

## HPLC, LC/MS Columns

# InertSustain® PFP



### Physical Properties

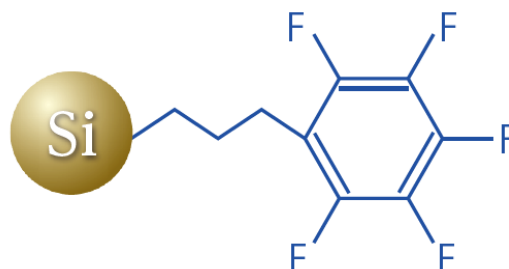
- Silica : Newly Developed ES Silica Gel
- Particle Size : 3  $\mu\text{m}$ 、 5  $\mu\text{m}$
- Surface Area : 350  $\text{m}^2/\text{g}$
- Pore Size : 100  $\text{\AA}$  (10 nm)
- Pore Volume : 0.85  $\text{mL/g}$
- Bonded Phase : Pentafluorophenyl
- End-capping : Yes
- Carbon Loading : 10 %
- pH Range : 2~7.5
- USP Code : L43

# InertSustain<sup>®</sup> PFP

InertSustain PFP columns are bonded with Pentafluorophenyl groups to our newly developed ES silica gel, which delivers unique separation patterns with excellent peak shape and sensitivity. The chromatographic difference stems from the fact that the PFP phases provide interactions such as  $\pi$ - $\pi$ , dipole, hydrogen bonding, and ionic interactions unlike conventional PFP columns.

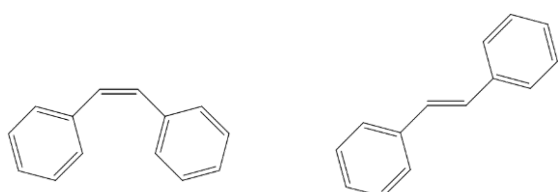
## Benefit

- Able to obtain unique separation patterns
- Increased retention for highly polar analytes
- Low adsorption of Symmetrical peak shape
- High reproducibility



## Benefit1: Unique separation patterns

The goal of all the chromatographers is to separate analytes. InertSustain PFP columns has ability to provide good resolution for isomers. As shown below, complete separation of *cis*-Stilbene and *trans*-Stilbene was successfully achieved .



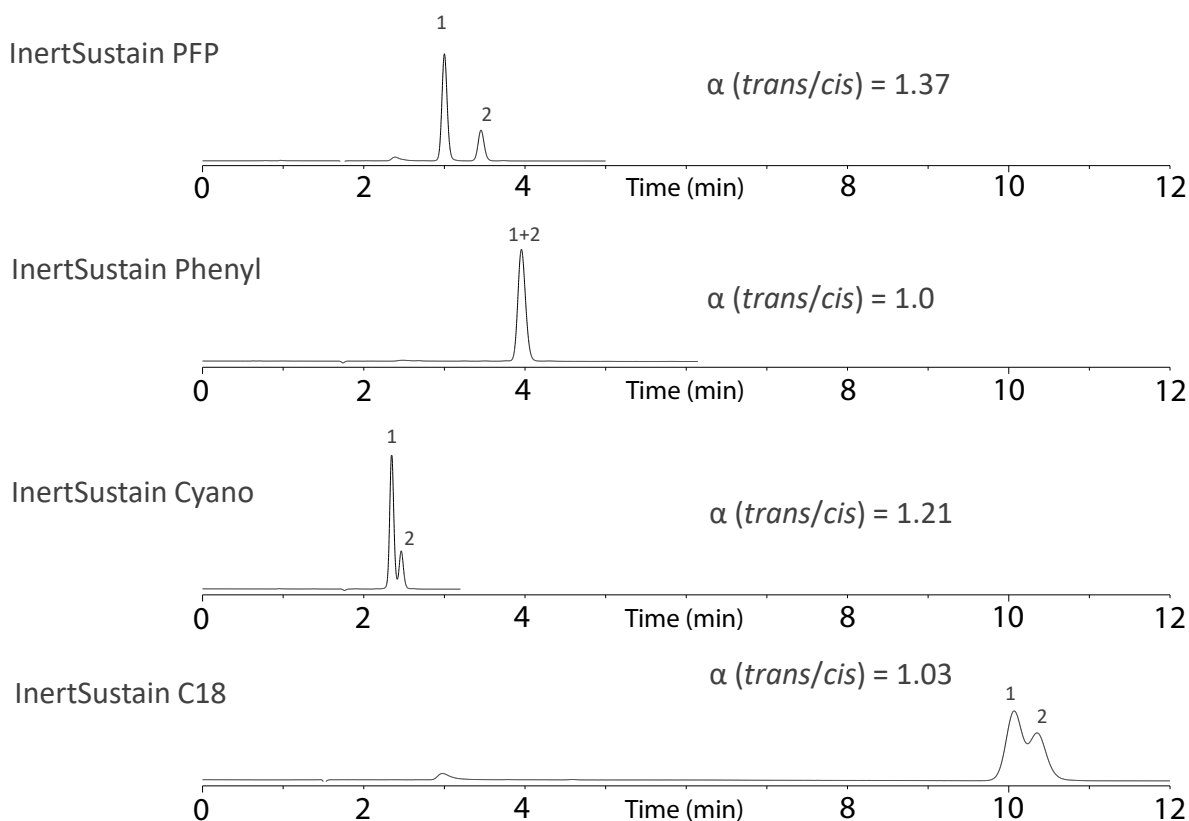
1. *cis*-Stilbene

2. *trans*-Stilbene

### Conditions

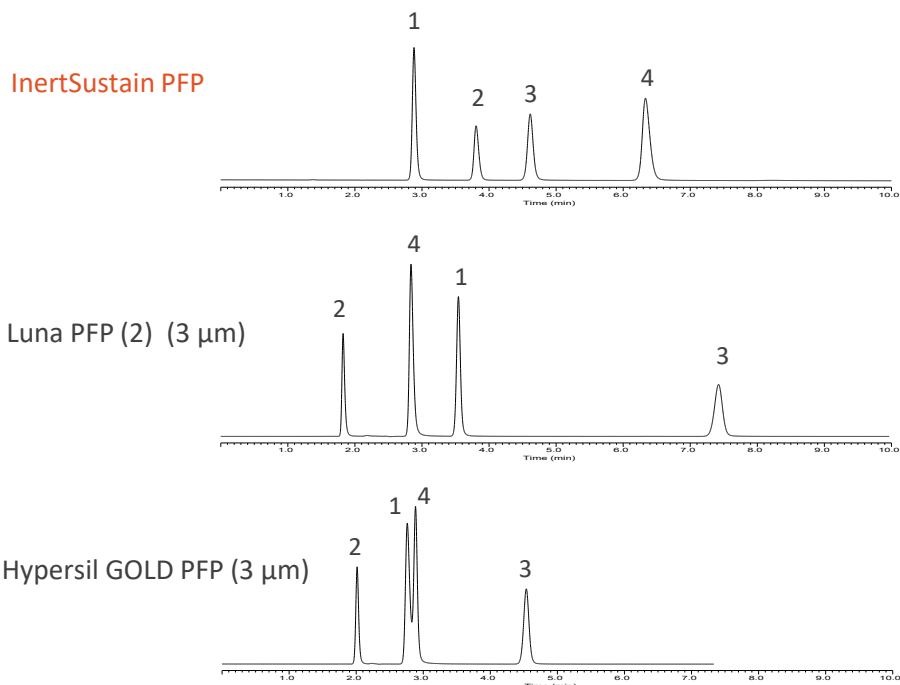
Eluent	: A) CH <sub>3</sub> OH B) H <sub>2</sub> O
	A/B = 80/20, v/v
Column Size	: 5 $\mu$ m, 150 $\times$ 4.6 mm I.D.
Flow Rate	: 1.0 mL/min
Col. Temp.	: 40 $^{\circ}$ C
Detection	: UV 210nm
Sample	: 1. <i>cis</i> -Stilbene
	2. <i>trans</i> -Stilbene

\*  $\alpha$  (*trans/cis*) : The ratio of retention factor of *cis*-Stilbene and *trans*-Stilbene

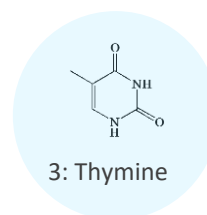
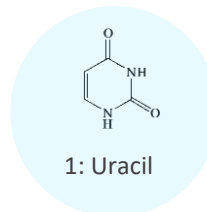


## Benefit 2: Increased retention for highly polar analytes

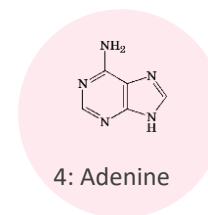
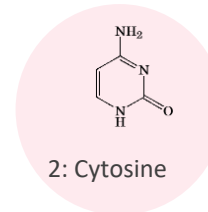
PFP columns shows greater retention for highly polar analytes. Our InertSustain PFP provides stronger retention when comparing from other manufacture's columns.



Neutral compounds



Basic compounds



Conditions

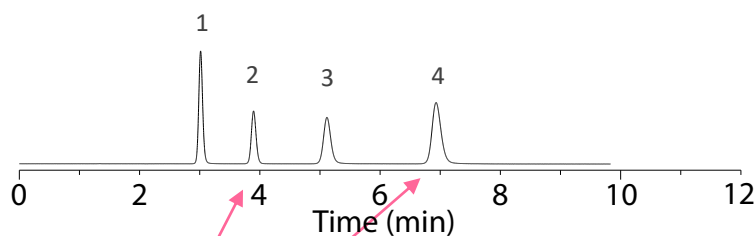
Column : 3 μm, 150 × 2.1 mm I.D.  
 Eluent : 0.1% HCOOH in H<sub>2</sub>O  
 Flow Rate : 0.2 mL/min  
 Col. Temp. : 40 °C  
 Detection : UV 254 nm

## Comparison between InertSustain AQ-C18 (ODS columns for highly polar analytes)

InertSustain PFP provides stronger retention especially for basic compounds. As shown below, InertSustain PFP offers stronger retention for basic compounds.

InertSustain PFP

Complete Base Line Separation

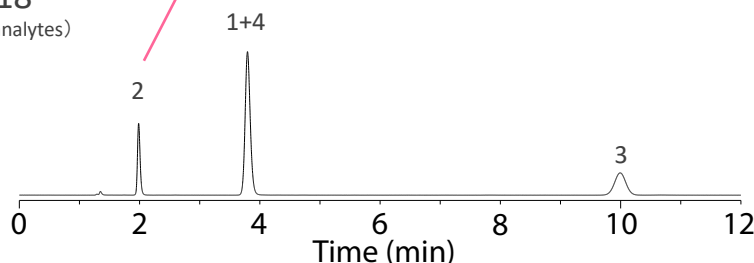


Conditions

Column : 5 μm, 150 × 4.6 mm I.D.  
 Eluent : 0.1% HCOOH in H<sub>2</sub>O  
 Flow Rate : 1 mL/min  
 Col. Temp. : 40 °C  
 Detection : UV 254 nm

InertSustain AQ-C18

(ODS columns for highly polar analytes)

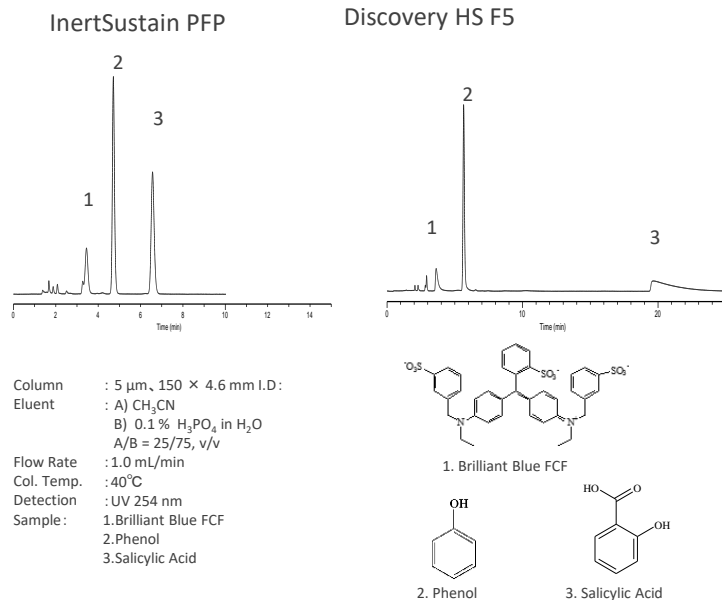
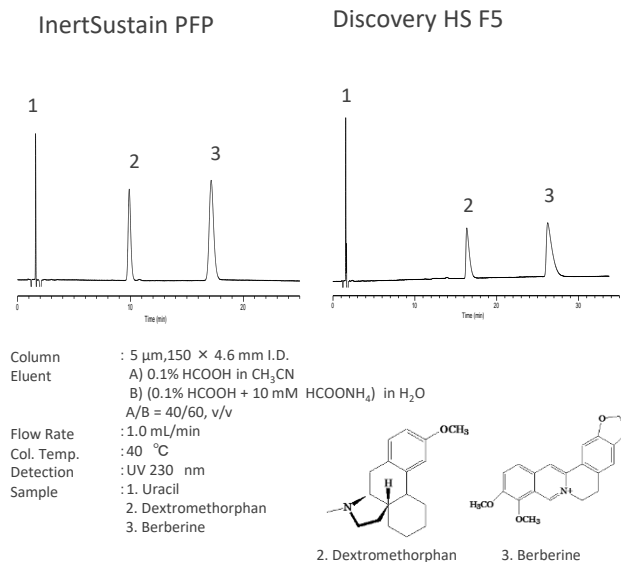


## Benefit 3: Low adsorption of Symmetrical peak shape

As shown below, InertSustain PFP columns provide symmetric peaks and excellent resolution for both strong basic and acidic compounds.

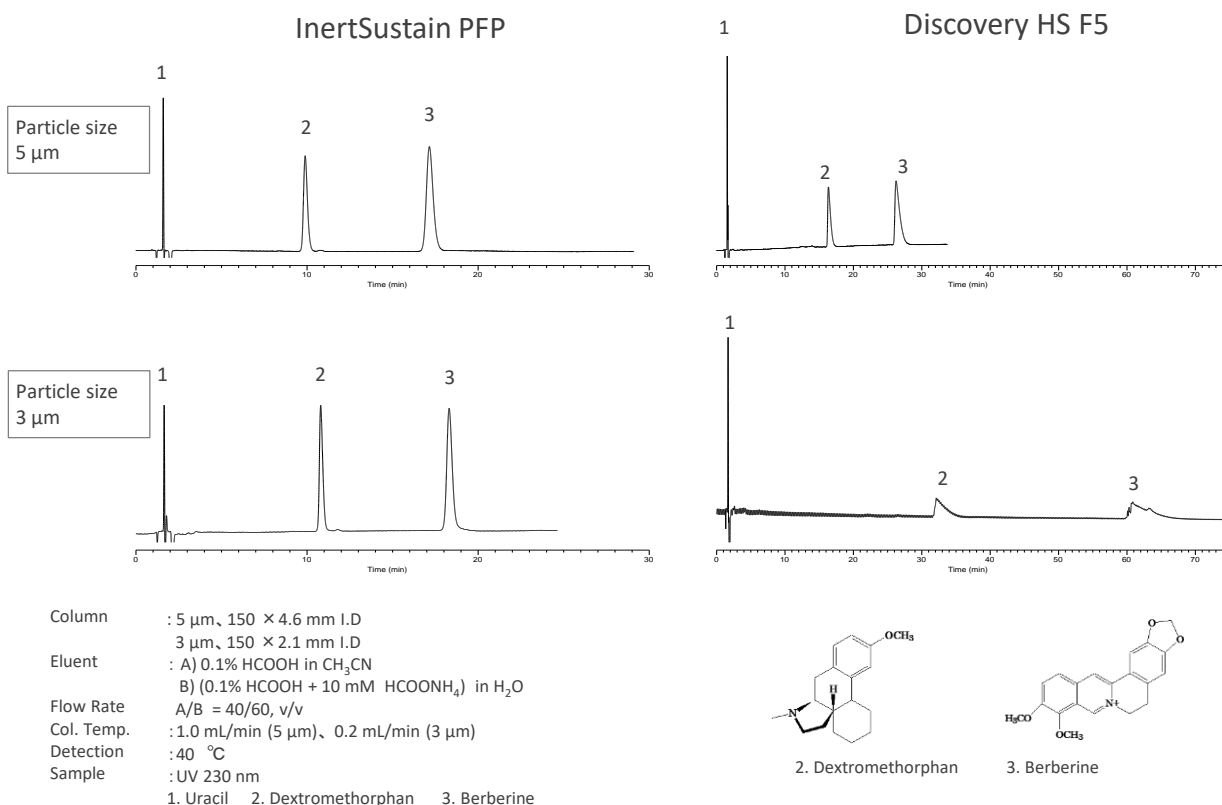
### Basic compounds

### Acidic compound



## Benefit 4: High reproducibility

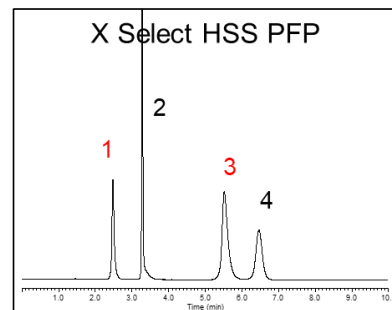
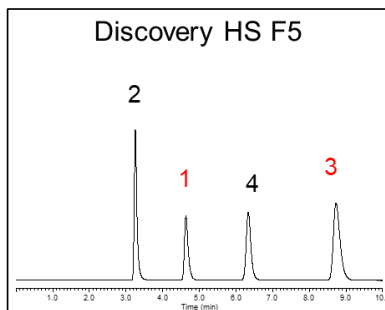
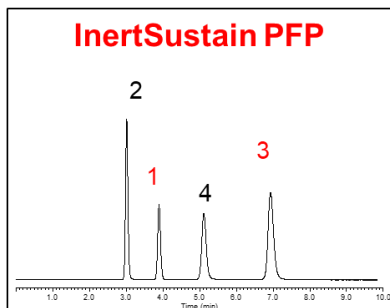
In general, retention behavior are often changed depending on particle size or lot you are using. As proven below, InertSustain PFP provides exceptional reproducibility even with those challenging and strong analytes such as Dextromethorphan or Berberine.



# Application

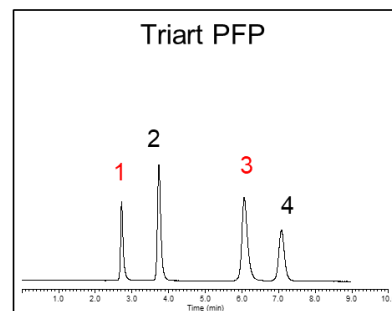
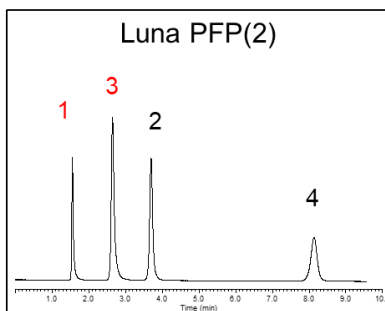
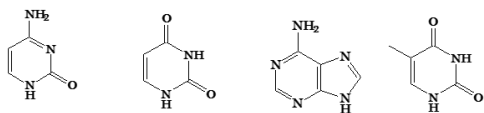
## Retention of polar analytes (1) –Nucleic Acids

InertSustain PFP shows stronger retention of basic analytes when comparing to other manufacture's columns.



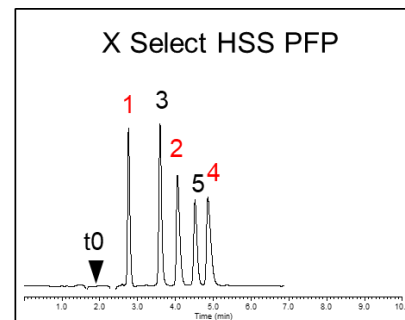
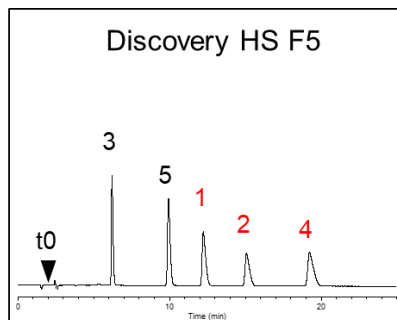
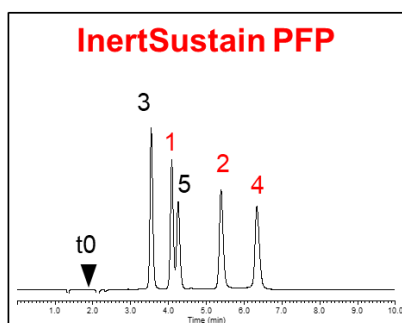
### Conditions

Column : 5  $\mu$ m, 4.6 mm I.D.  $\times$  150 mm  
 Eluent : A) 0.1 % HCOOH  
 Flow Rate : 1.0 mL / min  
 Col. Temp. : 40  $^{\circ}$ C  
 Detection : UV 254 nm  
 Sample : 1. Cytosine 2. Uracil 3. Adenine 4. Thymine



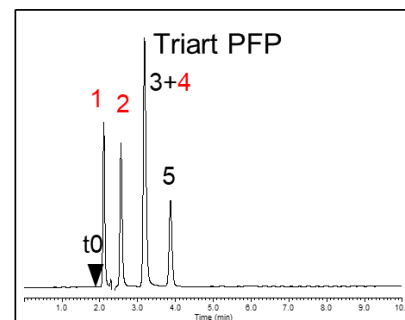
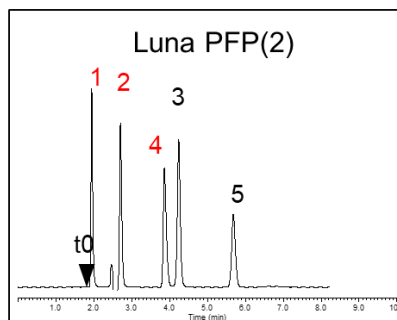
As shown below, InertSustain PFP can be used to improve separations of isomeric analytes that prove problematic on conventional ODS columns. Depending on your desired analytes, Metal-Free PEEK columns can be used for chelating compounds.

## Retention of polar analytes (2) –Catecholamine



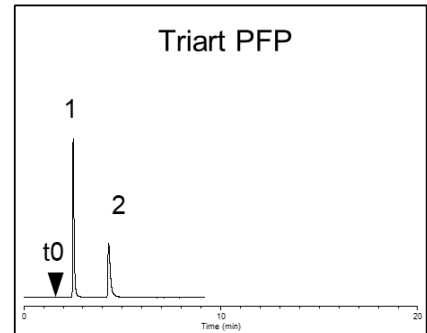
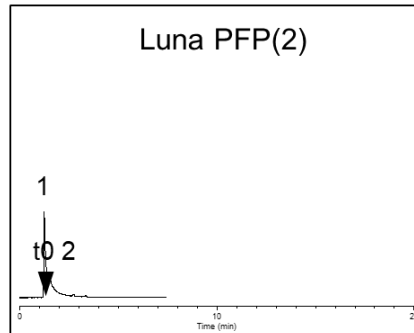
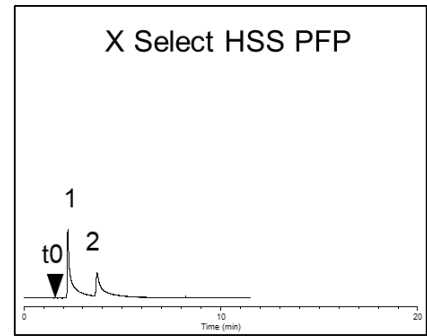
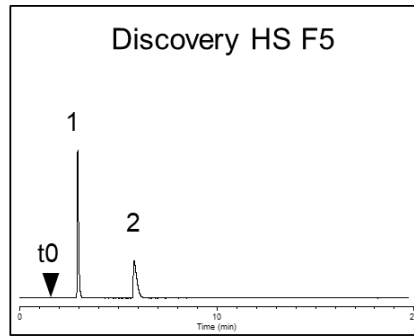
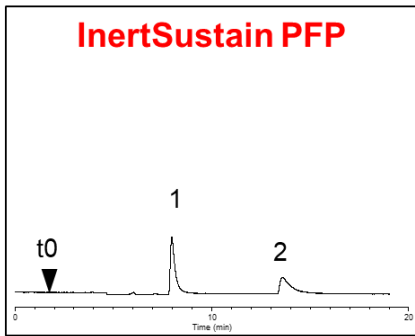
### Conditions

Column : 3  $\mu$ m, 2.1 mm I.D.  $\times$  150 mm  
 Eluent : A) 0.1 % HCOOH  
 Flow Rate : 1.0 mL / min  
 Col. Temp. : 40  $^{\circ}$ C  
 Detection : UV 210 nm  
 Sample : 1. Norepinephrine  
 2. L-Adrenaline  
 3. L-DOPA  
 4. Dopamine  
 5. L-(-)-Tyrosine



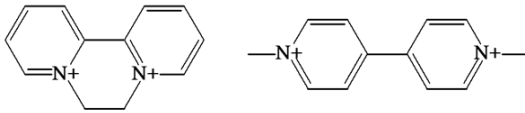
# Application

## Retention of polar analytes (3) – Praquat and Diquat



### Conditions

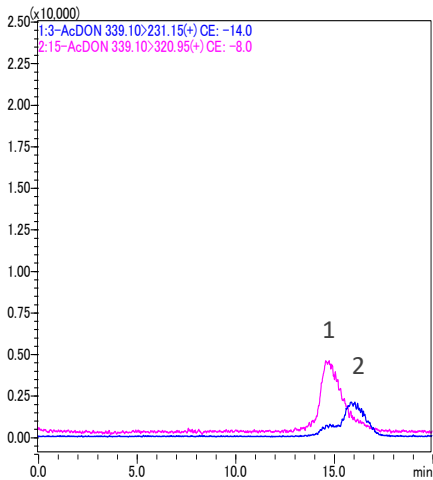
Column : 5  $\mu$ m, 4.6 mm I.D.  $\times$  150 mm  
 Eluent : A) 0.1 % HCOOH  
 Flow Rate : 1.0 mL/min  
 Col. Temp. : 40  $^{\circ}$ C  
 Detection : UV 290 nm  
 Sample : 1. Diquat 2. Praquat



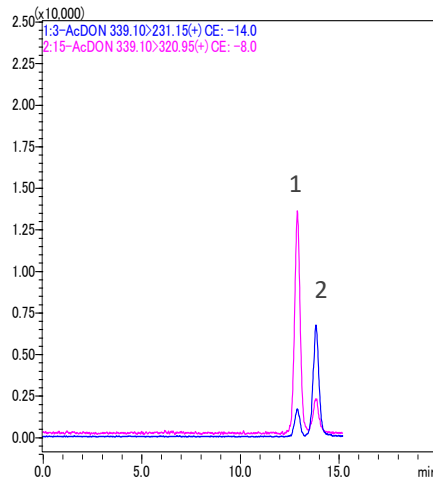
## 15-AcDON and 3-AcDON

As shown below, InertSustain PFP can be used to improve separations of isomeric analytes that prove problematic on conventional ODS columns. Depending on your desired analytes, Metal-Free PEEK columns can be used for chelating compounds.

InertSustain PFP  
(SUS column)



InertSustain PFP  
Metal-Free PEEK Columns  
Details are described in P7

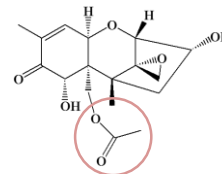


### Conditions

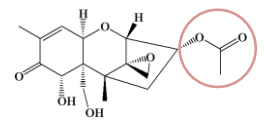
Column : InertSustain PFP  
 (3  $\mu$ m, 150  $\times$  2.1 mm I.D.)  
 Eluent : A) 0.1% HCOOH in H<sub>2</sub>O  
 B) CH<sub>3</sub>OH  
 A/B=85/15, v/v  
 Flow Rate : 0.2 mL/min  
 Col. Temp. : 40  $^{\circ}$ C  
 Detection : MS/MS (ESI, Postivie, SRM)  
 Injection Vol. : 1  $\mu$ L

### Sample:

- 15-Acetyldioxynivalenol (15-AcDON)
  - 3-Acetyldioxynivalenol (3-AcDON)
- (1.0 mg/L each)



1. 15-AcDON

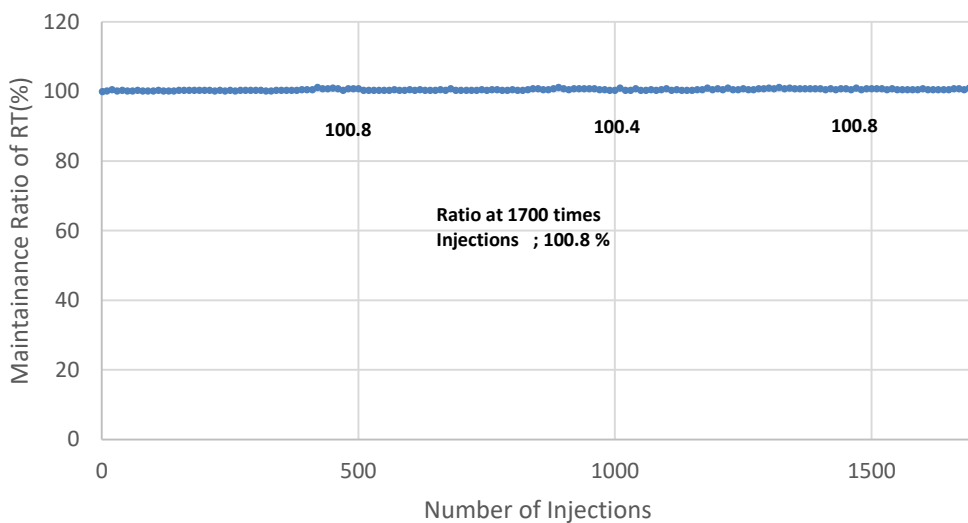


2. 3-AcDON

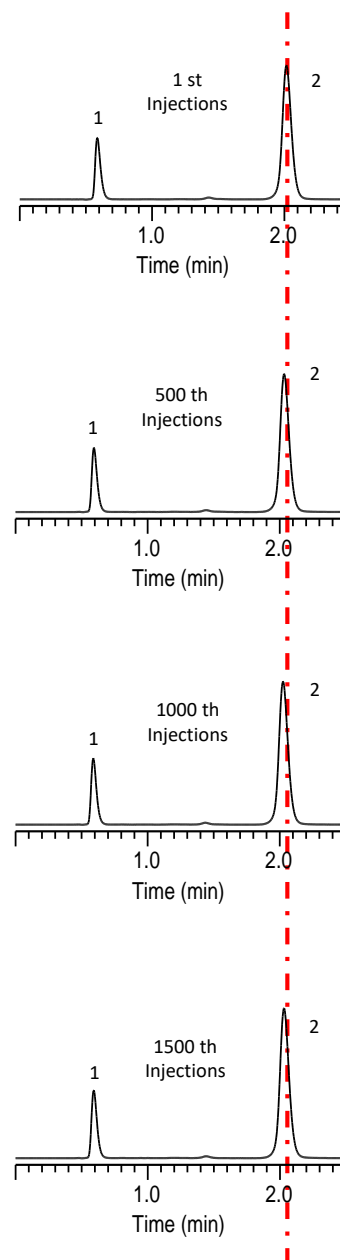
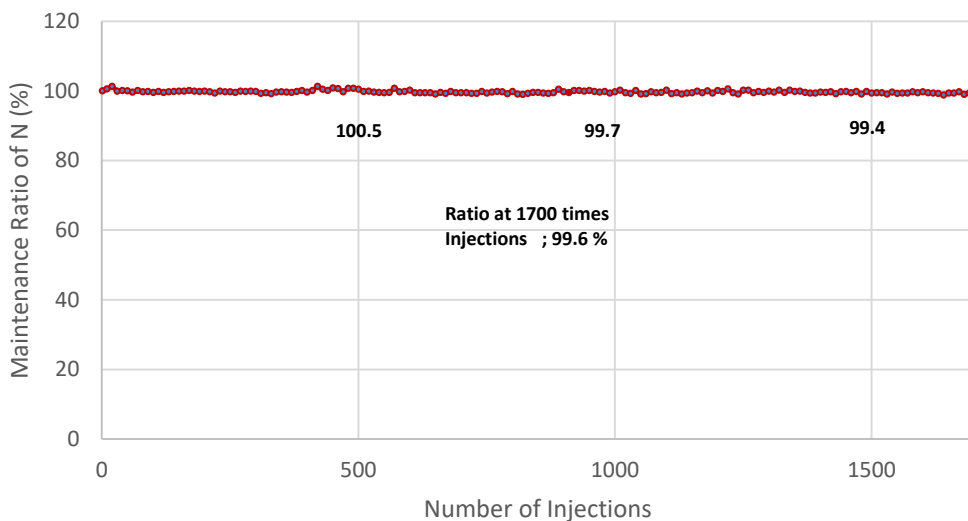
# InertSustain PFP Durability test under Acidic Condition; pH 2.0

Column : InertSustain PFP 3  $\mu$ m 50 $\times$ 4.6 mm I.D.  
Eluent : A) CH<sub>3</sub>CN  
          B) 10 mM KH<sub>2</sub>PO<sub>4</sub> in H<sub>2</sub>O (pH=2.0, H<sub>3</sub>PO<sub>4</sub>)  
          A/B = 45/55, v/v  
Flow Rate : 1.0 mL/min  
Col Temp : 40  $^{\circ}$ C  
Detection : UV 230 nm  
Inj Volume : 10  $\mu$ L  
Sample : 1: Uracil 2: Berberine  
Number of Injections : **1700 times**

### Berberine Retention Time



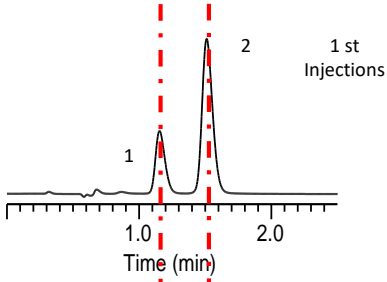
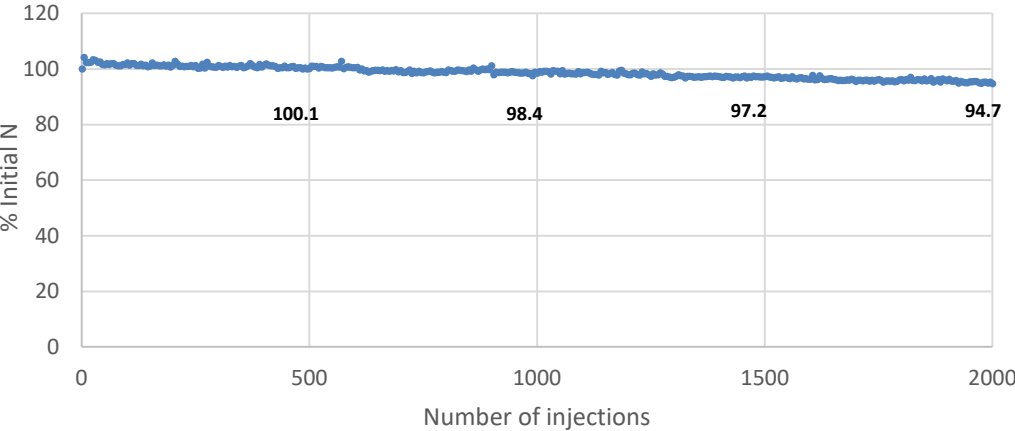
### Berberine Theoretical Plate Number



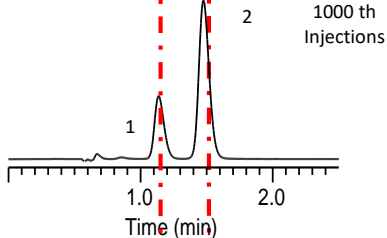
# InertSustain PFP Durability test under Neutral Condition

Column : InertSustain PFP 3 μm 50×4.6 mm I.D.  
 Eluent : MeOH / H<sub>2</sub>O = 80 / 20, v/v  
 Flow Rate : 1.0 mL/min  
 Col Temp : 40 °C  
 Detection : UV 254 nm  
 Inj Volume : 10 uL  
 Sample : 1. *o*-Terphenyl 2. *m*-Terphenyl  
 Number of Injections : **2000 times**

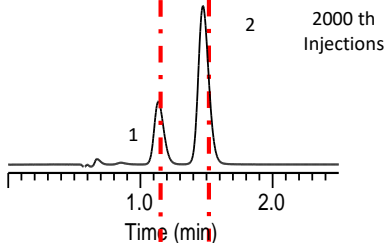
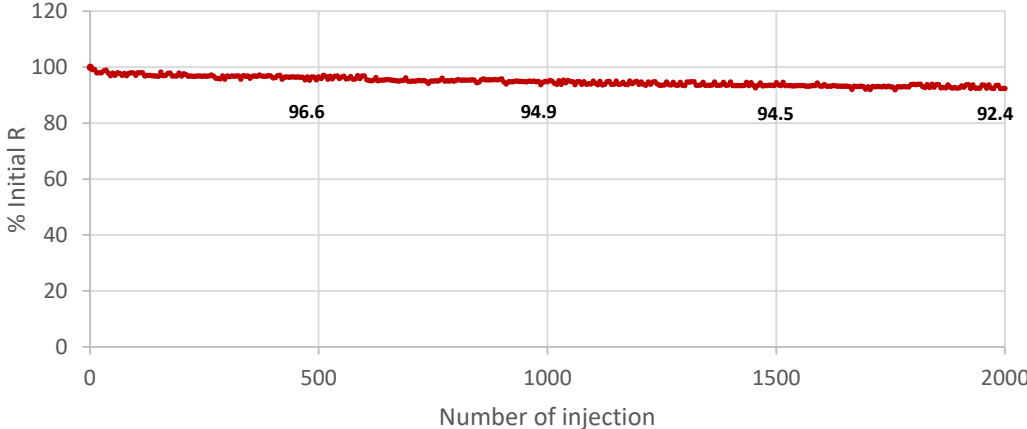
Theoretical plate retention ratio



500 th Injections



Resolution retention ratio

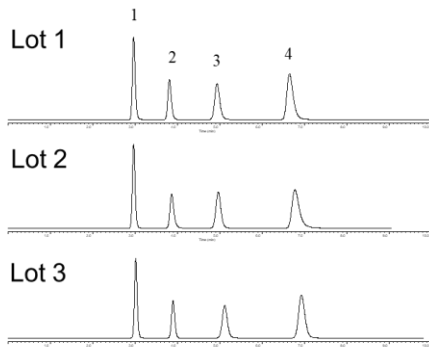




# Why InertSustain PFP?

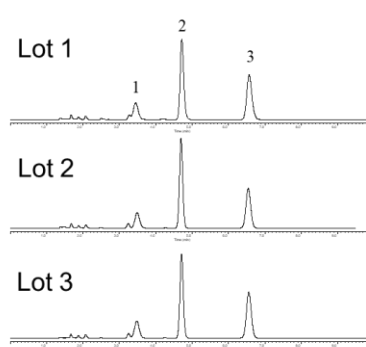
## Lot to lot reproducibility

### Polar Basic compounds



**Conditions**  
 Column : InertSustain PFP (5  $\mu$ m, 4.6 mm I.D.  $\times$  150 mm)  
 Eluent : 0.1% HCOOH in H<sub>2</sub>O  
 Flow Rate : 1.0 mL/min  
 Col. Temp. : 40  $^{\circ}$ C  
 Detection : UV 254 nm  
 1. Uracil 2. Cytosine 3. Thymine 4. Adenine

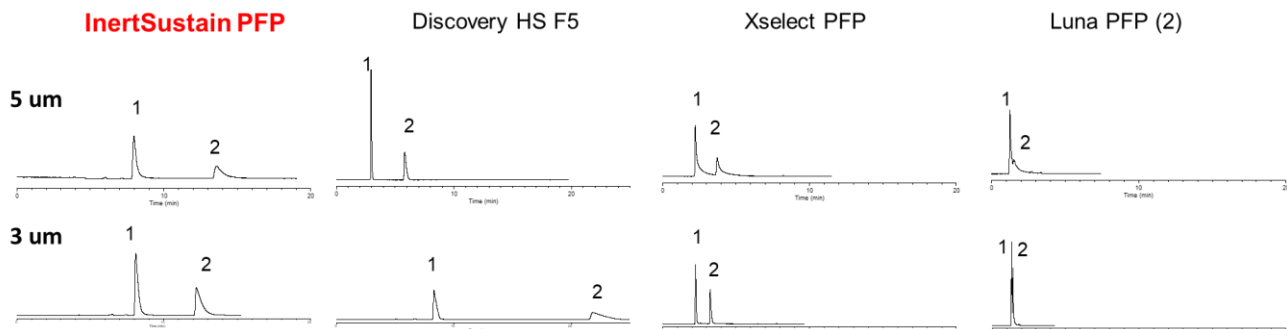
### Acidic compounds



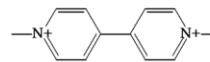
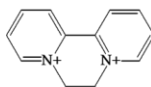
**Conditions**  
 Column : InertSustain PFP (5  $\mu$ m, 4.6 mm I.D.  $\times$  150 mm)  
 Eluent : A) 0.1% H<sub>3</sub>PO<sub>4</sub> B) ACN A/B = 75/25, v/v  
 Flow Rate : 1.0 mL/min  
 Col. Temp. : 40  $^{\circ}$ C  
 Detection : UV 254 nm  
 1. Brilliant Blue FCF 2. Phenol 3. Salicylic acid

## Retention and particle size

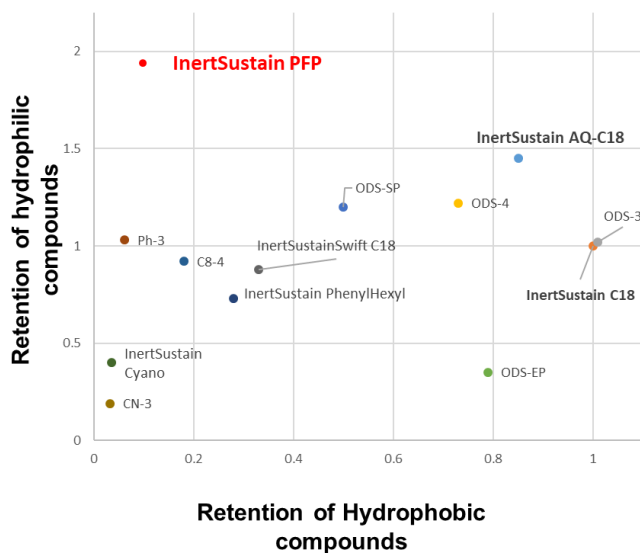
InertSustain PFP columns are designed to have stable retention even under different particle size.



**Conditions**  
 Column : 4.6 mm I.D.  $\times$  150 mm  
 Eluent : A) 0.1 % HCOOH  
 Flow Rate : 1.0 mL / min  
 Col. Temp. : 40  $^{\circ}$ C  
 Detection : UV 290 nm  
 Sample : 1. Diquat 2. Praquat



## InertSustain PFP shows strong retention especially in basic compounds.



### Vertical axis

Calculated by the Retention Factor of Acidic, basic and neutral compounds under 100% water mobile phase.

### Horizontal axis

Retention factor of Amylbenzene under H<sub>2</sub>O: MeOH 20:80.

# Ordering Information

## InertSustain® PFP Analytical Columns

HP Series Particle Size: 3 µm  Max. Operating Pressure: 50 MPa (500 Bar)	Length/ ID (mm)	2.1	3.0	4.6
	30	5020-87917	5020-87923	5020-87929
	50	5020-87918	5020-87924	5020-87930
	75	5020-87919	5020-87925	5020-87931
	100	5020-87920	5020-87926	5020-87932
	150	5020-87921	5020-87927	5020-87933
	250	5020-87922	5020-87928	5020-87934

※ End-fittings are 1/16" Waters-compatible.

※ UHPLC compatible end-fittings are also available upon request for UHPLC systems (Ex: UPLC®) to avoid dead volume.

※ Indicate "UP Type end-fittings" when ordering. (Please note that UP type is not available for a 4.6 mm I.D. column)

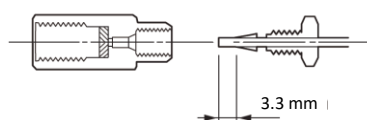
UPLC® is a registered trademark of Waters Corporation.

Particle Size: 3 µm	Length/ ID (mm)	1.0	1.5		
	30	5020-87868	5020-87874		
	50	5020-87869	5020-87875		
	75	5020-87870	5020-87876		
	100	5020-87871	5020-87877		
	150	5020-87872	5020-87878		
	250	5020-87873	5020-87879		
	Length/ ID (mm)	2.1	3.0	4.0	4.6
	30	5020-87828	5020-87836	5020-87844	5020-87852
	50	5020-87829	5020-87837	5020-87845	5020-87853
	75	5020-87830	5020-87838	5020-87846	5020-87854
	100	5020-87831	5020-87839	5020-87847	5020-87855
	125	5020-87832	5020-87840	5020-87848	5020-87856
150	5020-87833	5020-87841	5020-87849	5020-87857	
250	5020-87834	5020-87842	5020-87850	5020-87858	
Particle Size: 5 µm	Length/ ID (mm)	1.0	1.5		
	30	5020-87741	5020-87747		
	50	5020-87742	5020-87748		
	75	5020-87743	5020-87749		
	100	5020-87744	5020-87750		
	150	5020-87745	5020-87751		
	250	5020-87746	5020-87752		
	Length/ ID (mm)	2.1	3.0	4.0	4.6
	30	5020-87701	5020-87709	5020-87717	5020-87725
	50	5020-87702	5020-87710	5020-87718	5020-87726
	75	5020-87703	5020-87711	5020-87719	5020-87727
	100	5020-87704	5020-87712	5020-87720	5020-87728
	125	5020-87705	5020-87713	5020-87721	5020-87729
150	5020-87706	5020-87714	5020-87722	5020-87730	
250	5020-87707	5020-87715	5020-87723	5020-87731	

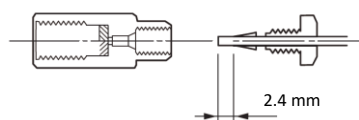
\*End-fittings are 1/16" Waters-compatible.

\*Other column sizes available upon request.

### End-fitting Format



1/16" Waters End-fittings



UP Type End-fittings

# Ordering Information

## InertSustain® PFP Cartridge Guard Column E

I.D. of the Analytical Column Applicable (mm)	Length (mm)	I.D. (mm)	Replacement Cartridge E Guard Column (2 EA.)		Cartridge E Holder / Cartridge Set (2 Cartridge E Guard Columns & 1 Holder)	
			Particle Size		Particle Size	
			3 μm	5 μm	3 μm	5 μm
1.0	10	1.0	5020-87907	5020-87807	5020-87908	5020-87808
1.5、2.1		1.5	5020-87909	5020-87809	5020-87910	5020-87810
2.1、3.0		3.0	5020-87905	5020-87805	5020-87906	5020-87806
4.0、4.6		4.0	5020-87903	5020-87803	5020-87904	5020-87804
2.1、3.0	20	3.0	5020-87913	5020-87813	5020-87914	5020-87814
4.0、4.6		4.0	5020-87911	5020-87811	5020-87912	5020-87812
Holder for Cartridge Guard Column E				For 10 mm		5020-08500
				For 20 mm		5020-08550



Cartridge Guard Column E

※ End-fittings are 1/16" Waters-compatible.  
 ※ Maximum operating pressure is 20 MPa, 200 Bar.

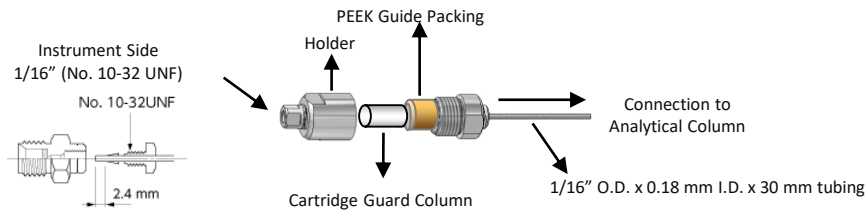
## Guard Column for UHPLC (Max. Operating Pressure 80 MPa, 800 Bar)

I.D. of the Analytical Column Applicable (mm)	Length (mm)	I.D. (mm)	Replacement Cartridge E Guard Column (2 EA.)	Cartridge E Holder / Cartridge Set (2 Cartridge E Guard Columns & 1 Holder)
			Particle Size 3 μm	Particle Size 3 μm
1.0	10	1.5	5020-87821	5020-87824
1.5、2.1		2.1	5020-87822	5020-87825
2.1、3.0		3.0	5020-87823	5020-87826
Holder for Guard Column for UHPLC				5020-08630



Guard Column for UHPLC

※ For connection details, please refer to the diagram below.

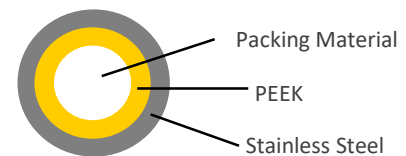


## Metal-Free PEEK Columns

As introduced at P5, InertSustain and Inertsil series HPLC columns are now available in PEEK hardware. It's not only the hardware, but the frits are also made from PEEK, which the sample contacts only PEEK.

### High pressure resistance UHPLC-PEEK Column (Particle Size: 3 μm)

Particle Size	Length (mm)	I.D. (mm)	
		2.1	4.6
3 μm	50	5020-87592	5020-87596
	100	5020-87593	5020-87597
	150	5020-87594	5020-87598
	250	5020-87595	5020-87599



Max. operating pressure : 80 MPa

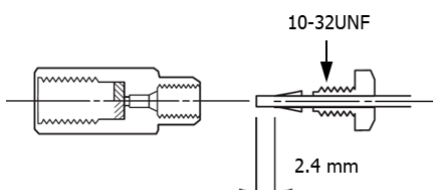
### PEEK Column (Particle Size: 5 μm)

Particle Size	Length (mm)	I.D. (mm)	
		2.1	4.6
5 μm	50	5020-87600	5020-87604
	100	5020-87601	5020-87605
	150	5020-87602	5020-87606
	250	5020-87603	5020-87607



Max. operating pressure : 20 MPa

As shown below, end-fittings are "UP" type end-fittings, which are UHPLC compatible end-fittings for UHPLC systems (Ex: UPLC®) to avoid dead volume.





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Inertsil

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The specification and the column type are subject to change without notice due to continual improvements.