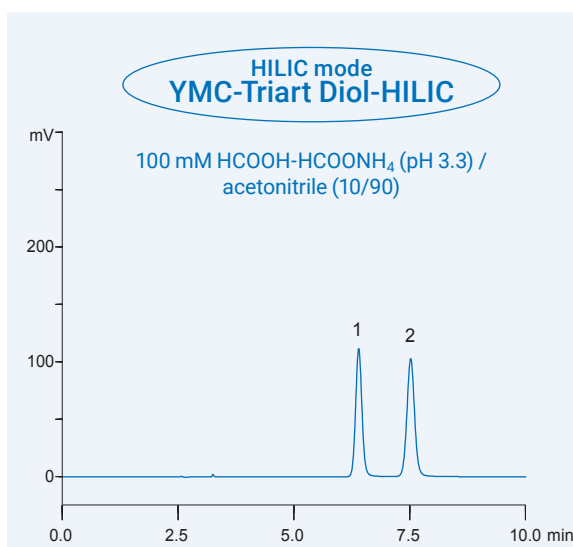
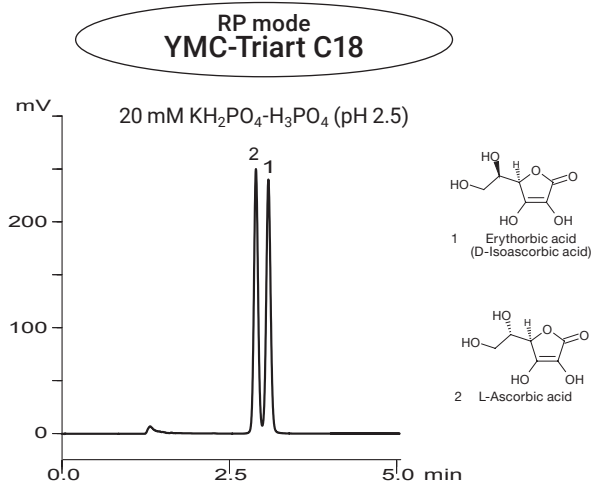
Water soluble vitamins



1. Caffeine
2. Nicotinamide
3. Pyridoxine hydrochloride (Vitamin B<sub>6</sub>)
4. Riboflavin (Vitamin B<sub>2</sub>)
5. Orotic acid
6. Erythorbic acid (D-Isoascorbic acid)
7. L-Ascorbic acid (Vitamin C)
8. Nicotinic acid (Vitamin B<sub>3</sub>)
9. 2-O- $\alpha$ -D-Glucopyranosyl-L-ascorbic acid (Ascorbic acid 2-glycoside)
10. Thiamine hydrochloride (Vitamin B<sub>1</sub>)
11. Cyanocobalamin (Vitamin B<sub>12</sub>)

Column: YMC-Triart Diol-HILIC (5  $\mu$ m, 12 nm) 150 x 3.0 mm ID  
 Part No.: TDH12S05-1503PTH  
 Eluent: A) acetonitrile/200 mM HCOOH-HCOONH<sub>4</sub> (pH 3.6)/water (90/5/5)  
 B) acetonitrile/200 mM HCOOH-HCOONH<sub>4</sub> (pH 3.6)/water (50/5/45)  
 Gradient: 0-75%B (0-20 min)  
 Flow rate: 0.425 mL/min  
 Temperature: 40°C  
 Detection: UV at 254 nm  
 Injection: 4  $\mu$ L (50  $\mu$ g/mL)

Polar and hydrophilic compounds



Column: (5  $\mu$ m, 12nm) 150 x 3.0 mm ID  
 Part No.: TDH12S05-1503PTH  
 Flow rate: 0.425 mL/min  
 Temperature: 40°C  
 Detection: UV at 254 nm  
 Injection: 4  $\mu$ L (0.05 mg/mL)

YMC-Triart C18 (RP) shows very weak retention and poor resolution of L-ascorbic acid and its stereoisomer (erythorbic acid) even if 100% aqueous mobile phase is used. However, YMC-Triart Diol-HILIC shows strong retention and good resolution of these compounds with mobile phase containing 90% organic solvent.



## SFC

*SFC compatibility  
 certified by an  
 independent institute!*

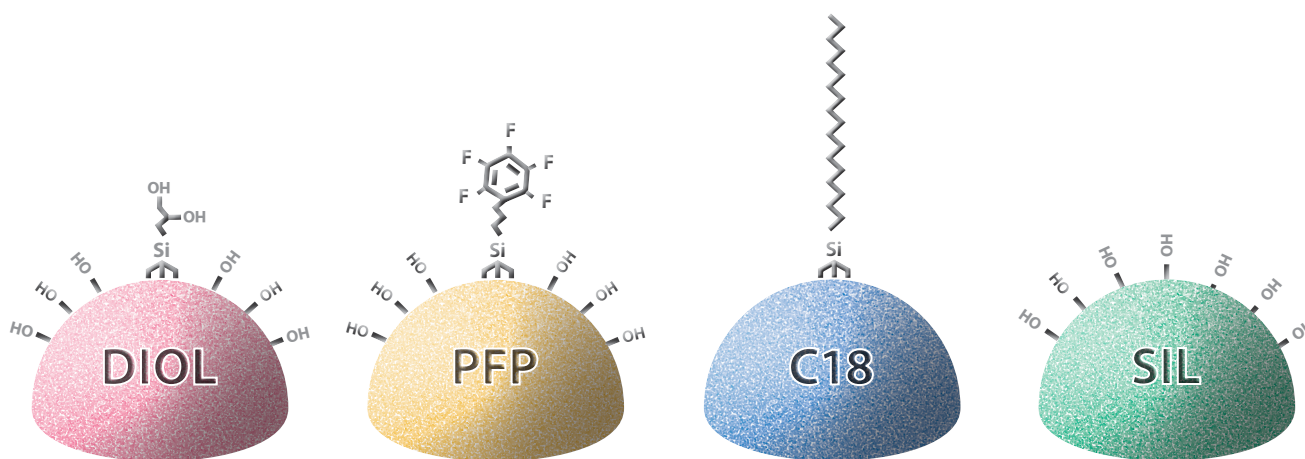
### Phases for Supercritical Fluid Chromatography

YMC-Triart Diol

YMC-Triart PFP

YMC-Triart C18

YMC-Triart SIL



### Specification YMC-Triart

	Diol	PFP	C18	SIL
Base	organic/inorganic hybrid silica			
Stationary phase	Diol (USP L20)	Pentafluorophenyl (USP L43)	C18 (USP L1)	Unmodified
Particle size	1.9, 3 and 5 µm			3 and 5 µm
Pore size	12 nm			
Specific surface	360 m <sup>2</sup> /g			
Carbon content	—	15%	20%	—
Bonding	trifunctional	trifunctional	trifunctional	—
Endcapping	none	none	multi-stage	—
pH range	2 ~ 10	1 ~ 8	1 ~ 12	—
Temperature range	50 °C	50 °C	pH < 7: 90 °C pH > 7: 50 °C	50 °C
Pressure limit	1.9 µm: 100 MPa (15,000 psi) 3/5 µm: 45 MPa (6,525 psi)			
SFC compatibility	100% SFC compatible hardware*			

\*Statement is available to confirm the usability in SFC mode!

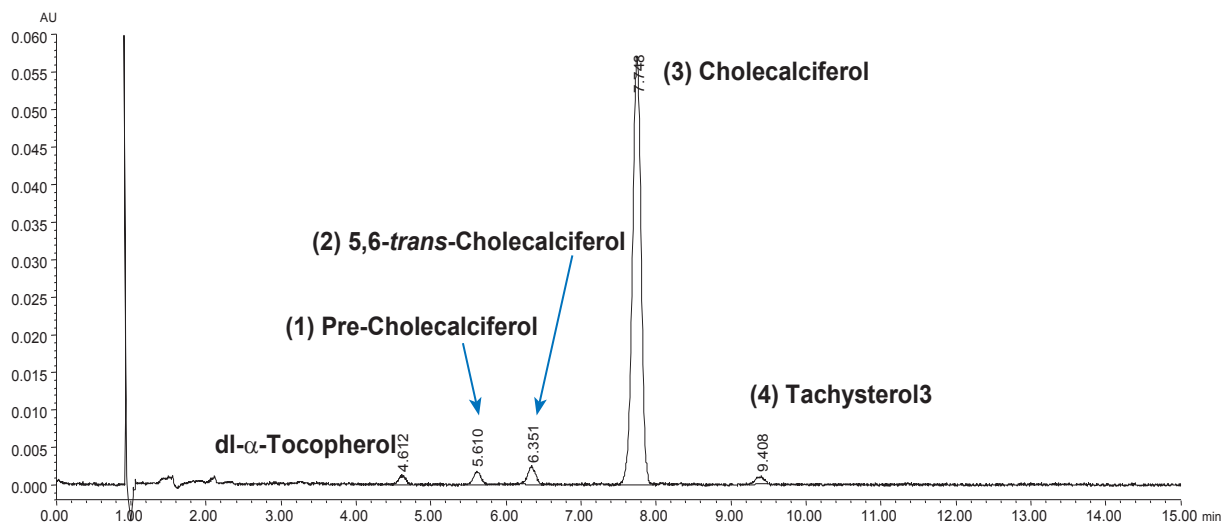
### SFC columns by YMC

Further, optionally SFC dedicated columns with 5 µm are available: Alcyon SFC Triart. Alcyon SFC columns are specifically packed in a SFC dedicated hardware. The stationary phase used in Alcyon SFC

columns is identical to that used in the corresponding YMC-Triart LC columns. The selection of phases, particle sizes and dimensions are limited compared to the LC column hardware.



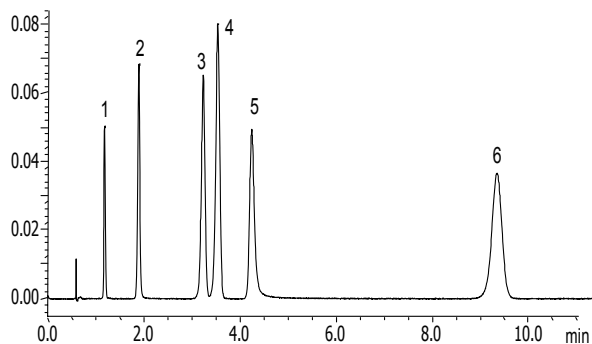
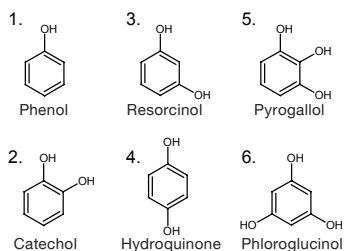
### Rapid analysis of vitamin D3 and related substances in nutritional products



Column: YMC-Triart Diol (3  $\mu$ m, 12 nm) 250 x 4.6 mm ID  
 Part No.: TDH12S03-2546PTHB  
 Mobile phase: CO<sub>2</sub>/ethanol (96/4)  
 Flow rate: 3.0 mL/min  
 Temperature: 40 °C  
 Detection: UV at 254 nm  
 Back pressure: 10.3 MPa (2,000 psi)  
 System: UPC<sup>2</sup>

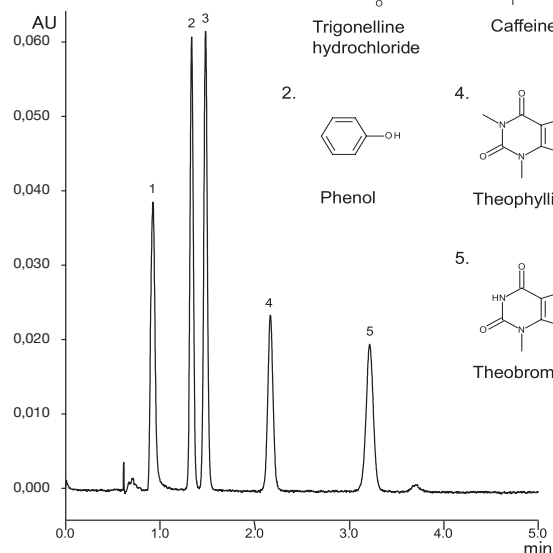
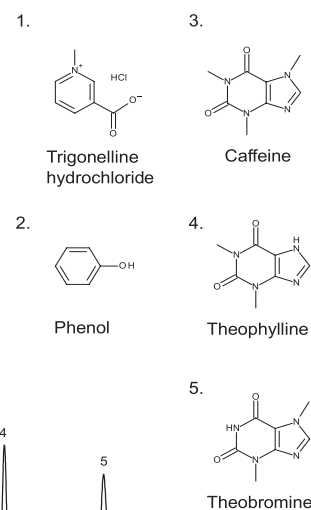
Trade quality and stressed samples used were supplied by DSM Nutritional Products, Site Sisseln (CH)

### Quick separation of phenols



Column: YMC-Triart Diol (5  $\mu$ m, 12 nm) 250 x 4.6 mm ID  
 Part No.: TDH12S05-2546PTHB  
 Eluent: CO<sub>2</sub>/methanol (88/12)  
 Flow rate: 3.0 mL/min  
 Temperature: 30 °C  
 Detection: UV at 230 nm  
 Back pressure: 10.3 MPa (2,000 psi)

### Purin alkaloids

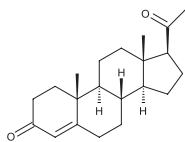


Column: YMC-Triart Diol (5  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TDH12S05-1546PTHB  
 Eluent: CO<sub>2</sub>/methanol (90/10)  
 Flow rate: 3.0 mL/min  
 Temperature: 40 °C  
 Detection: UV at 230 nm  
 Back pressure: 13.8 MPa (2,000 psi)  
 Injection: 5  $\mu$ L (0.085 – 5.7 mg/mL)

# SFC

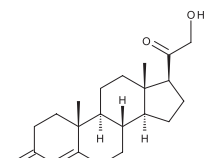
## Steroids using different modifiers

1.



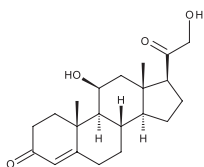
Progesterone

2.



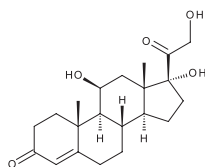
Deoxycorticosterone

3.



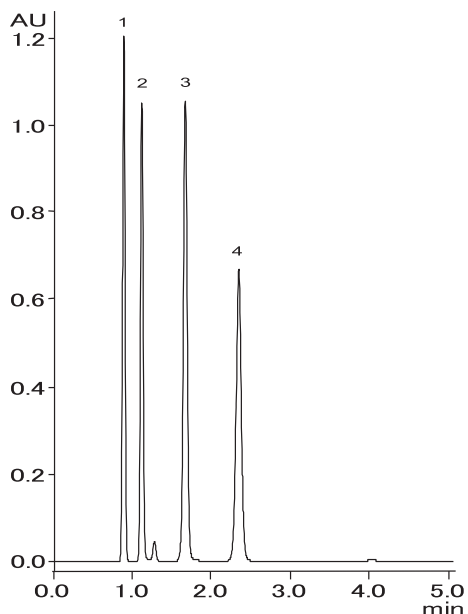
Corticosterone

4.

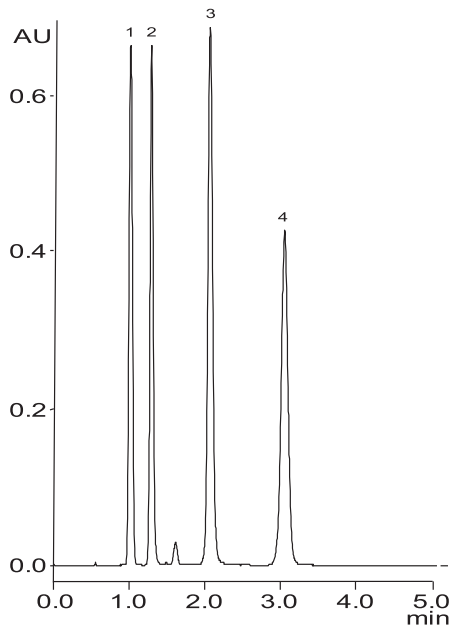


Hydrocortisone

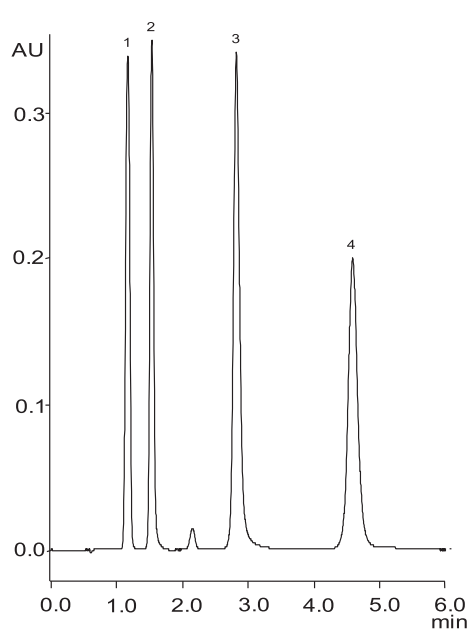
### Methanol



### Ethanol

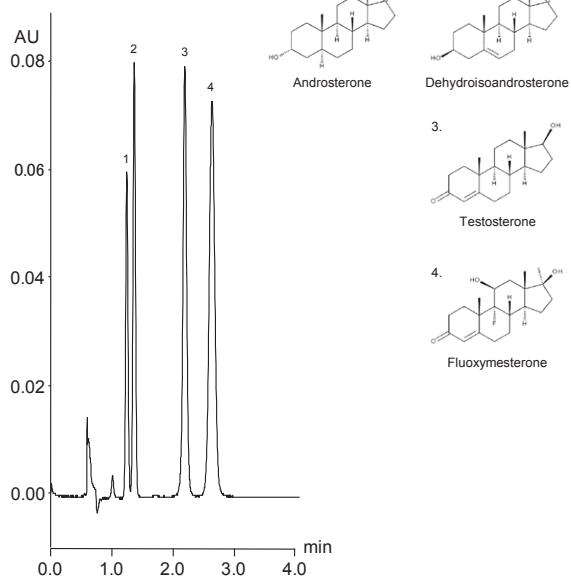


### Isopropanol



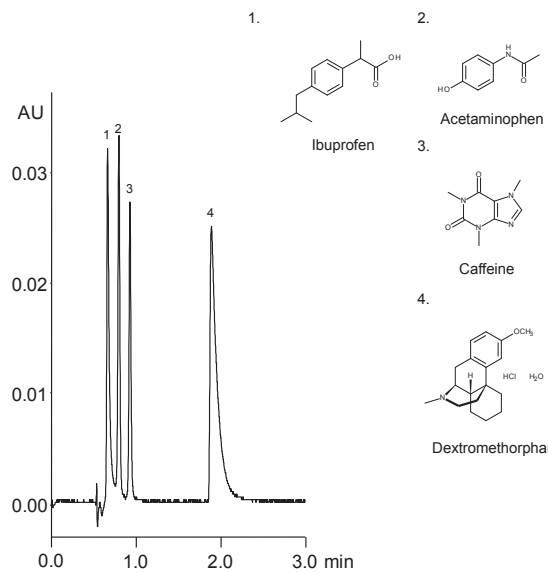
Column: YMC-Triart Diol (5  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TDH12S05-1546PTHB  
 Eluent: CO<sub>2</sub>/alcohol (80/20)  
 Flow rate: 3.0 mL/min  
 Temperature: 40°C  
 Detection: UV at 254 nm  
 Back pressure: 13.8 MPa (2,000 psi)  
 Injection: 5  $\mu$ L (0.8 mg/mL)

### Androgens



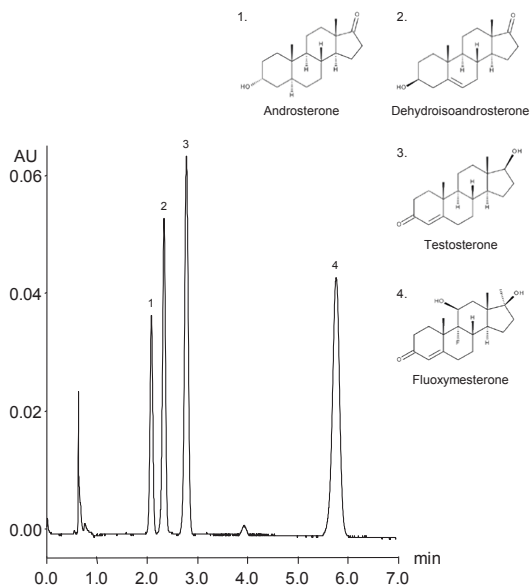
Column: YMC-Triart PFP (5  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TPF12S05-1546PTH  
 Eluent: CO<sub>2</sub>/ethanol (90/10)  
 Flow rate: 3.0 mL/min  
 Temperature: 40 °C  
 Detection: UV at 254 nm  
 Back pressure: 13.8 MPa (2,000 psi)  
 Injection: 5  $\mu$ L (0.56 mg/mL ~ 6.7 mg/mL)

### Ingredients in a cough/cold medication



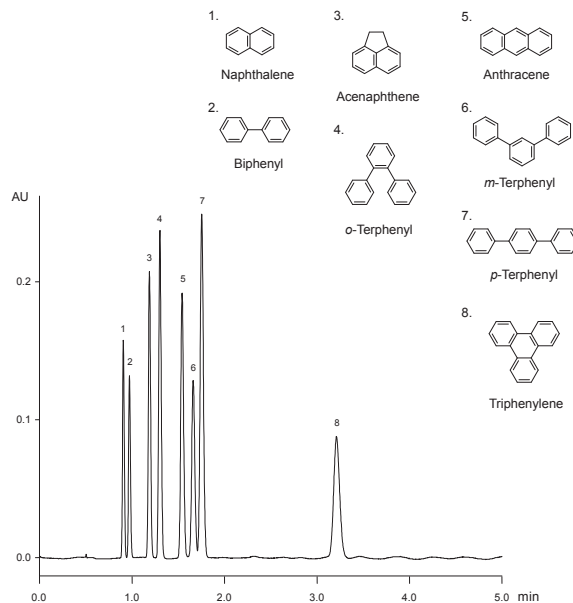
Column: YMC-Triart PFP (5  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TPF12S05-1546PTH  
 Eluent: CO<sub>2</sub>/methanol containing 0.1% diethylamine (80/20)  
 Flow rate: 3.0 mL/min  
 Temperature: 40 °C  
 Detection: UV at 254 nm  
 Back pressure: 13.8 MPa (2,000 psi)  
 Injection: 1  $\mu$ L (0.044mg/mL ~ 5.32 mg/mL)

### Androgens



Column: YMC-Triart Diol (5  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TDH12S05-1546PTH  
 Eluent: CO<sub>2</sub>/methanol (90/10)  
 Flow rate: 3.0 mL/min  
 Temperature: 40 °C  
 Detection: UV at 254 nm  
 Back pressure: 13.8 MPa (2,000 psi)  
 Injection: 5  $\mu$ L (0.56 ~ 6.7 mg/mL)

### Polyaromatic hydrocarbons



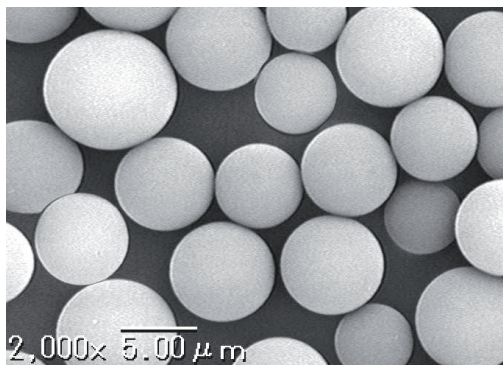
Column: YMC-Triart C18 (5  $\mu$ m, 12 nm) 150 x 4.6 mm ID  
 Part No.: TA12S05-1546PTH  
 Eluent: CO<sub>2</sub>/methanol (95/5)  
 Flow rate: 3.0 mL/min  
 Temperature: 40 °C  
 Detection: UV at 254 nm  
 Back pressure: 13.8 MPa (2,000 psi)  
 Injection: 2  $\mu$ L (0.03 ~ 1.0 mg/mL)

## QC Data – Low back pressure

### YMC-Triart: Improved quality of particles

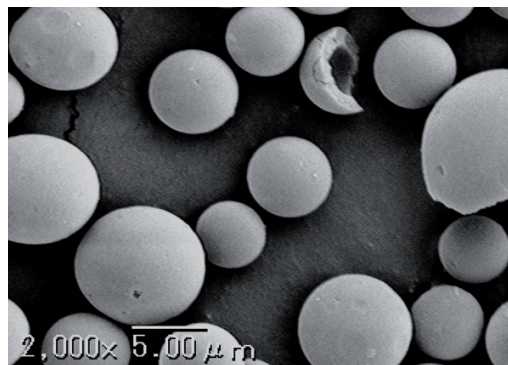
#### Uniform spherical particles

YMC-Triart



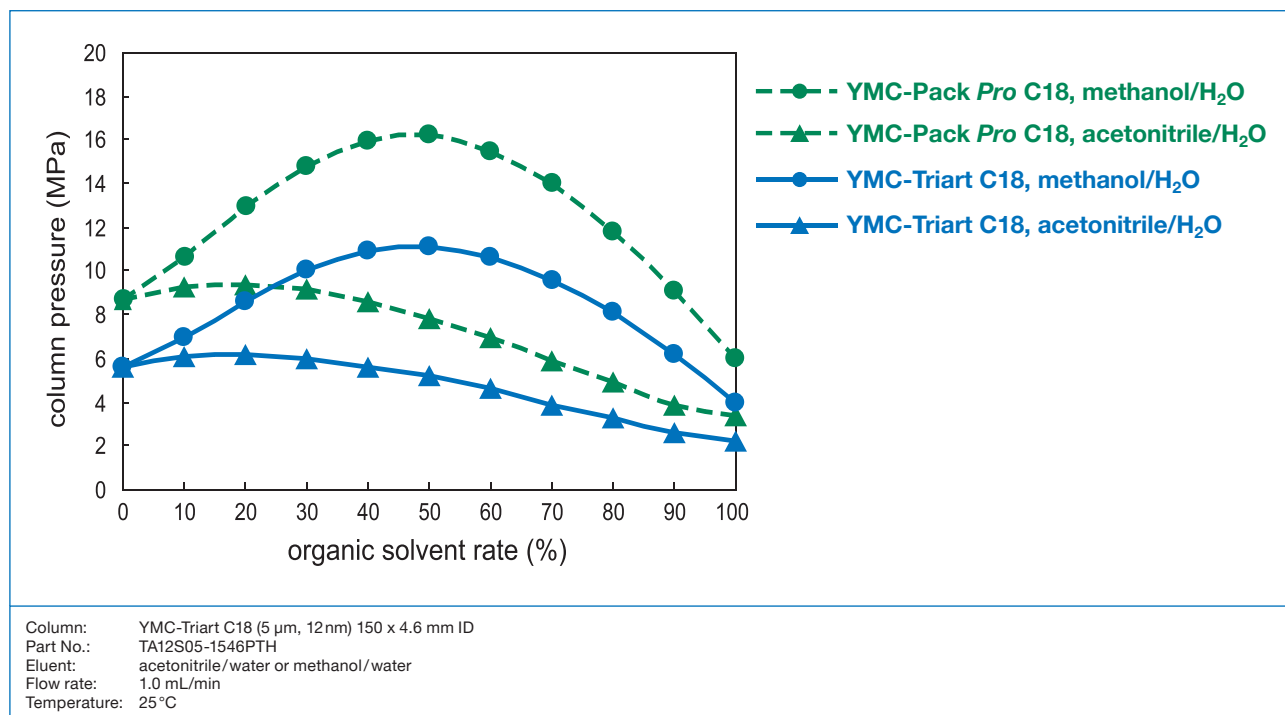
by courtesy of YMC Co., Ltd.

XBridge HILIC



The uniform spherical particle support is used for all YMC-Triart phases. The particles are produced using micro-reactor technology for the granulation process. This results in reduction of the backpressure and leads to more reproducibility in surface modification.

#### Low column backpressure



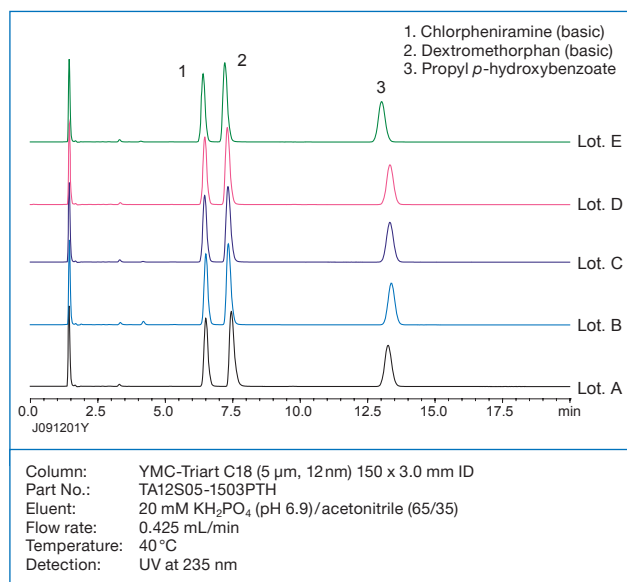
The revolutionary production technique, adapted from micro-reactor flow technology, produces a silica/organic hybrid stationary phase, with outstanding narrow pore size and particle size distributions which result in low back pressures. YMC-Triart is designed for use under a wide range of conditions. Elution with higher viscosity methanol (compared with acetonitrile), YMC-Triart generates lower pressure (approx. 30% lower than with conventional phases).

## QC Data – Excellent reproducibility

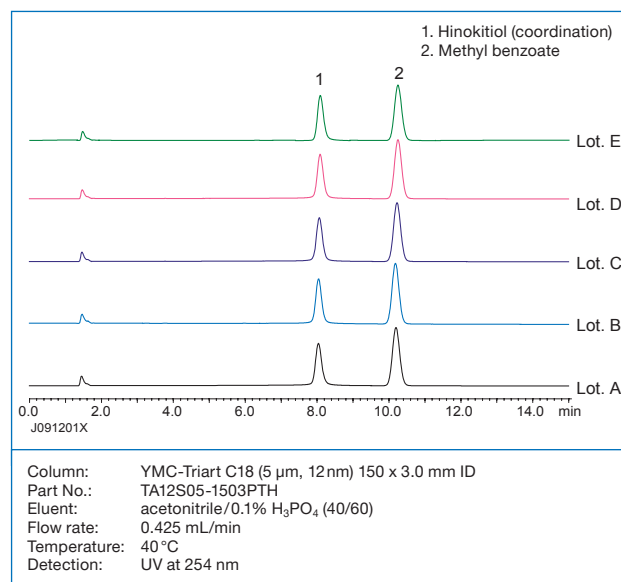
### Batch-to-batch reproducibility

Excellent reproducibility of YMC-Triart phases is available even for the analysis of basic and coordination compounds which normally exhibit tailing and adsorption effects.

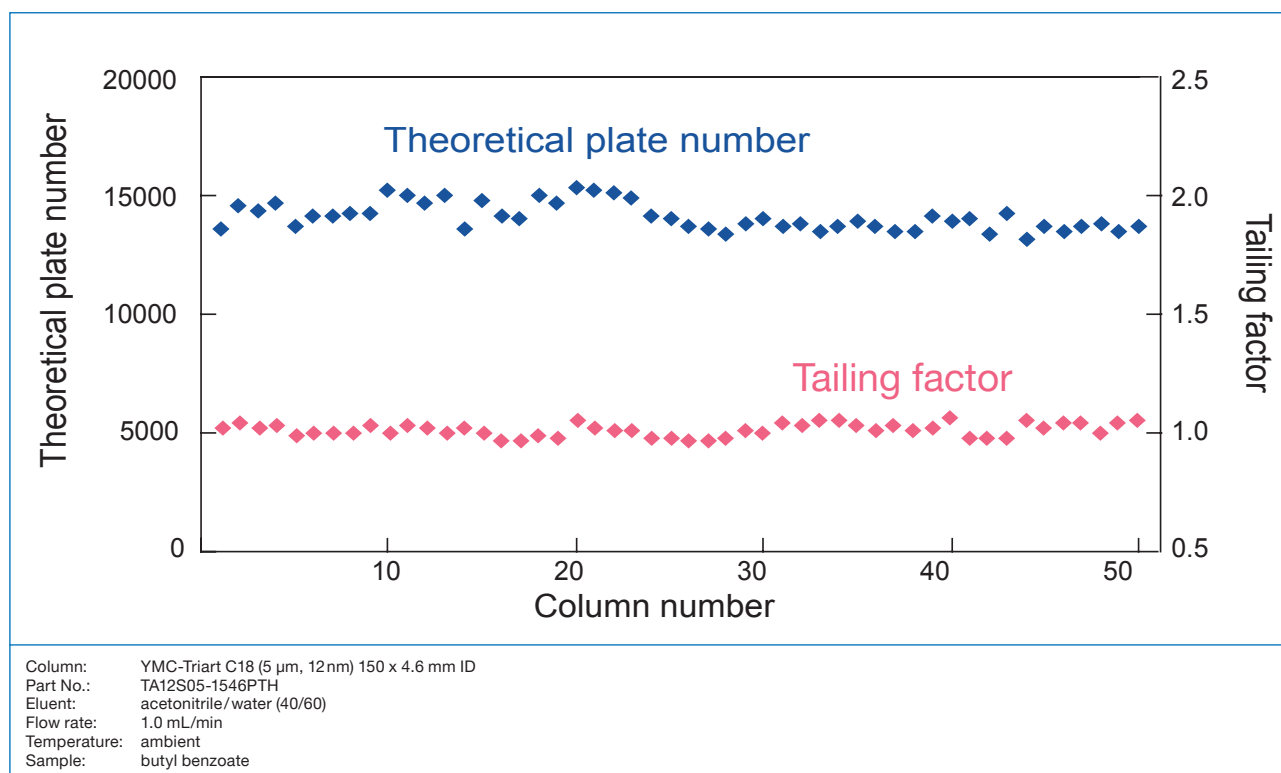
### Basic compounds



### Coordinating compounds

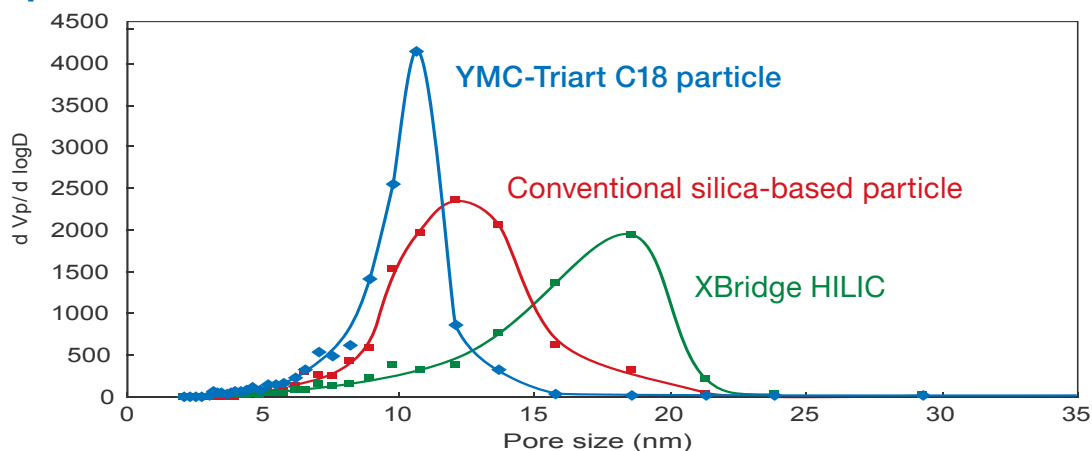


The reproducibility of packed columns is shown below in terms of theoretical plate number (N) and tailing factor (Tf). YMC-Triart packed columns exhibit a very narrow range of variation.



## QC Data – High loadability

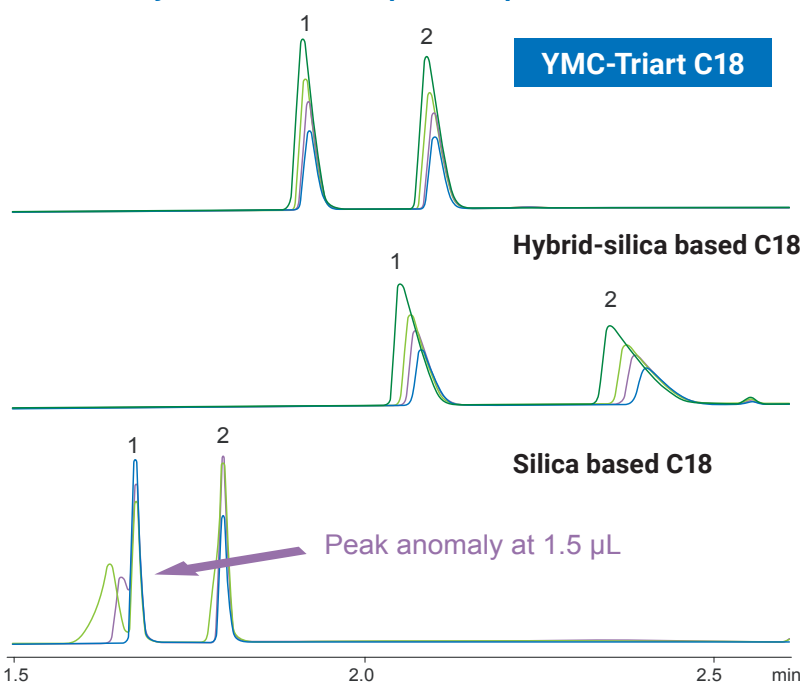
### Narrow pore distribution



This figure shows the pore size distributions of some competitive material. Comparing the pore size distributions shows that YMC-Triart has a narrower distribution which results in sharper peak shapes.

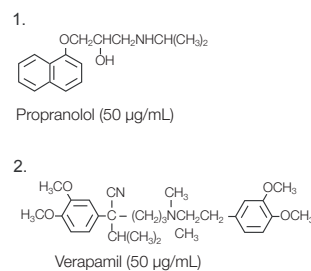
### Improved loadability

#### Influence of injection volume on peak shapes



solvent for sample  
acetonitrile

injection volume  
1.0 µL  
1.5 µL  
2.0 µL  
3.0 µL



Column: 5 µm, 50 x 2.0 or 2.1 mm ID  
Part No.: TA12S05-0502WT  
Eluent: A) water + 0.1% formic acid  
B) acetonitrile + 0.1% formic acid  
Gradient: 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

In order to prevent peak errors, there is a limit to the injection volume when a sample is injected in high elution solvents (such as 100% acetonitrile). Compared with traditional columns, more than double the injection volume can be injected into YMC-Triart columns as a result of the extremely narrow particle size distribution.

## QC Data – Efficient endcapping

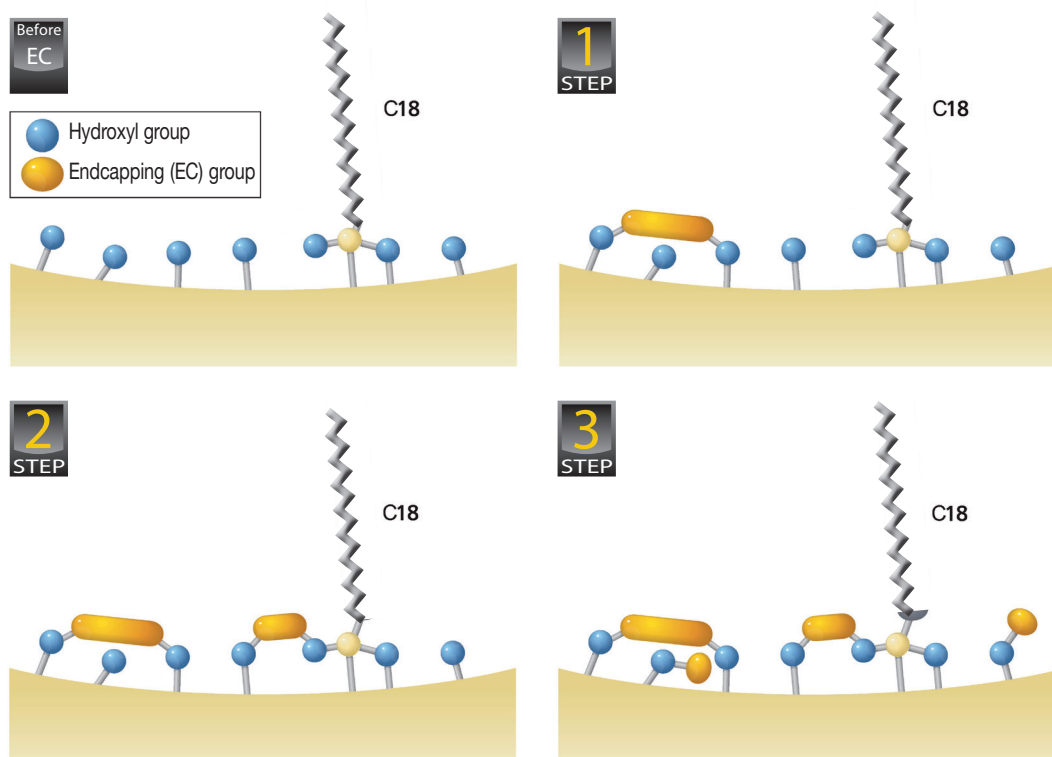
### Multi-stage endcapping

After bonding the alkyl chain, there are highly reactive and less reactive silanols on the surface. In traditional bonding processes, these are reacted with a single endcapping-compound in one step.

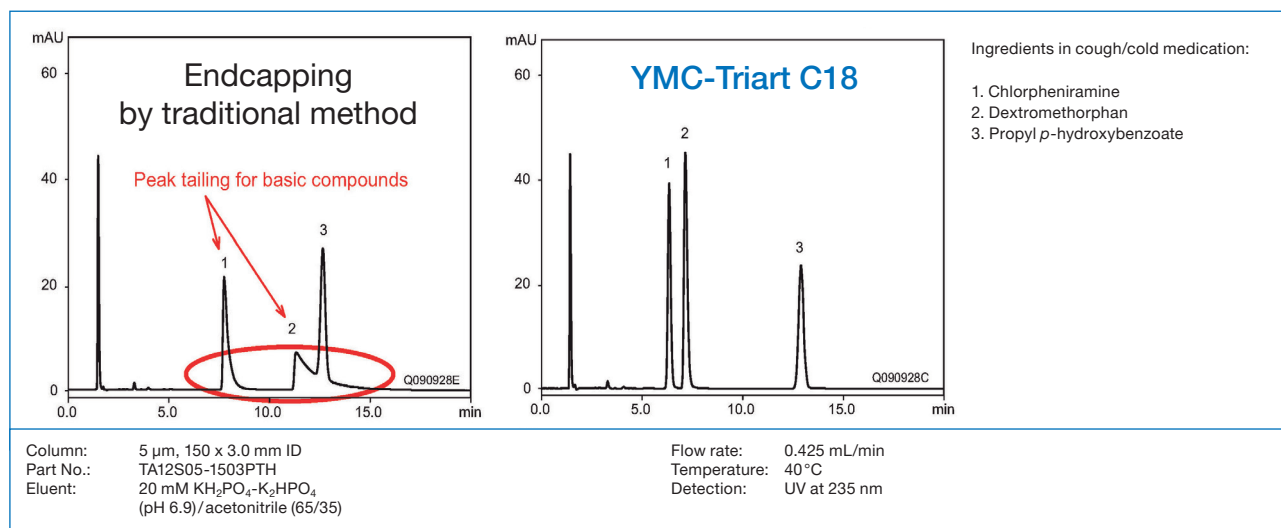
However, the highly reactive silanols can be hydrolysed easily which contributes to the poor stability. The less reactive silanols are hard to endcap which

results in poor resolution due to peak tailing. YMC-Triart phases use an innovation in endcapping called “multi-stage endcapping” for its surface modification process.

By using a number of compounds with different reactivities in successive steps, all silanols can be capped to the maximum extent.

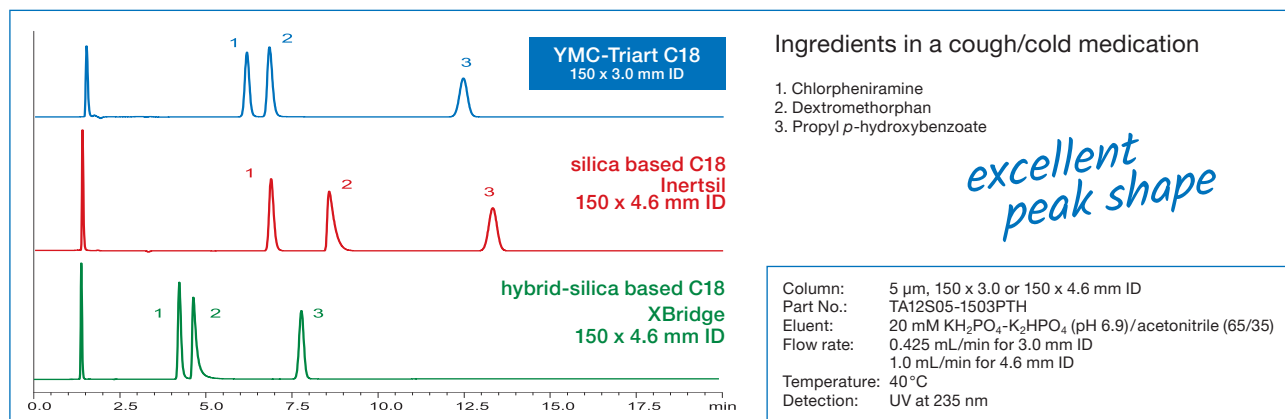


The chromatographic result of a “good” endcapping is demonstrated:



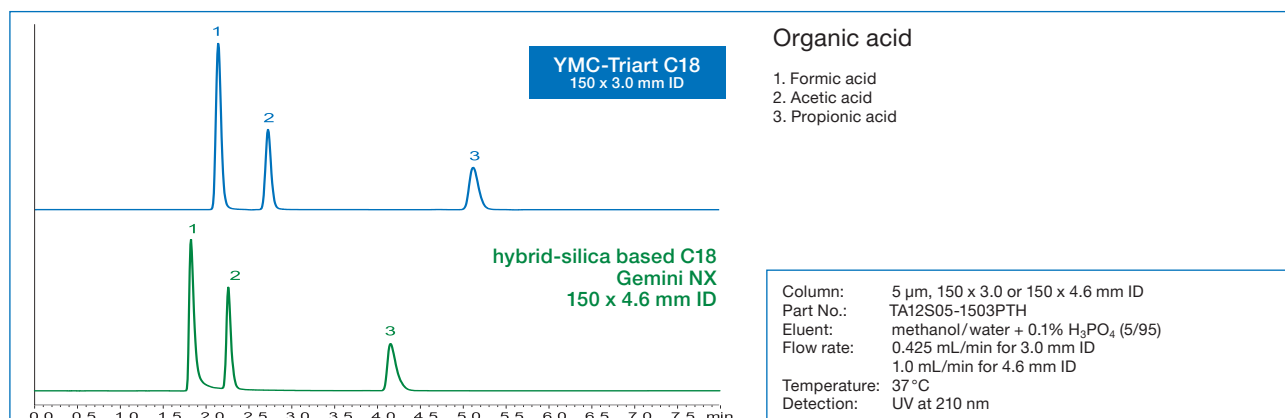
## QC Data – Symmetric peaks

### Basic compounds



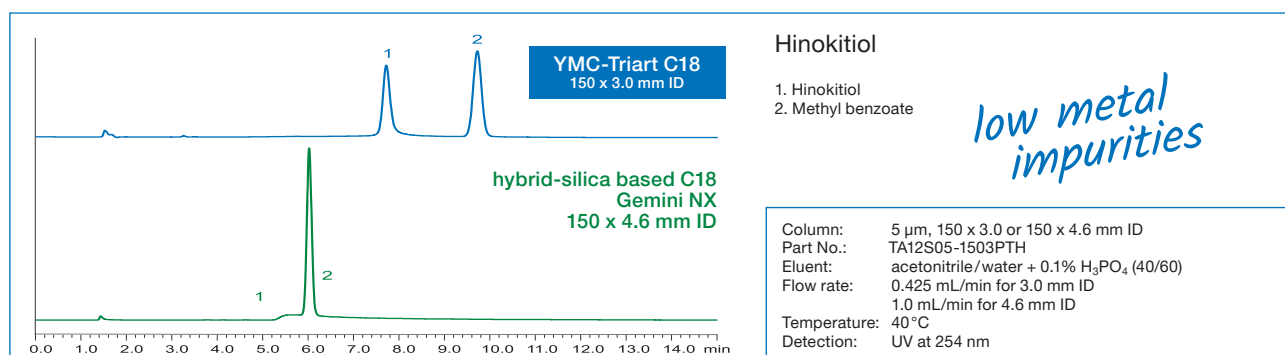
The innovative surface modification technology results in excellent peak shapes even for basic compounds that often exhibit peak tailing with conventional silica- and hybrid silica-based reversed phase columns.

### Acidic compounds



YMC-Triart phases are synthesised using methodology adapted from micro-reactor technology. This technique ensures a reduction of impurities that contribute to peak tailing during the analysis of some types of acidic compounds.

### Coordinating compounds

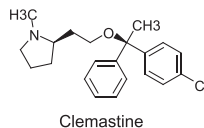


YMC-Triart phases have an extremely low level of metal impurities, much lower than conventional products, ensuring excellent peak shape for coordination compounds.



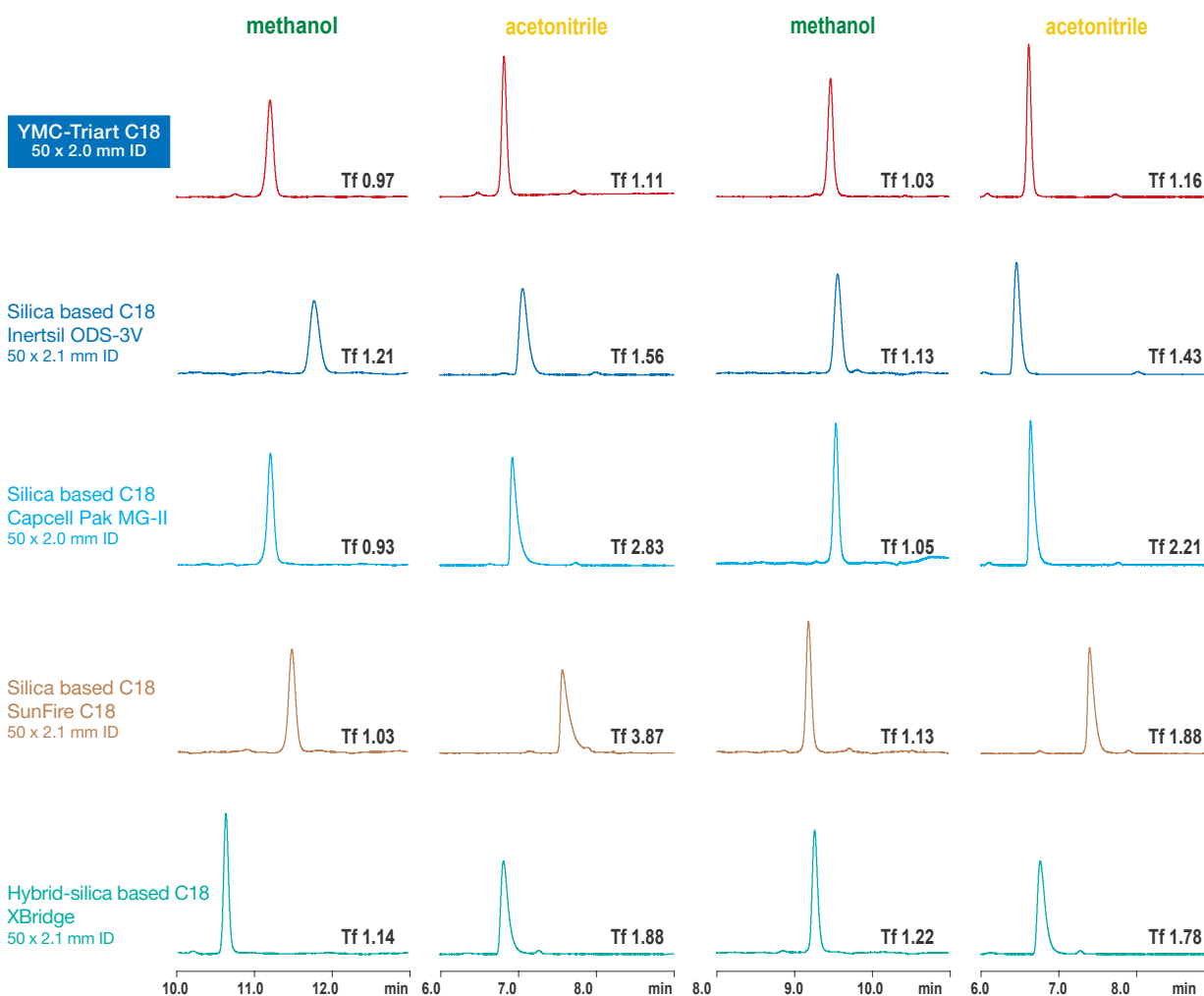
## QC Data – Base deactivation

### Peak shape comparison of basic compound clemastine



10 mM phosphate buffer (pH 6.7)/organic solvent

10 mM CH<sub>3</sub>COONH<sub>4</sub>/organic solvent

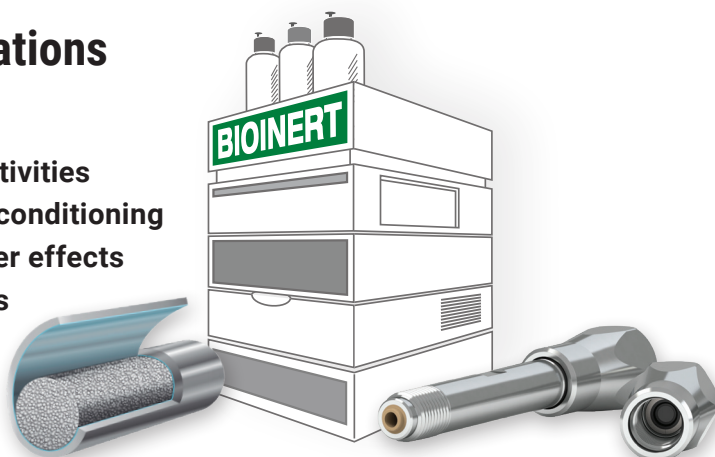


Column: 5  $\mu$ m, 50 x 2.0 or 50 x 2.1 mm ID  
 Part No.: TA12S05-0502WT  
 Eluent: A) 10 mM KH<sub>2</sub>PO<sub>4</sub>-K<sub>2</sub>HPO<sub>4</sub> (pH 6.7) or 10 mM CH<sub>3</sub>COONH<sub>4</sub>  
 B) methanol or acetonitrile  
 Gradient: 5–90%B (0–10 min), 90%B (10–15 min)  
 Flow rate: 0.2 mL/min  
 Temperature: 25°C  
 Detection: UV at 230 nm

Clemastine is a well-known basic compound which readily exhibits peak tailing with conventional ODS columns. YMC-Triart C18 provides sharp separations with many different buffer/solvent compositions.

# Bioinert columns for bioseparations and coordinating compounds

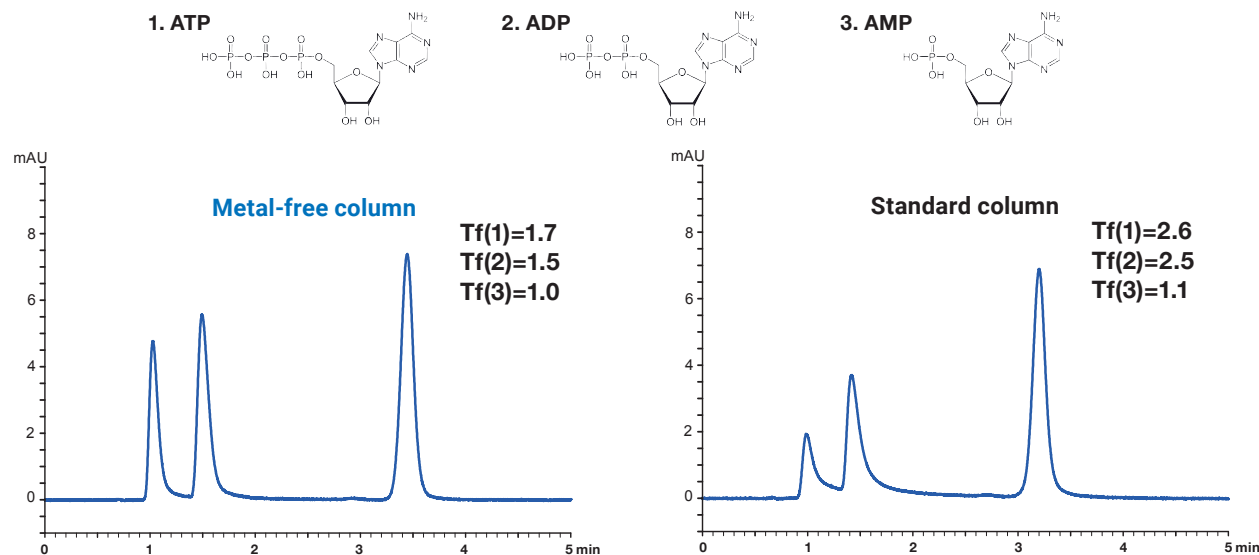
- Exceptional peak shapes with high sensitivities
- Excellent recoveries without column preconditioning
- Superior reproducibility and no carry-over effects
- Ideal for highly sensitive LC/MS analyses
- Different bioinert hardware options



## Specification

	YMC Accura Triart	YMC-Triart metal-free PEEK-lined
YMC-Triart modifications	C18, C18 ExRS, Bio C18, C8, Bio C4, Phenyl, PFP, Diol-HILIC	
Particle Size	1.9, 3 and 5 µm	
Column hardware	Bioinert coated stainless steel	PEEK-lined stainless steel
Frit hardware	Bioinert coated stainless steel	PEEK
Hardware properties	Less hydrophobic	More hydrophobic
Pressure limit	1.9 µm: 100 MPa (15,000 psi) 3/5 µm: 45 MPa (6,525 psi)	
Column connection	No special connections required	Selected universal connectors such as MarvelXACT™

### Improved sensitivity for coordination compounds



Column: YMC-Triart C18 (3 µm, 12nm) 50 x 2.1 mm ID  
 Part Nos.: TA12S03-05Q1PTP (metal-free) or TA12S03-05Q1PTH (regular hardware)  
 Eluent: 5 mM HCOONH<sub>4</sub>  
 Flow rate: 0.21 mL/min

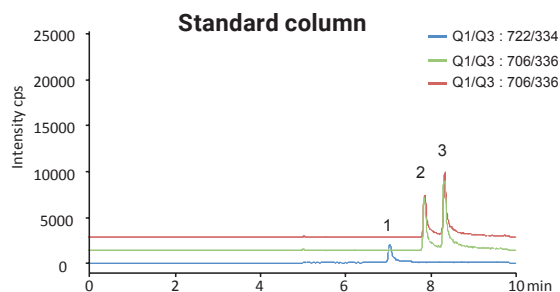
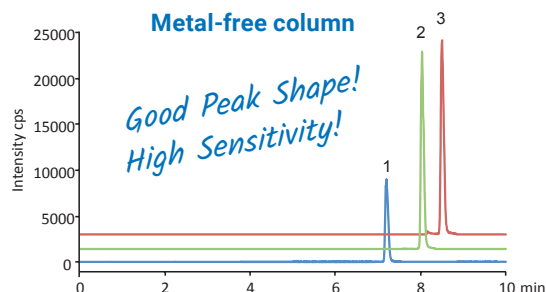
Temperature: 25 °C  
 Detection: UV at 265 nm  
 Injection: 1 µL (10 µg/mL)  
 System: bioinert/"metal-free" HPLC system

Metal coordinating compounds, which have a phosphate group in their structure, tend to show poor peak shape due to interactions with metals, such as the stainless steel in column bodies and frits. By using a bioinert column hardware, better peak shapes can be expected.

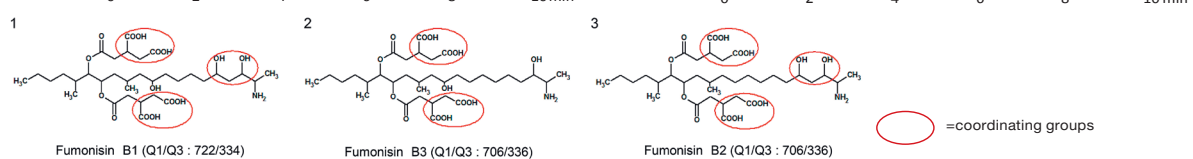
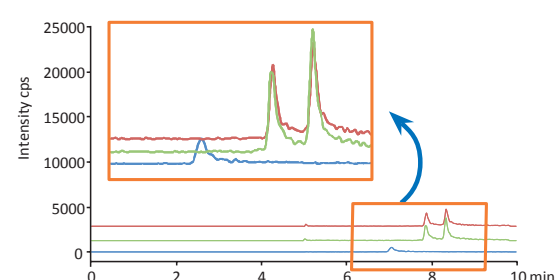
Nucleotides with phosphate groups also show better peak shapes when compared to the regular column hardware. The applied YMC-Triart metal-free PEEK-lined as well as the YMC Accura Triart column hardware are ideal for highly sensitive analyses using LC/MS.

# Bioinert columns for bioseparations and coordinating compounds

## Improved LC/MS results



### Blank run after the analysis of fumonisins standard



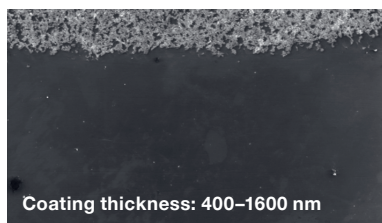
Column: YMC-Triart C18 (metal-free/standard) (3µm, 12 nm) 150x2.1 mm ID  
 Part Nos.: TA12S03-15Q1PTP/TA12S03-15Q1PTH  
 Eluent: A) water/HCOOH (100/0.1)  
 B) acetonitrile  
 25–50%B (0–5 min), 50%B (5–8 min), 50–90%B (8–10 min)  
 Flow rate: 0.2 mL/min

Temperature: 40°C  
 Detection: ESI, positive  
 Scheduled MRM (Metal-free column)  
 MRM (Standard column)  
 Injection: 5 µL (0.1 mg/mL)  
 Instrument: LC) Shimadzu Prominence UFLC, MS) AB Sciex 3200 QTRAP

The YMC-Triart metal-free PEEK-lined column showed excellent peak shapes when used to analyse fumonisins, while the regular column showed severe peak tailing due to interactions between the sample and the hardware. No carry-over was observed when using the

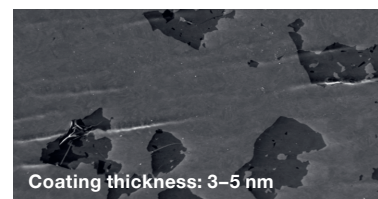
PEEK-lined column, while the regular column showed sample carry-over caused by adsorption of the sample on the hardware. The YMC-Triart metal-free PEEK-lined column gives excellent peak shape for these coordination compounds and contributes to reliable analyses.

## YMC Accura Triart: durable bioinert coating



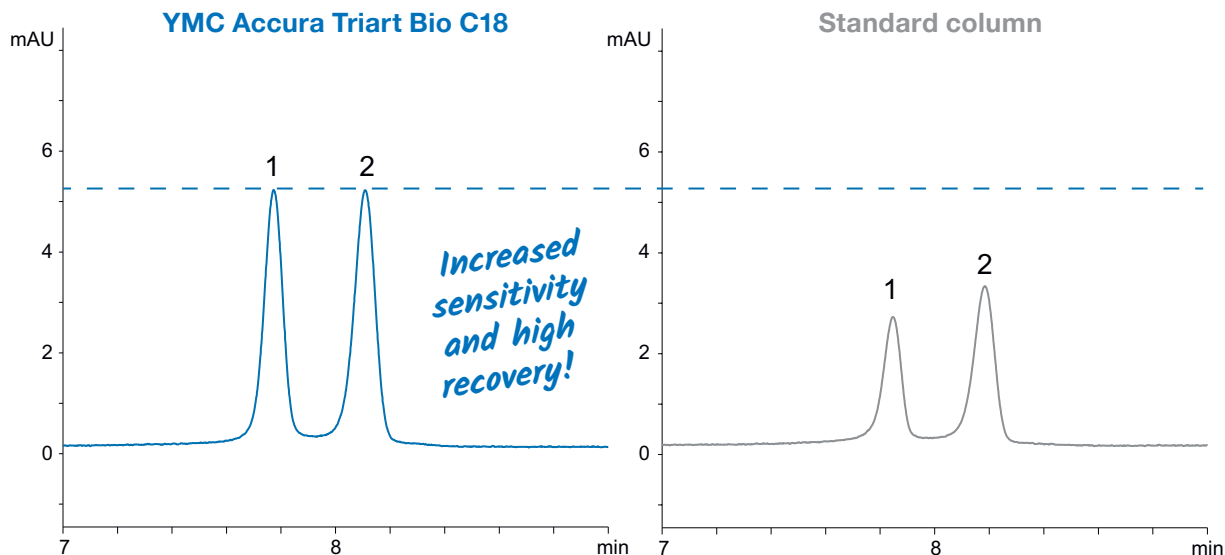
The robust bioinert coating used on YMC Accura hardware is 130 to 320-fold thicker making it more durable than other similar hardware concepts. A long-term inertness against sensitive substances is ensured. In order to demonstrate its robustness, a YMC Accura column was packed multiple times. Even though this is quite a challenge for the column surface, the coating remains unaffected (SEM\* picture: top area is bare steel for comparison). \*Scanning Electron Microscope

Other coated columns can lose their inertness over time. This will again lead to adsorption of sensitive compounds on the uncovered metallic surfaces. Peak tailing, loss of recovery and sample carry-over are typical results of the delamination of the coating. After only unpacking a coated competitor column most of the coating is already delaminated (dark spots: remaining coating).



# Bioinert columns for bioseparations and coordinating compounds

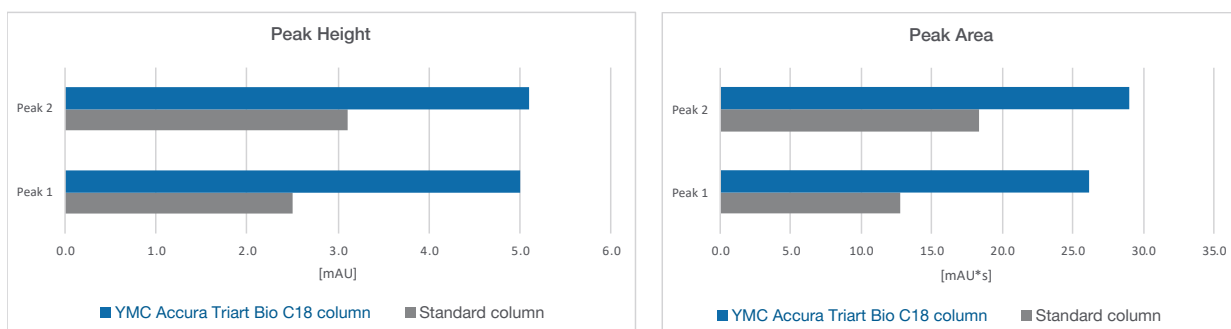
Ideal choice for challenging analytes such as phosphorothioate oligonucleotides



Column: YMC Accura Triart Bio C18 (1.9 μm, 30 nm) 50 x 2.1 mm ID  
 Part No.: TA30SP9-05Q1PTC  
 Eluent: A) 15 mM triethylamine - 400 mM HFIP\*  
 B) methanol  
 Gradient: 8–18%B (0–10 min)  
 Flow rate: 0.42 mL/min  
 Temperature: 65 °C  
 Detection: UV at 260 nm  
 Injection: 1 μL  
 Sample: All PS RNA 20mer (1) (5'-U<sup>^</sup>C<sup>^</sup>A<sup>^</sup>U<sup>^</sup>C<sup>^</sup>A<sup>^</sup>C<sup>^</sup>A<sup>^</sup>C<sup>^</sup>U<sup>^</sup>G<sup>^</sup>A<sup>^</sup>A<sup>^</sup>U<sup>^</sup>A<sup>^</sup>C<sup>^</sup>C<sup>^</sup>A<sup>^</sup>A<sup>^</sup>U<sup>^</sup>-3')  
 All PS RNA 21mer (2) (5'-G<sup>^</sup>U<sup>^</sup>C<sup>^</sup>A<sup>^</sup>U<sup>^</sup>C<sup>^</sup>A<sup>^</sup>C<sup>^</sup>A<sup>^</sup>C<sup>^</sup>U<sup>^</sup>G<sup>^</sup>A<sup>^</sup>A<sup>^</sup>U<sup>^</sup>A<sup>^</sup>C<sup>^</sup>A<sup>^</sup>C<sup>^</sup>A<sup>^</sup>A<sup>^</sup>U<sup>^</sup>-3')  
 ^=Phosphorothioate

\*1,1,1,3,3,3-hexafluoro-2-propanol

## High sensitivity and recovery



*Doubled peak height and area!*

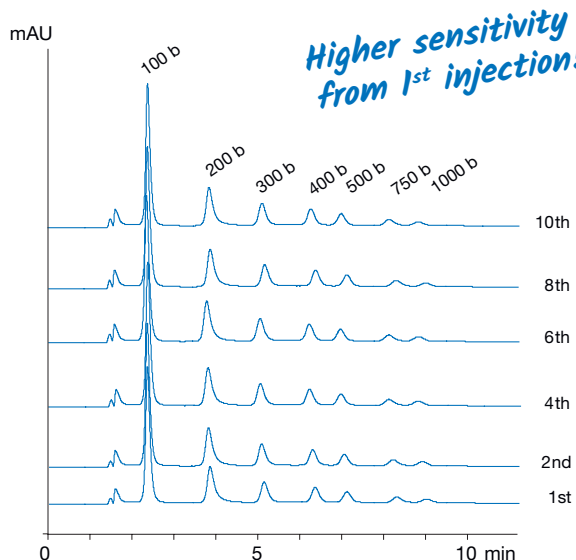
The YM Accura Triart Bio C18 column provides double peak heights and peak areas for theoligonucleotides compared to those for regular stainless-steel columns.

YMC Accura Triart columns enhance the sensitivity significantly and help to save precious samples without any loss.

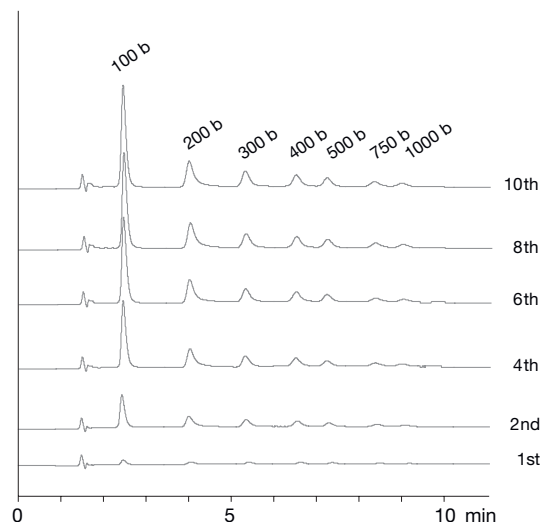
## Bioinert columns for bioseparations and coordinating compounds

No preconditioning required for reliable results

YMC Accura Triart Bio C4



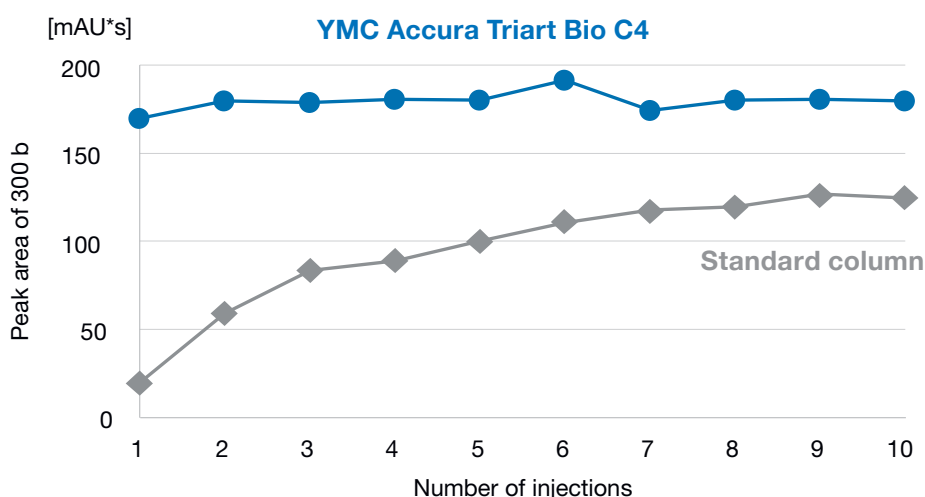
Standard column



Column: YMC Accura Triart Bio C4 (3µm, 30 nm) 100 x 2.1 mm ID  
 Part No.: TA30S03-10Q1PTC  
 Eluent: A) 50mM TEAA\* (pH 7.0)/acetonitrile (95/5)  
 B) 50 mM TEAA (pH 7.0)/acetonitrile (50/50)  
 Gradient: 9–14%B (0–10 min), 80%B (10–15 min)  
 Flow rate: 0.2 mL/min  
 Temperature: 80°C  
 Detection: UV at 254 nm  
 Injection: 1 µL (0.25 mg/mL)  
 Sample: 100–1,000 bases (Century™-Plus RNA Markers)

\* Triethylammonium acetate

Constantly higher peak areas and therefore recoveries



The YMC Accura Triart Bio C4 column shows stable peak areas from the first injection, while the standard stainless-steel column provides only 10% of the peak area (for the 300 base marker) with the first injection.

Even after the tenth injection, the peak areas of the stainless-steel column are considerably less than those of the YMC Accura Triart column.

# Substance index

<b>A</b>			BSA	40, 42	Delphinidin	33	L-Glutamine (Gln)	47
Acesulfame K	32	<i>n</i> -Butylparabene	8	Delphinidin-3-O-arabinoside	33	Gluten markers	34, 35	
Acenaphthene	59	Butylbenzene	15	Delphinidin-3-O-galactoside	33	Glycidic acid	52	
4-Acetamidoacetophenone	28	<b>C</b>			Delphinidin-3-O-glucoside	33	L-Glycine (Gly)	47
2-Acetamidophenol	28, 29	Cadaverine	22	Deoxycorticosterone	58	Glycitein	38	
Acetaminophene	29, 59	Caffeine	29, 55, 57, 59	Dextromethorphan	8, 12, 14, 59, 61, 63, 64	Glycitin	38	
Acetaminophenone	28	Candesartan cilexetil	24	Diazepam	20	Glycolic acid	52	
Acetanilide	28, 29	Cannabivarin (CBV)	25	Dichlorophenols	18	Glycyrrhizin acid ammonium salt	25	
Acetic acid	52, 64	Cannabidiol (CBDA)	25	3,4-Dihydroxymandelic acid (DOMA)	23	Glyphosate	31	
6''-O-Acetylaidzin	38	Cannabigerol (CBG)	25	3,4-Dihydroxyphenylacetic acid (DOPAC)	23	Guaiaacol	28	
6''-O-Acetylgenistin	38	Cannabidiol (CBD)	25	3,4-Dihydroxyphenylalanine (DOPA)	23	Guanine	50, 51, 53	
6''-O-Acetylglycitin	38	Cannabinol (CBN)	25	1,2-Dimethoxyl benzene	28	<b>H</b>		
Acetylsalicylic acid	29	Cannabicyclol (CBL)	25	dT DNA	54	Halosulfuron methyl	13	
Acidic compounds	52	Cannabichromene (CBC)	25	Docetaxel	11	Hemoglobin (digest)	45	
Acrylic acid	52	Carvedilol	24	Docosahexaenoic acid	18	Herceptin	39	
Adalimumab	11, 39	Casein peptide	36	Dopamine hydrochloride (DA)	23	Hinokitiol	61, 64	
Adenine	50, 51, 53	Catechol	57	Duloxetine	21, 30	L-Histidine (His)	46, 47	
Adenosine diphosphate (ADP)	66	Catecholamines	23	Duloxetine isomers	30	Homovanillic acid (HVA)	23	
Adenosine monophosphate (AMP)	66	Ceramide-1-phosphate (C1P)	26	<b>E</b>			Humira	11, 39
Adenosine triphosphate (ATP)	66	Chavicine	22	Egg peptide	36	Hydrochlorothiazide	24	
Adrenaline hydrochloride (A)	23	4-Chloroacetanilide	28	Eicosapentaenoic acid	18	2-Hydroxyacetophenone	28	
L-Alanine (Ala)	47	Chlorophenol	18	$\beta$ -Endorphin	43, 44	$\alpha$ -Hydroxyalprazolam	20	
4-Aminophenone	28	Chloroquine phosphate	29	$\gamma$ -Endorphin	44	Hydrocortisone	19, 58	
$\gamma$ -Aminobutyric acid (GABA)	47	Chlorpheniramine	12, 14, 25, 61, 63, 64	Epinephrine hydrochloride	23	5-Hydroxyindoleacetic acid (5HIAA)	23	
Amitriptyline	8, 15, 20	Chlortetracycline	26	Ergocalciferol	16, 17	Hydroxychloroquine sulfate	29	
Amlodipine besilate	24	Cholecalciferol	16, 17, 57	Erythorbic acid	38, 55	21-Hydroxyprogesterone	19	
AMPA	31	$\alpha$ -Chymotrypsinogen	40, 42, 43	Erythromycin	9, 27	Hydroquinone	57	
Amyloid $\beta$	41	Pre-Cholecalciferol	57	Erythromycin estolate	9	5-Hydroxytryptamine hydrochloride (5-HT)	21, 23	
Androsterone	59	5,6-trans-Cholecalciferol	57	Erythromycin ethylsuccinate	9	<b>I</b>		
Angiotensin I	44	Cinnamic acid	14	$\alpha$ -Estradiol	19	Ibuprofen	8, 15, 59	
Angiotensin II	44	Citric acid	52	$\beta$ -Estradiol	19	Ifosfamide	11	
Angiotensin III	44	Citrulline (Cit)	47	Estradiol	19	Imipramine	20	
Anthocyanidins	33	Clemastine	65	Estriol	19	Insulin	40, 42, 43, 44	
Anthocyanins	33	Clonazepam	20	Estrone	19	D-Isoascorbic acid	53, 55	
Antracene	59	Conalbumin	42	Etoposide	11	Isochavicine	22	
Arachidonic acid	18	Copper 8-quinolinolate	13	<b>F</b>			L-Isoleucine (Ile)	46, 47
L-Arginine (Arg)	46, 47	Corticosterone	19, 58	Fatty acids	18	Isopiperine	22	
L-Ascorbic acid	38, 53, 55	Cortisol	19	Flazasulfuron	13	<b>K</b>		
L-Ascorbic acid 2-glucoside	38, 53, 55	Cyanidin	33	Fluoxymesterone	59	Kynamro	48	
L-Asparagine (Asn)	47	Cyanidin-3-O-arabinoside	33	Folic acid	53	<b>L</b>		
L-Aspartic acid (Asp)	46, 47	Cyanidin-3-O-galactoside	33	Formic acid	52, 64	Lactic acid	52	
Asulam	13	Cyanidin-3-O-glucoside	33	Fumaric acid	52	$\beta$ -Lactoglobulin A	40, 42, 43	
Atenolol	26	Cyanocobalamin	38, 53, 55	Fumonisin B1-3	67	L-Leucine (Leu)	46, 47	
Atorvastatin calcium hydrate	24	Cyclamate Na	32	<b>G</b>			Leu-Enkephalin	43, 44
Avastin	39	Cyclophosphamide	11	Gemcitabine	11	Linoleic acid	18	
Azoxystrobin	13	L-Cysteine (Cys)	47	Genistein	38	$\alpha$ -Linolenic acid	18	
<b>B</b>			Cytochrome-C	40, 42	Genistin	38	$\gamma$ -Linolenic acid	18
Benzethonium chloride	25	Cytosine	50, 51, 53, 54	L-Glutamic acid (Glu)	47	L-Lysine (Lys)	21, 47	
Betablockers	26	<b>D</b>			<b>L</b>			
Bevacizumab	39	Daidzein	38	<b>L</b>			Lysozyme	42, 43
D-Biotin	53	Daidzin	38	<b>L</b>				
Biphenyl	59	Dehydroisoandrosterone	59	<b>L</b>				
Bovine insulin	44			<b>L</b>				

## Substance index

<b>M</b>			Norepinephrine hydrochloride	23	Pyridoxal HCl	53	Delta-9-tetrahydrocannabinol	
MabThera	39		Nortriptyline	20	Pyridoxine HCl	25, 38, 53, 55	(Δ9-THC)	25
Macrolide antibiotics	27		<b>O</b>			Pyrocatechol	28	Delta-8-tetrahydrocannabinol
Maleic acid sodium salt	25		Oleic acid	18	Pyrogallol	57	(Δ8-THC)	25
L-Malic acid	52		Oligonucleotides	48, 49	<b>Q</b>			Tetrahydrocannabinolic acid
Malonic acid	52		Ornithine HCl (Orn)	47	8-Quinololinol	15	(THCA)	25
6''-O-Malonyldaidzin	38		Orotic acid	55	<b>R</b>			Tetrahydrozoline HCl
6''-O-Malonylgenistin	38		Ovalbumin	42	Rebaudioside A	33	Theobromine	57
6''-O-Malonylglucitin	38		Oxalic acid	52	Remdesivir	27	Theophylline	57
Malvidin	33		Oxazepam	20	Resorcinol	57	Thiamine HCl	38, 53, 55
Malvidin-3-O-arabinoside	33		Oxine-copper	13	Riboflavin	38, 53, 55	Thiram	13
Malvidin-3-O-galactoside	33		Oxytetracycline	26	Ribonuclease A	42	L-Threonine (Thr)	47
Malvidin-3-O-glucoside	33		Oxytocin	43, 44	Rituximab	39	Thymine	50, 51, 53
Mecoprop	13		<b>P</b>			Rituximab	39	dl-alpha-Tocopherol
Met-Enkephalin	44		Palmitoleic acid	18	siRNA	49	Toluol	20
L-Methionine (Met)	46, 47		D-(+)-Pantothenic acid	18	RNA marker	48, 69	Transferrin	40
3-Methoxy-4-hydroxyphenylglycol (MHPG)	23		calcium salt	53	PS RNA	68	Trastuzumab	39
3-Methoxytyramine hydrochloride (3MT)	23		Paracetamol	28	<b>S</b>			Triclopyr
Metformin HCl	54		Peonidin	33	Saccharin	8, 32	Trigonelline HCl	57
Methyl benzoate	28, 61		Peonidin-3-O-arabinoside	33	Salicylic acid	14, 29	Triphenylene	15, 59
Methotrexate	11		Peonidin-3-O-galactoside	33	L-Serine (Ser)	47	L-Tryptophan (Trp)	23, 47
Metoprolol	26		Peonidin-3-O-glucoside	33	Serotonin hydrochloride	21, 23	L-Tyrosine (Tyr)	21, 23, 47
Mipomersen	48		Peptides	45	Siduron	13	<b>U</b>	
Molnupiravir	27		Pesticides	31	Spermidine	22	Uracil	27, 50, 51, 53
<b>N</b>			Petunidin	33	Spermine	22	<b>V</b>	
Nadolol	26		Petunidin-3-O-arabinoside	33	Sphingosine-1-phosphate (S1P)	26	L-Valine (Val)	46, 47
Naphazolin HCl	25		Petunidin-3-O-galactoside	33	Somatropine	10, 41	Valsartan	24
Naphthalene	15, 59		Petunidin-3-O-glucoside	33	Soy isoflavones	38	Vanillylmandelic acid (VMA)	23
Neostigmine methylsulfate	25		Phenacetine	29	Spiramycin	27	Verapamil	62
Neurotensin	44		Phenformin HCl	54	Stevioside hydrate	33	Veterinary drugs	37
Nicotinamide	38, 53, 55		Phenol	28, 57	Succinic acid	52	Vitamin B1	38, 53, 55
Nicotinic acid	38, 53, 55		L-Phenylalanine (Phe)	47	Sulphamerazine	27	Vitamin B2	38, 53, 55
NISTmAb	11, 39		Phloroglucinol	57	Sulphamethoxazole	27	Vitamin B3	38, 53, 55
4-Nitrophenol	28		Pindolol	26	Sulphathiazole	27	Vitamin B5	53
N-Nitrosodimethylamine (NDMA)	30		Piperine	22	<b>T</b>			Vitamin B6
N-Nitroso-N-methyl-4-aminobutyric acid (NMBA)	30		Porcine insulin	44	Tachysterol3	57	Vitamin B7	53
N-Nitrosodiethylamine (NDEA)	30		Prednisone	19	Tartaric acid	52	Vitamin B12	38, 53, 55
N-Nitrosoisopropylethylamine (NIPEA)	30		Progesterone	19, 58	Temazepam	20	Vitamin C	38, 53, 55
N-Nitrosodiiisopropylamine (NDIPA)	30		L-Proline (Pro)	47	m-Terpheny	59	Vitamin D2	16, 17
N-Nitrosodibutylamine (NDBA)	30		Propranolol	26, 62	o-Terphenyl	15, 59	Vitamin D3	16, 17, 57
Noradrenaline hydrochloride (NA)	23		Propionic acid	52, 64	p-Terpheny	59	<b>W</b>	
			Propylbenzene	15	Testosterone	15, 59	Water-soluble vitamins	38, 53, 55
			n-Propyl paraben	12, 14,	Tetracycline	26		
			Propyl p-hydroxybenzoate	61, 63, 64	Tetrahydrocannabivarin (THCV)	25		
			Putrescine	22				

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## Ordering information

### YMC-Triart 1.9 µm, UHPLC columns (max. pressure 100 MPa)

Phase	Column ID (mm)	Column length (mm)						Guard cartridges* with 5 mm length  (pack of 3)
		20	30	50	75	100	150	
C18	1.0	—	—	TA12SP9-0501WT	—	TA12SP9-1001WT	TA12SP9-1501WT	TA12SP9-E5Q1CC**
	2.0	TA12SP9-0202PT	TA12SP9-0302PT	TA12SP9-0502PT	TA12SP9-L502PT	TA12SP9-1002PT	TA12SP9-1502PT	TA12SP9-E5Q1CC**
	2.1	TA12SP9-02Q1PT	TA12SP9-03Q1PT	TA12SP9-05Q1PT	TA12SP9-L5Q1PT	TA12SP9-10Q1PT	TA12SP9-15Q1PT	TA12SP9-E5Q1CC**
	3.0	—	—	TA12SP9-0503PT	TA12SP9-L503PT	TA12SP9-1003PT	TA12SP9-1503PT	TA12SP9-E503CC
C18 ExRS	2.0	TAR08SP9-0202PT	TAR08SP9-0302PT	TAR08SP9-0502PT	TAR08SP9-L502PT	TAR08SP9-1002PT	TAR08SP9-1502PT	TAR08SP9-E5Q1CC**
	2.1	TAR08SP9-02Q1PT	TAR08SP9-03Q1PT	TAR08SP9-05Q1PT	TAR08SP9-L5Q1PT	TAR08SP9-10Q1PT	TAR08SP9-15Q1PT	TAR08SP9-E5Q1CC**
	3.0	—	—	TAR08SP9-0503PT	TAR08SP9-L503PT	TAR08SP9-1003PT	TAR08SP9-1503PT	TAR08SP9-E503CC
Bio C18	2.0	TA30SP9-0202PT	TA30SP9-0302PT	TA30SP9-0502PT	TA30SP9-L502PT	TA30SP9-1002PT	TA30SP9-1502PT	TA30SP9-E5Q1CC**
	2.1	TA30SP9-02Q1PT	TA30SP9-03Q1PT	TA30SP9-05Q1PT	TA30SP9-L5Q1PT	TA30SP9-10Q1PT	TA30SP9-15Q1PT	TA30SP9-E5Q1CC**
	3.0	—	—	TA30SP9-0503PT	TA30SP9-L503PT	TA30SP9-1003PT	TA30SP9-1503PT	TA30SP9-E503CC
C8	2.0	T012SP9-0202PT	T012SP9-0302PT	T012SP9-0502PT	T012SP9-L502PT	T012SP9-1002PT	T012SP9-1502PT	T012SP9-E5Q1CC**
	2.1	T012SP9-02Q1PT	T012SP9-03Q1PT	T012SP9-05Q1PT	T012SP9-L5Q1PT	T012SP9-10Q1PT	T012SP9-15Q1PT	T012SP9-E5Q1CC**
	3.0	—	—	T012SP9-0503PT	T012SP9-L503PT	T012SP9-1003PT	T012SP9-1503PT	T012SP9-E503CC
Bio C4	2.0	TB30SP9-0202PT	TB30SP9-0302PT	TB30SP9-0502PT	TB30SP9-L502PT	TB30SP9-1002PT	TB30SP9-1502PT	TB30SP9-E5Q1CC**
	2.1	TB30SP9-02Q1PT	TB30SP9-03Q1PT	TB30SP9-05Q1PT	TB30SP9-L5Q1PT	TB30SP9-10Q1PT	TB30SP9-15Q1PT	TB30SP9-E5Q1CC**
	3.0	—	—	TB30SP9-0503PT	TB30SP9-L503PT	TB30SP9-1003PT	TB30SP9-1503PT	TB30SP9-E503CC
Phenyl	2.0	TPH12SP9-0202PT	TPH12SP9-0302PT	TPH12SP9-0502PT	TPH12SP9-L502PT	TPH12SP9-1002PT	TPH12SP9-1502PT	TPH12SP9-E5Q1CC**
	2.1	TPH12SP9-02Q1PT	TPH12SP9-03Q1PT	TPH12SP9-05Q1PT	TPH12SP9-L5Q1PT	TPH12SP9-10Q1PT	TPH12SP9-15Q1PT	TPH12SP9-E5Q1CC**
	3.0	—	—	TPH12SP9-0503PT	TPH12SP9-L503PT	TPH12SP9-1003PT	TPH12SP9-1503PT	TPH12SP9-E503CC
PPF	2.0	TPF12SP9-0202PT	TPF12SP9-0302PT	TPF12SP9-0502PT	TPF12SP9-L502PT	TPF12SP9-1002PT	TPF12SP9-1502PT	TPF12SP9-E5Q1CC**
	2.1	TPF12SP9-02Q1PT	TPF12SP9-03Q1PT	TPF12SP9-05Q1PT	TPF12SP9-L5Q1PT	TPF12SP9-10Q1PT	TPF12SP9-15Q1PT	TPF12SP9-E5Q1CC**
	3.0	—	—	TPF12SP9-0503PT	TPF12SP9-L503PT	TPF12SP9-1003PT	TPF12SP9-1503PT	TPF12SP9-E503CC
Diol-HILIC	2.0	TDH12SP9-0202PT	TDH12SP9-0302PT	TDH12SP9-0502PT	TDH12SP9-L502PT	TDH12SP9-1002PT	TDH12SP9-1502PT	—
	2.1	TDH12SP9-02Q1PT	TDH12SP9-03Q1PT	TDH12SP9-05Q1PT	TDH12SP9-L5Q1PT	TDH12SP9-10Q1PT	TDH12SP9-15Q1PT	—
	3.0	—	—	TDH12SP9-0503PT	TDH12SP9-L503PT	TDH12SP9-1003PT	—	—
Diol*** (SFC)	2.0	TDH12SP9-0202PTB	TDH12SP9-0302PTB	TDH12SP9-0502PTB	TDH12SP9-L502PTB	TDH12SP9-1002PTB	TDH12SP9-1502PTB	—
	2.1	TDH12SP9-02Q1PTB	TDH12SP9-03Q1PTB	TDH12SP9-05Q1PTB	TDH12SP9-L5Q1PTB	TDH12SP9-10Q1PTB	TDH12SP9-15Q1PTB	—
	3.0	—	—	TDH12SP9-0503PTB	TDH12SP9-L503PTB	TDH12SP9-1003PTB	—	—

\*Guard cartridge holder required, part no. XPCUHP

\*\*Guard cartridge: 2.1 mm ID

\*\*\*Supplied as YMC-Triart Diol-HILIC shipped on 2-propanol

### YMC Accura Triart 1.9 µm, coated bioinert UHPLC columns (max. pressure 100 MPa)

Phase	Column ID (mm)	Column length (mm)		
		50	100	150
C18	2.1	TA12SP9-05Q1PTC	TA12SP9-10Q1PTC	TA12SP9-15Q1PTC
C18 ExRS	2.1	TAR08SP9-05Q1PTC	TAR08SP9-10Q1PTC	TAR08SP9-15Q1PTC
Bio C18	2.1	TA30SP9-05Q1PTC	TA30SP9-10Q1PTC	TA30SP9-15Q1PTC
C8	2.1	T012SP9-05Q1PTC	T012SP9-10Q1PTC	T012SP9-15Q1PTC
Bio C4	2.1	TB30SP9-05Q1PTC	TB30SP9-10Q1PTC	TB30SP9-15Q1PTC
Phenyl	2.1	TPH12SP9-05Q1PTC	TPH12SP9-10Q1PTC	TPH12SP9-15Q1PTC
PPF	2.1	TPF12SP9-05Q1PTC	TPF12SP9-10Q1PTC	TPF12SP9-15Q1PTC
Diol-HILIC	2.1	TDH12SP9-05Q1PTC	TDH12SP9-10Q1PTC	TDH12SP9-15Q1PTC



## Ordering information

### YMC-Triart metal-free 1.9 $\mu\text{m}$ , PEEK-lined UHPLC columns (max. pressure 100 MPa)

Phase	Column ID (mm)	Column length (mm)		
		50	100	150
C18	2.1	TA12SP9-05Q1PTP	TA12SP9-10Q1PTP	TA12SP9-15Q1PTP
C18 ExRS	2.1	TAR08SP9-05Q1PTP	TAR08SP9-10Q1PTP	TAR08SP9-15Q1PTP
Bio C18	2.1	TA30SP9-05Q1PTP	TA30SP9-10Q1PTP	TA30SP9-15Q1PTP
C8	2.1	T012SP9-05Q1PTP	T012SP9-10Q1PTP	T012SP9-15Q1PTP
Bio C4	2.1	TB30SP9-05Q1PTP	TB30SP9-10Q1PTP	TB30SP9-15Q1PTP
Phenyl	2.1	TPH12SP9-05Q1PTP	TPH12SP9-10Q1PTP	TPH12SP9-15Q1PTP
PPF	2.1	TPF12SP9-05Q1PTP	TPF12SP9-10Q1PTP	TPF12SP9-15Q1PTP
Diol-HILIC	2.1	TDH12SP9-05Q1PTP	TDH12SP9-10Q1PTP	TDH12SP9-15Q1PTP

### YMC-Triart 1.9 $\mu\text{m}$ , 1/16" | 1/32" fitting\*, microLC columns (max. pressure 60 MPa)

Phase	Column ID ( $\mu\text{m}$ )	Column length (mm)				Guard cartridges** with 5 mm length (pack of 3)
		50	75	100	150	
C18	300	TA12SP9-05H0AU	TA12SP9-L5H0AU	TA12SP9-10H0AU	TA12SP9-15H0AU	TA12SP9-E5H0AU
	500	TA12SP9-05J0AU	TA12SP9-L5J0AU	TA12SP9-10J0AU	TA12SP9-15J0AU	TA12SP9-E5J0AU
C18 ExRS	300	TAR08SP9-05H0AU	TAR08SP9-L5H0AU	TAR08SP9-10H0AU	TAR08SP9-15H0AU	TAR08SP9-E5H0AU
	500	TAR08SP9-05J0AU	TAR08SP9-L5J0AU	TAR08SP9-10J0AU	TAR08SP9-15J0AU	TAR08SP9-E5J0AU
Bio C18	300	TA30SP9-05H0AU	TA30SP9-L5H0AU	TA30SP9-10H0AU	TA30SP9-15H0AU	TA30SP9-E5H0AU
	500	TA30SP9-05J0AU	TA30SP9-L5J0AU	TA30SP9-10J0AU	TA30SP9-15J0AU	TA30SP9-E5J0AU
C8	300	T012SP9-05H0AU	T012SP9-L5H0AU	T012SP9-10H0AU	T012SP9-15H0AU	T012SP9-E5H0AU
	500	T012SP9-05J0AU	T012SP9-L5J0AU	T012SP9-10J0AU	T012SP9-15J0AU	T012SP9-E5J0AU
Bio C4	300	TB30SP9-05H0AU	TB30SP9-L5H0AU	TB30SP9-10H0AU	TB30SP9-15H0AU	TB30SP9-E5H0AU
	500	TB30SP9-05J0AU	TB30SP9-L5J0AU	TB30SP9-10J0AU	TB30SP9-15J0AU	TB30SP9-E5J0AU
Phenyl	300	TPH12SP9-05H0AU	TPH12SP9-L5H0AU	TPH12SP9-10H0AU	TPH12SP9-15H0AU	TPH12SP9-E5H0AU
	500	TPH12SP9-05J0AU	TPH12SP9-L5J0AU	TPH12SP9-10J0AU	TPH12SP9-15J0AU	TPH12SP9-E5J0AU
PPF	300	TPF12SP9-05H0AU	TPF12SP9-L5H0AU	TPF12SP9-10H0AU	TPF12SP9-15H0AU	TPF12SP9-E5H0AU
	500	TPF12SP9-05J0AU	TPF12SP9-L5J0AU	TPF12SP9-10J0AU	TPF12SP9-15J0AU	TPF12SP9-E5J0AU
Diol-HILIC	300	TDH12SP9-05H0AU	TDH12SP9-L5H0AU	TDH12SP9-10H0AU	TDH12SP9-15H0AU	TDH12SP9-E5H0AU
	500	TDH12SP9-05J0AU	TDH12SP9-L5J0AU	TDH12SP9-10J0AU	TDH12SP9-15J0AU	TDH12SP9-E5J0AU

\* YMC capillary columns are available with 1/16" (10-32 thread) or with 1/32" (6-40 thread) connections.

The connection size is indicated by the terminal letters of the order code:

1/16" fittings end with AU; 1/32" fittings end with RU. For ordering 1/32" connections, simply exchange AU by RU.

\*\* no holder required, comes with a column coupler

Columns with 1/32" fitting are only available with 300 or 500  $\mu\text{m}$  ID.

**TIP**

In order to achieve longer column lengths, columns of 2 x 100 mm or 100 + 150 mm can be coupled by using a MarvelX column coupler (70 mm x 125  $\mu\text{m}$  ID, Part No. UPFS-YM6125070).

## Ordering information

YMC-Triart 3  $\mu$ m, analytical HPLC columns  
(max. pressure 45 MPa, 20/25 MPa (Diol, SIL))

Phase	Column ID ( $\mu$ m)	Column length (mm)					Guard columns** with 5 mm length
		50	75	100	150	250	
C18	2.0	TA12S03-0502WT	TA12S03-L502WT	TA12S03-1002WT	TA12S03-1502WT	TA12S03-2502WT	TA12S03-01Q1GC
	3.0	TA12S03-0503WT	TA12S03-L503WT	TA12S03-1003WT	TA12S03-1503WT	TA12S03-2503WT	TA12S03-0103GC
	4.6	TA12S03-0546WT	TA12S03-L546WT	TA12S03-1046WT	TA12S03-1546WT	TA12S03-2546WT	TA12S03-0104GC
C18 ExRS	2.0	TAR08S03-0502WT	TAR08S03-L502WT	TAR08S03-1002WT	TAR08S03-1502WT	TAR08S03-2502WT	TAR08S03-01Q1GC
	3.0	TAR08S03-0503WT	TAR08S03-L503WT	TAR08S03-1003WT	TAR08S03-1503WT	TAR08S03-2503WT	TAR08S03-0103GC
	4.6	TAR08S03-0546WT	TAR08S03-L546WT	TAR08S03-1046WT	TAR08S03-1546WT	TAR08S03-2546WT	TAR08S03-0104GC
Bio C18	2.0	TA30S03-0502WT	TA30S03-L502WT	TA30S03-1002WT	TA30S03-1502WT	TA30S03-2502WT	TA30S03-01Q1GC
	3.0	TA30S03-0503WT	TA30S03-L503WT	TA30S03-1003WT	TA30S03-1503WT	TA30S03-2503WT	TA30S03-0103GC
	4.6	TA30S03-0546WT	TA30S03-L546WT	TA30S03-1046WT	TA30S03-1546WT	TA30S03-2546WT	TA30S03-0104GC
C8	2.0	T012S03-0502WT	T012S03-L502WT	T012S03-1002WT	T012S03-1502WT	T012S03-2502WT	T012S03-01Q1GC
	3.0	T012S03-0503WT	T012S03-L503WT	T012S03-1003WT	T012S03-1503WT	T012S03-2503WT	T012S03-0103GC
	4.6	T012S03-0546WT	T012S03-L546WT	T012S03-1046WT	T012S03-1546WT	T012S03-2546WT	T012S03-0104GC
Bio C4	2.0	TB30S03-0502WT	TB30S03-L502WT	TB30S03-1002WT	TB30S03-1502WT	TB30S03-2502WT	TB30S03-01Q1GC
	3.0	TB30S03-0503WT	TB30S03-L503WT	TB30S03-1003WT	TB30S03-1503WT	TB30S03-2503WT	TB30S03-0103GC
	4.6	TB30S03-0546WT	TB30S03-L546WT	TB30S03-1046WT	TB30S03-1546WT	TB30S03-2546WT	TB30S03-0104GC
Phenyl	2.0	TPH12S03-0502WT	TPH12S03-L502WT	TPH12S03-1002WT	TPH12S03-1502WT	TPH12S03-2502WT	TPH12S03-01Q1GC
	3.0	TPH12S03-0503WT	TPH12S03-L503WT	TPH12S03-1003WT	TPH12S03-1503WT	TPH12S03-2503WT	TPH12S03-0103GC
	4.6	TPH12S03-0546WT	TPH12S03-L546WT	TPH12S03-1046WT	TPH12S03-1546WT	TPH12S03-2546WT	TPH12S03-0104GC
PFP	2.0	TPF12S03-0502WT	TPF12S03-L502WT	TPF12S03-1002WT	TPF12S03-1502WT	TPF12S03-2502WT	TPF12S03-01Q1GC
	3.0	TPF12S03-0503WT	TPF12S03-L503WT	TPF12S03-1003WT	TPF12S03-1503WT	TPF12S03-2503WT	TPF12S03-0103GC
	4.6	TPF12S03-0546WT	TPF12S03-L546WT	TPF12S03-1046WT	TPF12S03-1546WT	TPF12S03-2546WT	TPF12S03-0104GC
Diol-HILIC	2.0	TDH12S03-0502WT	TDH12S03-L502WT	TDH12S03-1002WT	TDH12S03-1502WT	TDH12S03-2502WT	TDH12S03-01Q1GC
	3.0	TDH12S03-0503WT	TDH12S03-L503WT	TDH12S03-1003WT	TDH12S03-1503WT	TDH12S03-2503WT	TDH12S03-0103GC
	4.6	TDH12S03-0546WT	TDH12S03-L546WT	TDH12S03-1046WT	TDH12S03-1546WT	TDH12S03-2546WT	TDH12S03-0104GC
Diol** (SFC)	2.0	TDH12S03-0502WTB	TDH12S03-L502WTB	TDH12S03-1002WTB	TDH12S03-1502WTB	TDH12S03-2502WTB	—
	3.0	TDH12S03-0503WTB	TDH12S03-L503WTB	TDH12S03-1003WTB	TDH12S03-1503WTB	TDH12S03-2503WTB	—
	4.6	TDH12S03-0546WTB	TDH12S03-L546WTB	TDH12S03-1046WTB	TDH12S03-1546WTB	TDH12S03-2546WTB	—
SIL (SFC)	2.0	TS12S03-0502WT	TS12S03-L502WT	TS12S03-1002WT	TS12S03-1502WT	TS12S03-2502WT	—
	3.0	TS12S03-0503WT	TS12S03-L503WT	TS12S03-1003WT	TS12S03-1503WT	TS12S03-2503WT	—
	4.6	TS12S03-0546WT	TS12S03-L546WT	TS12S03-1046WT	TS12S03-1546WT	TS12S03-2546WT	—

\*Guard cartridge holder required, part no. XPGCH-Q1

\*\*Supplied as YMC-Triart Diol-HILIC shipped on 2-propanol

## Ordering information

### YMC-Triart 3 $\mu$ m, analytical HPLC columns (max. pressure 45 MPa)

Phase	Column ID (mm)	Column length (mm)							Guard cartridges* with 10 mm length
		20	33	50	75	100	150	250	
<b>C18</b>	2.1	TA12S03-02Q1PTH	TA12S03-H3Q1PTH	TA12S03-05Q1PTH	TA12S03-L5Q1PTH	TA12S03-10Q1PTH	TA12S03-15Q1PTH	—	TA12S03-01Q1GC
	3.0	—	—	TA12S03-05Q3PTH	TA12S03-L5Q3PTH	TA12S03-10Q3PTH	TA12S03-15Q3PTH	—	TA12S03-01Q3GC
	4.6	—	TA12S03-H346PTH	TA12S03-0546PTH	TA12S03-L546PTH	TA12S03-1046PTH	TA12S03-1546PTH	TA12S03-2546PTH	TA12S03-01Q4GC
<b>C18 ExRS</b>	2.1	TAR08S03-02Q1PTH	TAR08S03-H3Q1PTH	TAR08S03-05Q1PTH	TAR08S03-L5Q1PTH	TAR08S03-10Q1PTH	TAR08S03-15Q1PTH	—	TAR08S03-01Q1GC
	3.0	—	—	TAR08S03-05Q3PTH	TAR08S03-L5Q3PTH	TAR08S03-10Q3PTH	TAR08S03-15Q3PTH	—	TAR08S03-01Q3GC
	4.6	—	TAR08S03-H346PTH	TAR08S03-0546PTH	TAR08S03-L546PTH	TAR08S03-1046PTH	TAR08S03-1546PTH	TAR08S03-2546PTH	TAR08S03-01Q4GC
<b>Bio C18</b>	2.1	TA30S03-02Q1PTH	TA30S03-H3Q1PTH	TA30S03-05Q1PTH	TA30S03-L5Q1PTH	TA30S03-10Q1PTH	TA30S03-15Q1PTH	—	TA30S03-01Q1GC
	3.0	—	—	TA30S03-05Q3PTH	TA30S03-L5Q3PTH	TA30S03-10Q3PTH	TA30S03-15Q3PTH	—	TA30S03-01Q3GC
	4.6	—	TA30S03-H346PTH	TA30S03-0546PTH	TA30S03-L546PTH	TA30S03-1046PTH	TA30S03-1546PTH	TA30S03-2546PTH	TA30S03-01Q4GC
<b>C8</b>	2.1	T012S03-02Q1PTH	T012S03-H3Q1PTH	T012S03-05Q1PTH	T012S03-L5Q1PTH	T012S03-10Q1PTH	T012S03-15Q1PTH	—	T012S03-01Q1GC
	3.0	—	—	T012S03-05Q3PTH	T012S03-L5Q3PTH	T012S03-10Q3PTH	T012S03-15Q3PTH	—	T012S03-01Q3GC
	4.6	—	T012S03-H346PTH	T012S03-0546PTH	T012S03-L546PTH	T012S03-1046PTH	T012S03-1546PTH	T012S03-2546PTH	T012S03-01Q4GC
<b>Bio C4</b>	2.1	TB30S03-02Q1PTH	TB30S03-H3Q1PTH	TB30S03-05Q1PTH	TB30S03-L5Q1PTH	TB30S03-10Q1PTH	TB30S03-15Q1PTH	—	TB30S03-01Q1GC
	3.0	—	—	TB30S03-05Q3PTH	TB30S03-L5Q3PTH	TB30S03-10Q3PTH	TB30S03-15Q3PTH	—	TB30S03-01Q3GC
	4.6	—	TB30S03-H346PTH	TB30S03-0546PTH	TB30S03-L546PTH	TB30S03-1046PTH	TB30S03-1546PTH	TB30S03-2546PTH	TB30S03-01Q4GC
<b>Phenyl</b>	2.1	TPH12S03-02Q1PTH	TPH12S03-H3Q1PTH	TPH12S03-05Q1PTH	TPH12S03-L5Q1PTH	TPH12S03-10Q1PTH	TPH12S03-15Q1PTH	—	TPH12S03-01Q1GC
	3.0	—	—	TPH12S03-05Q3PTH	TPH12S03-L5Q3PTH	TPH12S03-10Q3PTH	TPH12S03-15Q3PTH	—	TPH12S03-01Q3GC
	4.6	—	TPH12S03-H346PTH	TPH12S03-0546PTH	TPH12S03-L546PTH	TPH12S03-1046PTH	TPH12S03-1546PTH	TPH12S03-2546PTH	TPH12S03-01Q4GC
<b>PPF</b>	2.1	TPF12S03-02Q1PTH	TPF12S03-H3Q1PTH	TPF12S03-05Q1PTH	TPF12S03-L5Q1PTH	TPF12S03-10Q1PTH	TPF12S03-15Q1PTH	—	TPF12S03-01Q1GC
	3.0	—	—	TPF12S03-05Q3PTH	TPF12S03-L5Q3PTH	TPF12S03-10Q3PTH	TPF12S03-15Q3PTH	—	TPF12S03-01Q3GC
	4.6	—	TPF12S03-H346PTH	TPF12S03-0546PTH	TPF12S03-L546PTH	TPF12S03-1046PTH	TPF12S03-1546PTH	TPF12S03-2546PTH	TPF12S03-01Q4GC
<b>Diol-HILIC</b>	2.1	TDH12S03-02Q1PTH	TDH12S03-H3Q1PTH	TDH12S03-05Q1PTH	TDH12S03-L5Q1PTH	TDH12S03-10Q1PTH	TDH12S03-15Q1PTH	—	TDH12S03-01Q1GC
	3.0	—	—	TDH12S03-05Q3PTH	TDH12S03-L5Q3PTH	TDH12S03-10Q3PTH	TDH12S03-15Q3PTH	—	TDH12S03-01Q3GC
	4.6	—	TDH12S03-H346PTH	TDH12S03-0546PTH	TDH12S03-L546PTH	TDH12S03-1046PTH	TDH12S03-1546PTH	TDH12S03-2546PTH	TDH12S03-01Q4GC
<b>Diol** (SFC)</b>	2.1	TDH12S03-02Q1PTHB	TDH12S03-H3Q1PTHB	TDH12S03-05Q1PTHB	TDH12S03-L5Q1PTHB	TDH12S03-10Q1PTHB	TDH12S03-15Q1PTHB	—	—
	3.0	—	—	TDH12S03-05Q3PTHB	TDH12S03-L5Q3PTHB	TDH12S03-10Q3PTHB	TDH12S03-15Q3PTHB	—	—
	4.6	—	TDH12S03-H346PTHB	TDH12S03-0546PTHB	TDH12S03-L546PTHB	TDH12S03-1046PTHB	TDH12S03-1546PTHB	TDH12S03-2546PTHB	—
<b>SIL (SFC)</b>	2.1	TS12S03-02Q1PTH	TS12S03-H3Q1PTH	TS12S03-05Q1PTH	TS12S03-L5Q1PTH	TS12S03-10Q1PTH	TS12S03-15Q1PTH	—	—
	3.0	—	—	TS12S03-05Q3PTH	TS12S03-L5Q3PTH	TS12S03-10Q3PTH	TS12S03-15Q3PTH	—	—
	4.6	—	TS12S03-H346PTH	TS12S03-0546PTH	TS12S03-L546PTH	TS12S03-1046PTH	TS12S03-1546PTH	TS12S03-2546PTH	—

## Ordering information

### YMC Accura Triart 3 μm, coated bioinert analytical columns (max. pressure 45 MPa)

Phase	Column ID (mm)	Column length (mm)		
		50	100	150
C18	2.1	TA12S03-05Q1PTC	TA12S03-10Q1PTC	TA12S03-15Q1PTC
	4.6	TA12S03-0546PTC	TA12S03-1046PTC	TA12S03-1546PTC
C18 ExRS	2.1	TAR08S03-05Q1PTC	TAR08S03-10Q1PTC	TAR08S03-15Q1PTC
	4.6	TAR08S03-0546PTC	TAR08S03-1046PTC	TAR08S03-1546PTC
Bio C18	2.1	TA30S03-05Q1PTC	TA30S03-10Q1PTC	TA30S03-15Q1PTC
	4.6	TA30S03-0546PTC	TA30S03-1046PTC	TA30S03-1546PTC
C8	2.1	T012S03-05Q1PTC	T012S03-10Q1PTC	T012S03-15Q1PTC
	4.6	T012S03-0546PTC	T012S03-1046PTC	T012S03-1546PTC
Bio C4	2.1	TB30S03-05Q1PTC	TB30S03-10Q1PTC	TB30S03-15Q1PTC
	4.6	TB30S03-0546PTC	TB30S03-1046PTC	TB30S03-1546PTC
Phenyl	2.1	TPH12S03-05Q1PTC	TPH12S03-10Q1PTC	TPH12S03-15Q1PTC
	4.6	TPH12S03-0546PTC	TPH12S03-1046PTC	TPH12S03-1546PTC
PPF	2.1	TPF12S03-05Q1PTC	TPF12S03-10Q1PTC	TPF12S03-15Q1PTC
	4.6	TPF12S03-0546PTC	TPF12S03-1046PTC	TPF12S03-1546PTC
Diol-HILIC	2.1	TDH12S03-05Q1PTC	TDH12S03-10Q1PTC	TDH12S03-15Q1PTC
	4.6	TDH12S03-0546PTC	TDH12S03-1046PTC	TDH12S03-1546PTC

### YMC-Triart metal-free 3 μm, PEEK-lined analytical columns (max. pressure 45 MPa)

Phase	Column ID (mm)	Column length (mm)		
		50	100	150
C18	2.1	TA12S03-05Q1PTP	TA12S03-10Q1PTP	TA12S03-15Q1PTP
	4.6	TA12S03-0546PTP	TA12S03-1046PTP	TA12S03-1546PTP
C18 ExRS	2.1	TAR08S03-05Q1PTP	TAR08S03-10Q1PTP	TAR08S03-15Q1PTP
	4.6	TAR08S03-0546PTP	TAR08S03-1046PTP	TAR08S03-1546PTP
Bio C18	2.1	TA30S03-05Q1PTP	TA30S03-10Q1PTP	TA30S03-15Q1PTP
	4.6	TA30S03-0546PTP	TA30S03-1046PTP	TA30S03-1546PTP
C8	2.1	T012S03-05Q1PTP	T012S03-10Q1PTP	T012S03-15Q1PTP
	4.6	T012S03-0546PTP	T012S03-1046PTP	T012S03-1546PTP
Bio C4	2.1	TB30S03-05Q1PTP	TB30S03-10Q1PTP	TB30S03-15Q1PTP
	4.6	TB30S03-0546PTP	TB30S03-1046PTP	TB30S03-1546PTP
Phenyl	2.1	TPH12S03-05Q1PTP	TPH12S03-10Q1PTP	TPH12S03-15Q1PTP
	4.6	TPH12S03-0546PTP	TPH12S03-1046PTP	TPH12S03-1546PTP
PPF	2.1	TPF12S03-05Q1PTP	TPF12S03-10Q1PTP	TPF12S03-15Q1PTP
	4.6	TPF12S03-0546PTP	TPF12S03-1046PTP	TPF12S03-1546PTP
Diol-HILIC	2.1	TDH12S03-05Q1PTP	TDH12S03-10Q1PTP	TDH12S03-15Q1PTP
	4.6	TDH12S03-0546PTP	TDH12S03-1046PTP	TDH12S03-1546PTP

## Ordering information

### YMC-Triart 3 µm, 1/16" | 1/32" fitting\*, micro/nanoLC columns (max. pressure 45/55 MPa)

Phase	Column ID (µm)	Column length (mm)				Guard columns** with 5 mm length
		50	75	100	150	
						(pack of 3)
C18	75	—	—	TA12S03-10E8AU	TA12S03-15E8AU	—
	100	—	—	TA12S03-10F0AU	TA12S03-15F0AU	—
	300	TA12S03-05H0AU	TA12S03-L5H0AU	TA12S03-10H0AU	TA12S03-15H0AU	TA12S03-E5H0AU
	500	TA12S03-05J0AU	TA12S03-L5J0AU	TA12S03-10J0AU	TA12S03-15J0AU	TA12S03-E5J0AU
C18 ExRS	75	—	—	TAR08S03-10E8AU	TAR08S03-15E8AU	—
	100	—	—	TAR08S03-10F0AU	TAR08S03-15F0AU	—
	300	TAR08S03-05H0AU	TAR08S03-L5H0AU	TAR08S03-10H0AU	TAR08S03-15H0AU	TAR08S03-E5H0AU
	500	TAR08S03-05J0AU	TAR08S03-L5J0AU	TAR08S03-10J0AU	TAR08S03-15J0AU	TAR08S03-E5J0AU
Bio C18	75	—	—	TA30S03-10E8AU	TA30S03-15E8AU	—
	100	—	—	TA30S03-10F0AU	TA30S03-15F0AU	—
	300	TA30S03-05H0AU	TA30S03-L5H0AU	TA30S03-10H0AU	TA30S03-15H0AU	TA30S03-E5H0AU
	500	TA30S03-05J0AU	TA30S03-L5J0AU	TA30S03-10J0AU	TA30S03-15J0AU	TA30S03-E5J0AU
C8	75	—	—	T012S03-10E8AU	T012S03-15E8AU	—
	100	—	—	T012S03-10F0AU	T012S03-15F0AU	—
	300	T012S03-05H0AU	T012S03-L5H0AU	T012S03-10H0AU	T012S03-15H0AU	T012S03-E5H0AU
	500	T012S03-05J0AU	T012S03-L5J0AU	T012S03-10J0AU	T012S03-15J0AU	T012S03-E5J0AU
Bio C4	75	—	—	TB30S03-10E8AU	TB30S03-15E8AU	—
	100	—	—	TB30S03-10F0AU	TB30S03-15F0AU	—
	300	TB30S03-05H0AU	TB30S03-L5H0AU	TB30S03-10H0AU	TB30S03-15H0AU	TB30S03-E5H0AU
	500	TB30S03-05J0AU	TB30S03-L5J0AU	TB30S03-10J0AU	TB30S03-15J0AU	TB30S03-E5J0AU
Phenyl	75	—	—	TPH12S03-10E8AU	TPH12S03-15E8AU	—
	100	—	—	TPH12S03-10F0AU	TPH12S03-15F0AU	—
	300	TPH12S03-05H0AU	TPH12S03-L5H0AU	TPH12S03-10H0AU	TPH12S03-15H0AU	TPH12S03-E5H0AU
	500	TPH12S03-05J0AU	TPH12S03-L5J0AU	TPH12S03-10J0AU	TPH12S03-15J0AU	TPH12S03-E5J0AU
PPF	75	—	—	TPF12S03-10E8AU	TPF12S03-15E8AU	—
	100	—	—	TPF12S03-10F0AU	TPF12S03-15F0AU	—
	300	TPF12S03-05H0AU	TPF12S03-L5H0AU	TPF12S03-10H0AU	TPF12S03-15H0AU	TPF12S03-E5H0AU
	500	TPF12S03-05J0AU	TPF12S03-L5J0AU	TPF12S03-10J0AU	TPF12S03-15J0AU	TPF12S03-E5J0AU
Diol-HILIC	75	—	—	TDH12S03-10E8AU	TDH12S03-15E8AU	—
	100	—	—	TDH12S03-10F0AU	TDH12S03-15F0AU	—
	300	TDH12S03-05H0AU	TDH12S03-L5H0AU	TDH12S03-10H0AU	TDH12S03-15H0AU	TDH12S03-E5H0AU
	500	TDH12S03-05J0AU	TDH12S03-L5J0AU	TDH12S03-10J0AU	TDH12S03-15J0AU	TDH12S03-E5J0AU

\*YMC capillary columns are available with 1/16" (10-32 thread) or with 1/32" (6-40 thread) connections. The connection size is indicated by the terminal letters of the order code:

1/16" fittings end with AU; 1/32" fittings end with RU. For ordering 1/32" connections, simply exchange AU by RU.

\*\*no holder required, comes with a column coupler

Columns with 1/32" fitting are only available with 300 or 500 µm ID.

### YMC-Triart 1.9 and 3 µm Method Development Kits (examples)

Phases	Dimensions	Particle size	Part No.
C18 / C18 ExRS / Phenyl	50 x 2.1 mm	1.9 µm	TATARTPHSP9-05Q1PT
		3 µm	TATARTPHS03-05Q1PTH
C18 / C8 / Phenyl		1.9 µm	TATOTPHSP9-05Q1PT
		3 µm	TATOTPHS03-05Q1PTH
C18 / PFP / Diol-HILIC		1.9 µm	TATPFDHSP9-05Q1PT
		3 µm	TATPFDHS03-05Q1PTH

## Ordering information

YMC-Triart 3 μm, analytical HPLC columns  
(max. pressure 45 MPa, 20/25 MPa (Diol, SIL))

Phase	Column ID (μm)	Column length (mm)					Guard columns** with 5 mm length
		50	75	100	150	250	
C18	2.0	TA12S05-0502WT	TA12S05-L502WT	TA12S05-1002WT	TA12S05-1502WT	TA12S05-2502WT	TA12S05-01Q1GC
	3.0	TA12S05-0503WT	TA12S05-L503WT	TA12S05-1003WT	TA12S05-1503WT	TA12S05-2503WT	TA12S05-0103GC
	4.6	TA12S05-0546WT	TA12S05-L546WT	TA12S05-1046WT	TA12S05-1546WT	TA12S05-2546WT	TA12S05-0104GC
	10	—	—	—	TA12S05-1510WT	TA12S05-2510WT	TA12S05-0110CC
C18 ExRS	2.0	TAR08S05-0502WT	TAR08S05-L502WT	TAR08S05-1002WT	TAR08S05-1502WT	TAR08S05-2502WT	TAR08S05-01Q1GC
	3.0	TAR08S05-0503WT	TAR08S05-L503WT	TAR08S05-1003WT	TAR08S05-1503WT	TAR08S05-2503WT	TAR08S05-0103GC
	4.6	TAR08S05-0546WT	TAR08S05-L546WT	TAR08S05-1046WT	TAR08S05-1546WT	TAR08S05-2546WT	TAR08S05-0104GC
	10	—	—	—	TAR08S05-1510WT	TAR08S05-2510WT	TAR08S05-0110CC
Bio C18	2.0	TA30S05-0502WT	TA30S05-L502WT	TA30S05-1002WT	TA30S05-1502WT	TA30S05-2502WT	TA30S05-01Q1GC
	3.0	TA30S05-0503WT	TA30S05-L503WT	TA30S05-1003WT	TA30S05-1503WT	TA30S05-2503WT	TA30S05-0103GC
	4.6	TA30S05-0546WT	TA30S05-L546WT	TA30S05-1046WT	TA30S05-1546WT	TA30S05-2546WT	TA30S05-0104GC
	10	—	—	—	TA30S05-1510WT	TA30S05-2510WT	TA30S05-0110CC
C8	2.0	T012S05-0502WT	T012S05-L502WT	T012S05-1002WT	T012S05-1502WT	T012S05-2502WT	T012S05-01Q1GC
	3.0	T012S05-0503WT	T012S05-L503WT	T012S05-1003WT	T012S05-1503WT	T012S05-2503WT	T012S05-0103GC
	4.6	T012S05-0546WT	T012S05-L546WT	T012S05-1046WT	T012S05-1546WT	T012S05-2546WT	T012S05-0104GC
	10	—	—	—	T012S05-1510WT	T012S05-2510WT	T012S05-0110CC
Bio C4	2.0	TB30S05-0502WT	TB30S05-L502WT	TB30S05-1002WT	TB30S05-1502WT	TB30S05-2502WT	TB30S05-01Q1GC
	3.0	TB30S05-0503WT	TB30S05-L503WT	TB30S05-1003WT	TB30S05-1503WT	TB30S05-2503WT	TB30S05-0103GC
	4.6	TB30S05-0546WT	TB30S05-L546WT	TB30S05-1046WT	TB30S05-1546WT	TB30S05-2546WT	TB30S05-0104GC
	10	—	—	—	TB30S05-1510WT	TB30S05-2510WT	TB30S05-0110CC
Phenyl	2.0	TPH12S05-0502WT	TPH12S05-L502WT	TPH12S05-1002WT	TPH12S05-1502WT	TPH12S05-2502WT	TPH12S05-01Q1GC
	3.0	TPH12S05-0503WT	TPH12S05-L503WT	TPH12S05-1003WT	TPH12S05-1503WT	TPH12S05-2503WT	TPH12S05-0103GC
	4.6	TPH12S05-0546WT	TPH12S05-L546WT	TPH12S05-1046WT	TPH12S05-1546WT	TPH12S05-2546WT	TPH12S05-0104GC
	10	—	—	—	TPH12S05-1510WT	TPH12S05-2510WT	TPH12S05-0110CC
PPF	2.0	TPF12S05-0502WT	TPF12S05-L502WT	TPF12S05-1002WT	TPF12S05-1502WT	TPF12S05-2502WT	TPF12S05-01Q1GC
	3.0	TPF12S05-0503WT	TPF12S05-L503WT	TPF12S05-1003WT	TPF12S05-1503WT	TPF12S05-2503WT	TPF12S05-0103GC
	4.6	TPF12S05-0546WT	TPF12S05-L546WT	TPF12S05-1046WT	TPF12S05-1546WT	TPF12S05-2546WT	TPF12S05-0104GC
	10	—	—	—	TPF12S05-1510WT	TPF12S05-2510WT	TPF12S05-0110CC
Diol-HILIC	2.0	TDH12S05-0502WT	TDH12S05-L502WT	TDH12S05-1002WT	TDH12S05-1502WT	TDH12S05-2502WT	TDH12S05-01Q1GC
	3.0	TDH12S05-0503WT	TDH12S05-L503WT	TDH12S05-1003WT	TDH12S05-1503WT	TDH12S05-2503WT	TDH12S05-0103GC
	4.6	TDH12S05-0546WT	TDH12S05-L546WT	TDH12S05-1046WT	TDH12S05-1546WT	TDH12S05-2546WT	TDH12S05-0104GC
	10	—	—	—	TDH12S05-1510WT	TDH12S05-2510WT	TDH12S05-0110CC
Diol** (SFC)	2.0	TDH12S05-0502WTB	TDH12S05-L502WTB	TDH12S05-1002WTB	TDH12S05-1502WTB	TDH12S05-2502WTB	—
	3.0	TDH12S05-0503WTB	TDH12S05-L503WTB	TDH12S05-1003WTB	TDH12S05-1503WTB	TDH12S05-2503WTB	—
	4.6	TDH12S05-0546WTB	TDH12S05-L546WTB	TDH12S05-1046WTB	TDH12S05-1546WTB	TDH12S05-2546WTB	—
	10	—	—	—	TDH12S05-1510WTB	TDH12S05-2510WTB	—
SIL (SFC)	2.0	TS12S05-0502WT	TS12S05-L502WT	TS12S05-1002WT	TS12S05-1502WT	TS12S05-2502WT	—
	3.0	TS12S05-0503WT	TS12S05-L503WT	TS12S05-1003WT	TS12S05-1503WT	TS12S05-2503WT	—
	4.6	TS12S05-0546WT	TS12S05-L546WT	TS12S05-1046WT	TS12S05-1546WT	TS12S05-2546WT	—
	10	—	—	—	TS12S05-1510WT	TS12S05-2510WT	—

\*Guard cartridge holder required, part no. XPGCH-Q1  
XPCHSPW1 (10 mm ID)

\*\*Supplied as YMC-Triart Diol-HILIC shipped on 2-propanol

## Ordering information

### YMC-Triart 5 µm, analytical HPLC columns (max. pressure 45 MPa)

Phase	Column ID (mm)	Column length (mm)							Guard cartridges* with 10 mm length
		20	33	50	75	100	150	250	
C18	2.1	TA12S05-02Q1PTH	TA12S05-H3Q1PTH	TA12S05-05Q1PTH	TA12S05-L5Q1PTH	TA12S05-10Q1PTH	TA12S05-15Q1PTH	—	TA12S05-01Q1GC
	3.0	—	—	TA12S05-05Q3PTH	TA12S05-L5Q3PTH	TA12S05-10Q3PTH	TA12S05-15Q3PTH	—	TA12S05-01Q3GC
	4.6	—	TA12S05-H346PTH	TA12S05-0546PTH	TA12S05-L546PTH	TA12S05-1046PTH	TA12S05-1546PTH	TA12S05-2546PTH	TA12S05-01Q4GC
C18 ExRS	2.1	TAR08S05-02Q1PTH	TAR08S05-H3Q1PTH	TAR08S05-05Q1PTH	TAR08S05-L5Q1PTH	TAR08S05-10Q1PTH	TAR08S05-15Q1PTH	—	TAR08S05-01Q1GC
	3.0	—	—	TAR08S05-05Q3PTH	TAR08S05-L5Q3PTH	TAR08S05-10Q3PTH	TAR08S05-15Q3PTH	—	TAR08S05-01Q3GC
	4.6	—	TAR08S05-H346PTH	TAR08S05-0546PTH	TAR08S05-L546PTH	TAR08S05-1046PTH	TAR08S05-1546PTH	TAR08S05-2546PTH	TAR08S05-01Q4GC
Bio C18	2.1	TA30S05-02Q1PTH	TA30S05-H3Q1PTH	TA30S05-05Q1PTH	TA30S05-L5Q1PTH	TA30S05-10Q1PTH	TA30S05-15Q1PTH	—	TA30S05-01Q1GC
	3.0	—	—	TA30S05-05Q3PTH	TA30S05-L5Q3PTH	TA30S05-10Q3PTH	TA30S05-15Q3PTH	—	TA30S05-01Q3GC
	4.6	—	TA30S05-H346PTH	TA30S05-0546PTH	TA30S05-L546PTH	TA30S05-1046PTH	TA30S05-1546PTH	TA30S05-2546PTH	TA30S05-01Q4GC
C8	2.1	T012S05-02Q1PTH	T012S05-H3Q1PTH	T012S05-05Q1PTH	T012S05-L5Q1PTH	T012S05-10Q1PTH	T012S05-15Q1PTH	—	T012S05-01Q1GC
	3.0	—	—	T012S05-05Q3PTH	T012S05-L5Q3PTH	T012S05-10Q3PTH	T012S05-15Q3PTH	—	T012S05-01Q3GC
	4.6	—	T012S05-H346PTH	T012S05-0546PTH	T012S05-L546PTH	T012S05-1046PTH	T012S05-1546PTH	T012S05-2546PTH	T012S05-01Q4GC
Bio C4	2.1	TB30S05-02Q1PTH	TB30S05-H3Q1PTH	TB30S05-05Q1PTH	TB30S05-L5Q1PTH	TB30S05-10Q1PTH	TB30S05-15Q1PTH	—	TB30S05-01Q1GC
	3.0	—	—	TB30S05-05Q3PTH	TB30S05-L5Q3PTH	TB30S05-10Q3PTH	TB30S05-15Q3PTH	—	TB30S05-01Q3GC
	4.6	—	TB30S05-H346PTH	TB30S05-0546PTH	TB30S05-L546PTH	TB30S05-1046PTH	TB30S05-1546PTH	TB30S05-2546PTH	TB30S05-01Q4GC
Phenyl	2.1	TPH12S05-02Q1PTH	TPH12S05-H3Q1PTH	TPH12S05-05Q1PTH	TPH12S05-L5Q1PTH	TPH12S05-10Q1PTH	TPH12S05-15Q1PTH	—	TPH12S05-01Q1GC
	3.0	—	—	TPH12S05-05Q3PTH	TPH12S05-L5Q3PTH	TPH12S05-10Q3PTH	TPH12S05-15Q3PTH	—	TPH12S05-01Q3GC
	4.6	—	TPH12S05-H346PTH	TPH12S05-0546PTH	TPH12S05-L546PTH	TPH12S05-1046PTH	TPH12S05-1546PTH	TPH12S05-2546PTH	TPH12S05-01Q4GC
PPF	2.1	TPF12S05-02Q1PTH	TPF12S05-H3Q1PTH	TPF12S05-05Q1PTH	TPF12S05-L5Q1PTH	TPF12S05-10Q1PTH	TPF12S05-15Q1PTH	—	TPF12S05-01Q1GC
	3.0	—	—	TPF12S05-05Q3PTH	TPF12S05-L5Q3PTH	TPF12S05-10Q3PTH	TPF12S05-15Q3PTH	—	TPF12S05-01Q3GC
	4.6	—	TPF12S05-H346PTH	TPF12S05-0546PTH	TPF12S05-L546PTH	TPF12S05-1046PTH	TPF12S05-1546PTH	TPF12S05-2546PTH	TPF12S05-01Q4GC
Diol-HILIC	2.1	TDH12S05-02Q1PTH	TDH12S05-H3Q1PTH	TDH12S05-05Q1PTH	TDH12S05-L5Q1PTH	TDH12S05-10Q1PTH	TDH12S05-15Q1PTH	—	TDH12S05-01Q1GC
	3.0	—	—	TDH12S05-05Q3PTH	TDH12S05-L5Q3PTH	TDH12S05-10Q3PTH	TDH12S05-15Q3PTH	—	TDH12S05-01Q3GC
	4.6	—	TDH12S05-H346PTH	TDH12S05-0546PTH	TDH12S05-L546PTH	TDH12S05-1046PTH	TDH12S05-1546PTH	TDH12S05-2546PTH	TDH12S05-01Q4GC
Diol (SFC)	2.1	TDH12S05-02Q1PTHB	TDH12S05-H3Q1PTHB	TDH12S05-05Q1PTHB	TDH12S05-L5Q1PTHB	TDH12S05-10Q1PTHB	TDH12S05-15Q1PTHB	—	—
	3.0	—	—	TDH12S05-05Q3PTHB	TDH12S05-L5Q3PTHB	TDH12S05-10Q3PTHB	TDH12S05-15Q3PTHB	—	—
	4.6	—	TDH12S05-H346PTHB	TDH12S05-0546PTHB	TDH12S05-L546PTHB	TDH12S05-1046PTHB	TDH12S05-1546PTHB	TDH12S05-2546PTHB	—
SIL (SFC)	2.1	TS12S05-02Q1PTH	TS12S05-H3Q1PTH	TS12S05-05Q1PTH	TS12S05-L5Q1PTH	TS12S05-10Q1PTH	TS12S05-15Q1PTH	—	—
	3.0	—	—	TS12S05-05Q3PTH	TS12S05-L5Q3PTH	TS12S05-10Q3PTH	TS12S05-15Q3PTH	—	—
	4.6	—	TS12S05-H346PTH	TS12S05-0546PTH	TS12S05-L546PTH	TS12S05-1046PTH	TS12S05-1546PTH	TS12S05-2546PTH	—

\*Guard cartridge holder required, part no. XPGCH-Q1

\*\*Supplied as YMC-Triart Diol-HILIC shipped on 2-propanol

## Ordering information

### YMC Accura Triart 5 µm, coated bioinert analytical columns (max. pressure 10/45 MPa)

Phase	Column ID (mm)	Column length (mm)			
		50	100	150	250
C18	2.1	TA12S05-05Q1PTC	TA12S05-10Q1PTC	TA12S05-15Q1PTC	–
	4.6	TA12S05-0546PTC	TA12S05-1046PTC	TA12S05-1546PTC	TA12S05-2546PTC
	10	–	TA12S05-1010PTC	TA12S05-1510PTC	TA12S05-2510PTC
C18 ExRS	2.1	TAR08S05-05Q1PTC	TAR08S05-10Q1PTC	TAR08S05-15Q1PTC	–
	4.6	TAR08S05-0546PTC	TAR08S05-1046PTC	TAR08S05-1546PTC	TAR08S05-2546PTC
	10	–	TAR08S05-1010PTC	TAR08S05-1510PTC	TAR08S05-2510PTC
Bio C18	2.1	TA30S05-05Q1PTC	TA30S05-10Q1PTC	TA30S05-15Q1PTC	–
	4.6	TA30S05-0546PTC	TA30S05-1046PTC	TA30S05-1546PTC	TA30S05-2546PTC
	10	–	TA30S05-1010PTC	TA30S05-1510PTC	TA30S05-2510PTC
C8	2.1	TO12S05-05Q1PTC	TO12S05-10Q1PTC	TO12S05-15Q1PTC	–
	4.6	TO12S05-0546PTC	TO12S05-1046PTC	TO12S05-1546PTC	TO12S05-2546PTC
	10	–	TO12S05-1010PTC	TO12S05-1510PTC	TO12S05-2510PTC
Bio C4	2.1	TB30S05-05Q1PTC	TB30S05-10Q1PTC	TB30S05-15Q1PTC	–
	4.6	TB30S05-0546PTC	TB30S05-1046PTC	TB30S05-1546PTC	TB30S05-2546PTC
	10	–	TB30S05-1010PTC	TB30S05-1510PTC	TB30S05-2510PTC
Phenyl	2.1	TPH12S05-05Q1PTC	TPH12S05-10Q1PTC	TPH12S05-15Q1PTC	–
	4.6	TPH12S05-0546PTC	TPH12S05-1046PTC	TPH12S05-1546PTC	TPH12S05-2546PTC
	10	–	TPH12S05-1010PTC	TPH12S05-1510PTC	TPH12S05-2510PTC
PPF	2.1	TPF12S05-05Q1PTC	TPF12S05-10Q1PTC	TPF12S05-15Q1PTC	–
	4.6	TPF12S05-0546PTC	TPF12S05-1046PTC	TPF12S05-1546PTC	TPF12S05-2546PTC
	10	–	TPF12S05-1010PTC	TPF12S05-1510PTC	TPF12S05-2510PTC
Diol-HILIC	2.1	TDH12S05-05Q1PTC	TDH12S05-10Q1PTC	TDH12S05-15Q1PTC	–
	4.6	TDH12S05-0546PTC	TDH12S05-1046PTC	TDH12S05-1546PTC	TDH12S05-2546PTC

### YMC-Triart metal-free 5 µm, PEEK-lined analytical columns (max. pressure 45 MPa)

Phase	Column ID (mm)	Column length (mm)		
		50	100	150
C18	2.1	TA12S05-05Q1PTP	TA12S05-10Q1PTP	TA12S05-15Q1PTP
	4.6	TA12S05-0546PTP	TA12S05-1046PTP	TA12S05-1546PTP
C18 ExRS	2.1	TAR08S05-05Q1PTP	TAR08S05-10Q1PTP	TAR08S05-15Q1PTP
	4.6	TAR08S05-0546PTP	TAR08S05-1046PTP	TAR08S05-1546PTP
Bio C18	2.1	TA30S05-05Q1PTP	TA30S05-10Q1PTP	TA30S05-15Q1PTP
	4.6	TA30S05-0546PTP	TA30S05-1046PTP	TA30S05-1546PTP
C8	2.1	TO12S05-05Q1PTP	TO12S05-10Q1PTP	TO12S05-15Q1PTP
	4.6	TO12S05-0546PTP	TO12S05-1046PTP	TO12S05-1546PTP
Bio C4	2.1	TB30S05-05Q1PTP	TB30S05-10Q1PTP	TB30S05-15Q1PTP
	4.6	TB30S05-0546PTP	TB30S05-1046PTP	TB30S05-1546PTP
Phenyl	2.1	TPH12S05-05Q1PTP	TPH12S05-10Q1PTP	TPH12S05-15Q1PTP
	4.6	TPH12S05-0546PTP	TPH12S05-1046PTP	TPH12S05-1546PTP
PPF	2.1	TPF12S05-05Q1PTP	TPF12S05-10Q1PTP	TPF12S05-15Q1PTP
	4.6	TPF12S05-0546PTP	TPF12S05-1046PTP	TPF12S05-1546PTP
Diol-HILIC	2.1	TDH12S05-05Q1PTP	TDH12S05-10Q1PTP	TDH12S05-15Q1PTP
	4.6	TDH12S05-0546PTP	TDH12S05-1046PTP	TDH12S05-1546PTP



## Ordering information

### YMC-Triart 5 µm, 1/16" | 1/32" fitting\*, micro/nanoLC columns (max. pressure 45/55 MPa)

Phase	Column ID (µm)	Column length (mm)				Guard columns** with 5 mm length (pack of 3)
		50	75	100	150	
C18	75	—	—	TA12S05-10E8AU	TA12S05-15E8AU	—
	100	—	—	TA12S05-10F0AU	TA12S05-15F0AU	—
	300	TA12S05-05H0AU	TA12S05-L5H0AU	TA12S05-10H0AU	TA12S05-15H0AU	TA12S05-E5H0AU
	500	TA12S05-05J0AU	TA12S05-L5J0AU	TA12S05-10J0AU	TA12S05-15J0AU	TA12S05-E5J0AU
C18 ExRS	75	—	—	TAR08S05-10E8AU	TAR08S05-15E8AU	—
	100	—	—	TAR08S05-10F0AU	TAR08S05-15F0AU	—
	300	TAR08S05-05H0AU	TAR08S05-L5H0AU	TAR08S05-10H0AU	TAR08S05-15H0AU	TAR08S05-E5H0AU
	500	TAR08S05-05J0AU	TAR08S05-L5J0AU	TAR08S05-10J0AU	TAR08S05-15J0AU	TAR08S05-E5J0AU
Bio C18	75	—	—	TA30S05-10E8AU	TA30S05-15E8AU	—
	100	—	—	TA30S05-10F0AU	TA30S05-15F0AU	—
	300	TA30S05-05H0AU	TA30S05-L5H0AU	TA30S05-10H0AU	TA30S05-15H0AU	TA30S05-E5H0AU
	500	TA30S05-05J0AU	TA30S05-L5J0AU	TA30S05-10J0AU	TA30S05-15J0AU	TA30S05-E5J0AU
C8	75	—	—	T012S05-10E8AU	T012S05-15E8AU	—
	100	—	—	T012S05-10F0AU	T012S05-15F0AU	—
	300	T012S05-05H0AU	T012S05-L5H0AU	T012S05-10H0AU	T012S05-15H0AU	T012S05-E5H0AU
	500	T012S05-05J0AU	T012S05-L5J0AU	T012S05-10J0AU	T012S05-15J0AU	T012S05-E5J0AU
Bio C4	75	—	—	TB30S05-10E8AU	TB30S05-15E8AU	—
	100	—	—	TB30S05-10F0AU	TB30S05-15F0AU	—
	300	TB30S05-05H0AU	TB30S05-L5H0AU	TB30S05-10H0AU	TB30S05-15H0AU	TB30S05-E5H0AU
	500	TB30S05-05J0AU	TB30S05-L5J0AU	TB30S05-10J0AU	TB30S05-15J0AU	TB30S05-E5J0AU
Phenyl	75	—	—	TPH12S05-10E8AU	TPH12S05-15E8AU	—
	100	—	—	TPH12S05-10F0AU	TPH12S05-15F0AU	—
	300	TPH12S05-05H0AU	TPH12S05-L5H0AU	TPH12S05-10H0AU	TPH12S05-15H0AU	TPH12S05-E5H0AU
	500	TPH12S05-05J0AU	TPH12S05-L5J0AU	TPH12S05-10J0AU	TPH12S05-15J0AU	TPH12S05-E5J0AU
PPF	75	—	—	TPF12S05-10E8AU	TPF12S05-15E8AU	—
	100	—	—	TPF12S05-10F0AU	TPF12S05-15F0AU	—
	300	TPF12S05-05H0AU	TPF12S05-L5H0AU	TPF12S05-10H0AU	TPF12S05-15H0AU	TPF12S05-E5H0AU
	500	TPF12S05-05J0AU	TPF12S05-L5J0AU	TPF12S05-10J0AU	TPF12S05-15J0AU	TPF12S05-E5J0AU
Diol-HILIC	75	—	—	TDH12S05-10E8AU	TDH12S05-15E8AU	—
	100	—	—	TDH12S05-10F0AU	TDH12S05-15F0AU	—
	300	TDH12S05-05H0AU	TDH12S05-L5H0AU	TDH12S05-10H0AU	TDH12S05-15H0AU	TDH12S05-E5H0AU
	500	TDH12S05-05J0AU	TDH12S05-L5J0AU	TDH12S05-10J0AU	TDH12S05-15J0AU	TDH12S05-E5J0AU

\*YMC capillary columns are available with 1/16" (10-32 thread) or with 1/32" (6-40 thread) connections. The connection size is indicated by the terminal letters of the order code:

**1/16" fittings end with AU; 1/32" fittings end with RU. For ordering 1/32" connections, simply exchange AU by RU.**

\*\* no holder required, comes with a column coupler

**Columns with 1/32" fitting are only available with 300 or 500 µm ID.**

## Ordering information

### YMC-Triart 5 µm in YMC-Actus high-throughput semipreparative hardware (max. pressure 20/30 MPa)

Phase	Column ID (mm)	Column length (mm)					Guard cartridges* with 10 mm length
		50	75	100	150	250	
C18	20	TA12S05-0520WX	TA12S05-L520WX	TA12S05-1020WX	TA12S05-1520WX	TA12S05-2520WX	TA12S05-0120CCN
	30	TA12S05-0530WX	TA12S05-L530WX	TA12S05-1030WX	TA12S05-1530WX	TA12S05-2530WX	TA12S05-0130CCN
	50***	—	—	TA12S05-1053DX	TA12S05-1553DX	TA12S05-2553DX	TA12S05-0553DXG**
C18 ExRS	20	TAR08S05-0520WX	TAR08S05-L520WX	TAR08S05-1020WX	TAR08S05-1520WX	TAR08S05-2520WX	TAR08S05-0120CCN
	30	TAR08S05-0530WX	TAR08S05-L530WX	TAR08S05-1030WX	TAR08S05-1530WX	TAR08S05-2530WX	TAR08S05-0130CCN
	50***	—	—	TAR08S05-1053DX	TAR08S05-1553DX	TAR08S05-2553DX	TAR08S05-0553DXG**
Bio C18	20	TA30S05-0520WX	TA30S05-L520WX	TA30S05-1020WX	TA30S05-1520WX	TA30S05-2520WX	TA30S05-0120CCN
	30	TA30S05-0530WX	TA30S05-L530WX	TA30S05-1030WX	TA30S05-1530WX	TA30S05-2530WX	TA30S05-0130CCN
	50***	—	—	TA30S05-1053DX	TA30S05-1553DX	TA30S05-2553DX	TA30S05-0553DXG**
C8	20	T012S05-0520WX	T012S05-L520WX	T012S05-1020WX	T012S05-1520WX	T012S05-2520WX	T012S05-0120CCN
	30	T012S05-0530WX	T012S05-L530WX	T012S05-1030WX	T012S05-1530WX	T012S05-2530WX	T012S05-0130CCN
	50***	—	—	T012S05-1053DX	T012S05-1553DX	T012S05-2553DX	T012S05-0553DXG**
Bio C4	20	TB30S05-0520WX	TB30S05-L520WX	TB30S05-1020WX	TB30S05-1520WX	TB30S05-2520WX	TB30S05-0120CCN
	30	TB30S05-0530WX	TB30S05-L530WX	TB30S05-1030WX	TB30S05-1530WX	TB30S05-2530WX	TB30S05-0130CCN
	50***	—	—	TB30S05-1053DX	TB30S05-1553DX	TB30S05-2553DX	TB30S05-0553DXG**
Phenyl	20	TPH12S05-0520WX	TPH12S05-L520WX	TPH12S05-1020WX	TPH12S05-1520WX	TPH12S05-2520WX	TPH12S05-0120CCN
	30	TPH12S05-0530WX	TPH12S05-L530WX	TPH12S05-1030WX	TPH12S05-1530WX	TPH12S05-2530WX	TPH12S05-0130CCN
	50***	—	—	TPH12S05-1053DX	TPH12S05-1553DX	TPH12S05-2553DX	TPH12S05-0553DXG**
PPF	20	TPF12S05-0520WX	TPF12S05-L520WX	TPF12S05-1020WX	TPF12S05-1520WX	TPF12S05-2520WX	TPF12S05-0120CCN
	30	TPF12S05-0530WX	TPF12S05-L530WX	TPF12S05-1030WX	TPF12S05-1530WX	TPF12S05-2530WX	TPF12S05-0130CCN
	50***	—	—	TPF12S05-1053DX	TPF12S05-1553DX	TPF12S05-2553DX	TPF12S05-0553DXG**

\*Guard cartridge holder required, part no. XPGHFSP20ID (20 mm ID)/XPGHFSP30ID (30 mm ID)

\*\*no holder required for 50 x 50 mm ID guard columns (no cartridge)

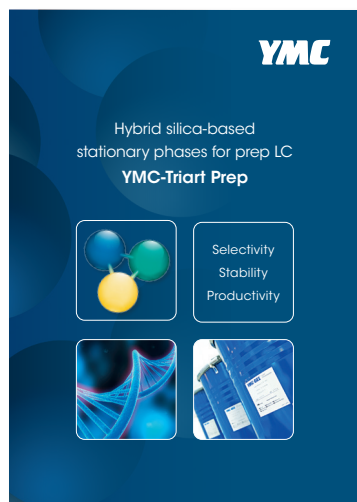
\*\*\*1/8" connections. For ordering 1/16" connections, simply exchange DX by AX.

### YMC-Triart, preparative bulk media

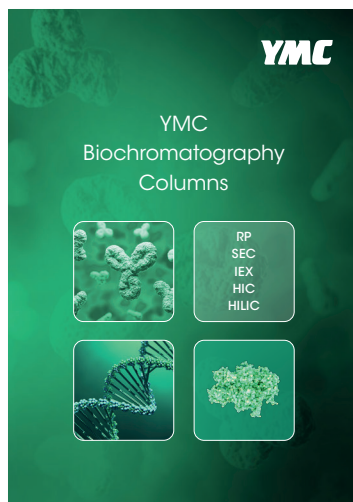
YMC-Triart Prep C18-S			YMC-Triart Prep C8-S			YMC-Triart Prep Bio200 C8			YMC-Triart Prep C4-S			YMC-Triart Prep Phenyl-S		
Pore size [nm]	Particle size [µm]	Product Code	Pore size [nm]	Particle size [µm]	Product Code	Pore size [nm]	Particle size [µm]	Product Code	Pore size [nm]	Particle size [µm]	Product Code	Pore size [nm]	Particle size [µm]	Product Code
12	7	TAS12S07	20	10	TOS20S11	20	10	TOB20S11	12	10	TBS12S11	12	10	TPS12S11
	10	TAS12S11		15	TOS20S16									
	15	TAS12S16		20	TOS20S21									
	20	TAS12S21												

NOTE: customised particle sizes and pore sizes are available on request. Contact YMC Europe GmbH for further details.

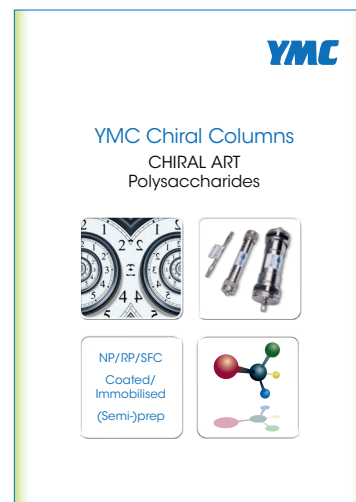
Please inquire for the corresponding catalogues



YMC-Triart Prep



YMC Biochromatography Columns



YMC Chiral Columns

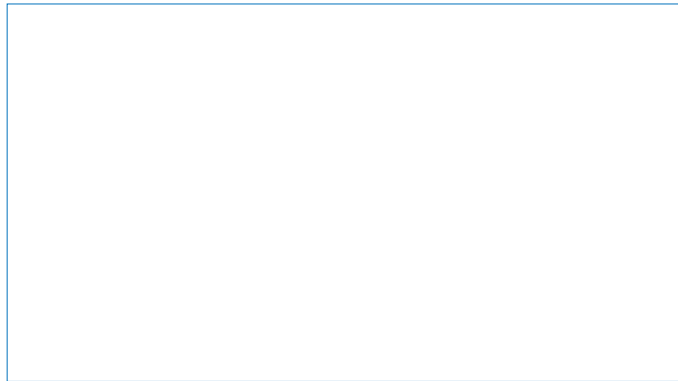
“

*“The possibility to use temperatures up to 90 °C with YMC-Triart Bio C4 simplifies the development of analytical methods. Furthermore, a good peak shape can be obtained without the addition of TFA, which means that I have fewer problems when using it for MS.”*

*Lars M. H. Reinders, Institute for Energy and Environmental Technology e. V. (IUTA, DE)*

”

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