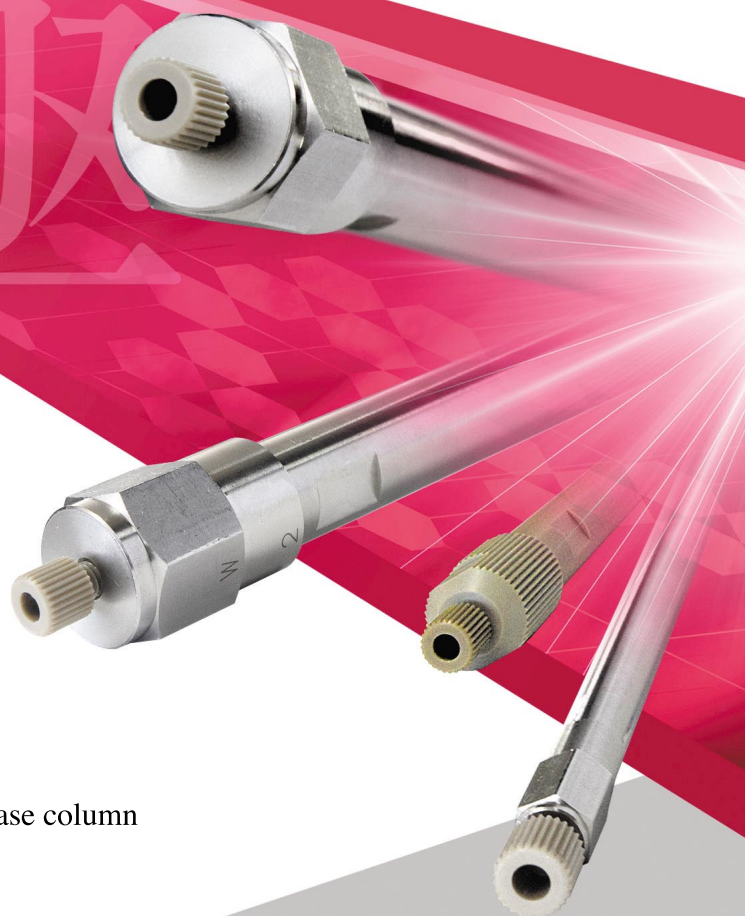


For High Performance Liquid Chromatography

**HSR** AQ C18  
C1  
Develosil

High-polarity compounds were separated on a reverse phase column



For High Performance Liquid Chromatography

**HSR** AQ C18  
C1  
Develosil



## High-polarity compounds were separated on a reverse phase column

The Develosil HSR series was developed for maximum retention and separation, durability and ease of use. This feature is widely applied to research and development and quality control. HILIC may also be used to analyze highly polar compounds. However, We would like to analyze with a familiar reversed phase column. Therefore Develosil HSR AQ C18 and C1 appeared !!

### ■ Specification of HSR series silica gel base material

In order to keep the highly polar compound in the reverse phase column, it is necessary to select a column that can be used in 100% water mobile phase. In particular, HSR C1 is an image with a short alkyl chain and weak retention, but it has become an epoch-making column overturning common sense by our synthesis technology.

There are many cases where HILIC column is used to hold highly polar compounds, but by all means, please experience this column which made full use of stability and ease of use unique to reversed phase.

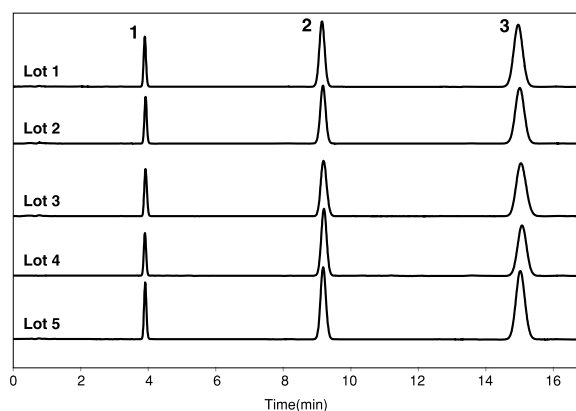
### ■仕様

	HSR AQ C18	HSR C1
Base	High purity silica gel	
Phase	C18	C1
Particle size	3 $\mu$ m, 5 $\mu$ m	
Surface area	450m <sup>2</sup> /g	
Pore size	10nm	
Endcapped	Yes	
Carbon load	17%	6.5%
pH range	pH2-9	pH2-8

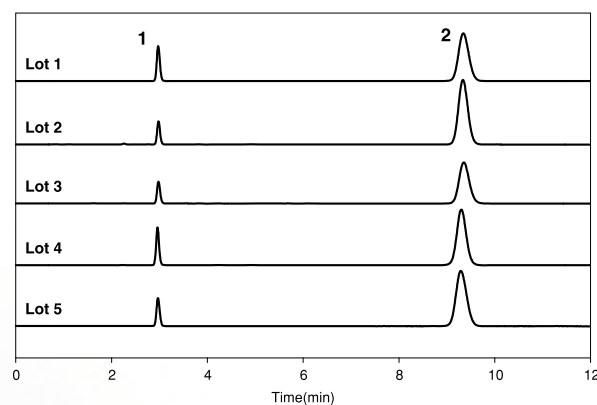
### ■ Reproducibility between lots

All of the Develosil series are produced by Nomura Chemical Co., Ltd. Therefore, quality control can be evaluated in detail. Columns with small difference between lots always maintain high reproducibility.

Develosil HSR AQ C18



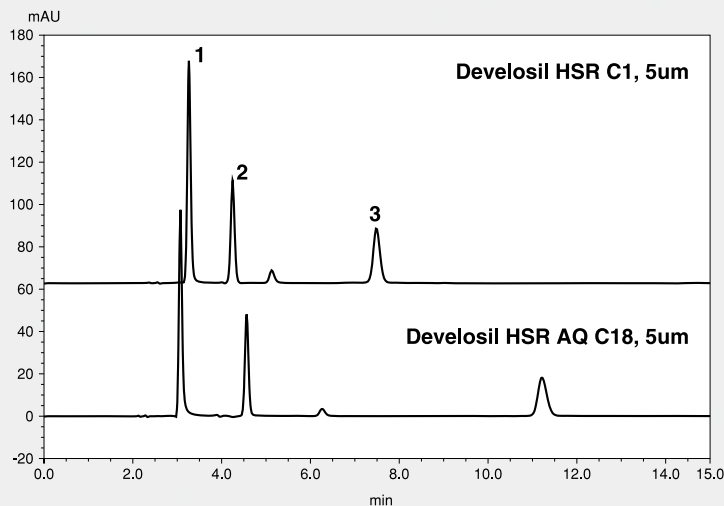
Develosil HSR C1



**Sharp peak for every compound**

Sharp peaks give trust and peace of mind to those who analyze. HSR series pursues this sharpness by developing original end cap technology.

**[ Peak shape of acidic compound ]**



**Analytical conditions:**

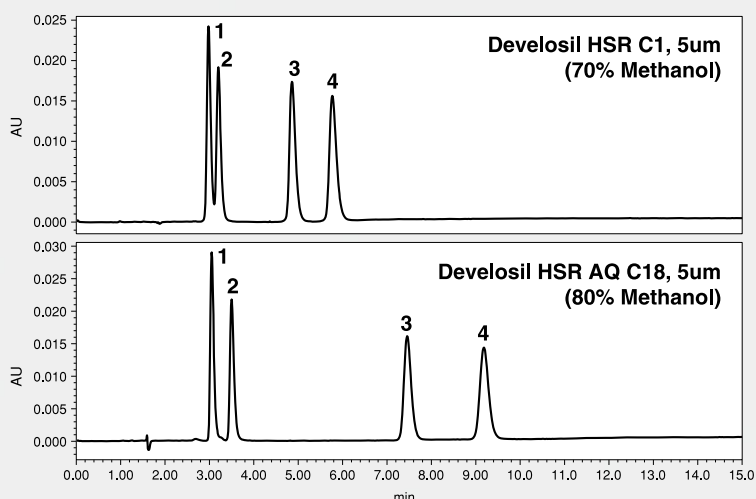
Column	Develosil HSR C1, 5um Develosil HSR AQ C18, 5um
Column size	: 4.6x150mm
Mobile phase	: 25mM (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub> , pH2.0
Flow rate	: 1.0mL/min
Temperature	: 40°C
Detection	: 210nm
Injection volume	: 2.0uL
Sample	: 1. Formic acid (5.0uL/ml) 2. Acetic acid (5.0uL/mL) 3. Propionic acid (5.0uL/mL)

**The tailing factor of each peak**

	HSR C1	HSR AQ C18
Formic acid	1.14	1.28
Acetic acid	1.06	1.07
Propionic acid	1.09	1.14

Formic acid is a tailing compound in the analysis of organic acids. Therefore, Develosil HSR AQ C18 and HSR C1 are designed to suppress tailing even with these compounds. In addition, since 100% water mobile phase can be used, the compound can be held to the maximum.

**[ Peak shape of basic compound ]**



**Analytical conditions:**

Column	Develosil HSR C1, 5um Develosil HSR AQ C18, 5um
Column size	: 4.6x150mm
Mobile phase	HSR C1, 5um MeOH/25mM (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub> , pH2.0=70/30 HSR AQ C18, 5um MeOH/25mM (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub> , pH2.0=80/20
Flow rate	: 1.0mL/min
Temperature	: 40°C
Detection	: 254nm
Injection volume	: 2.0uL
Sample	: 1. Desipramine HCl (64ug/ml) 2. Nortriptyline HCl (52ug/mL) 3. Imipramine HCl (54ug/mL) 4. Amitriptyline HCl (53ug/mL)

**The tailing factor of each peak**

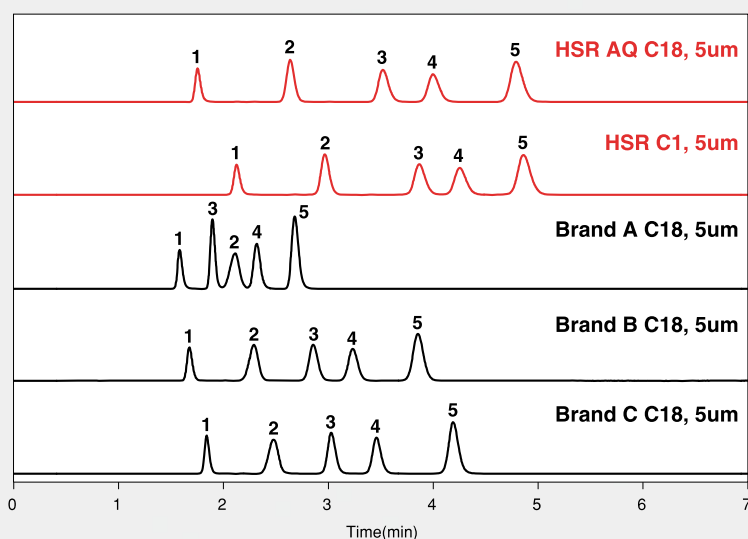
	HSR C1	HSR AQ C18
Desipramine HCl	N.D	1.26
Nortriptyline HCl	N.D	1.14
Imipramine HCl	1.25	1.11
Amitriptyline HCl	1.18	1.15

The basic compound greatly affects the peak shape. The Develosil HSR series including Develosil HSR AQ C18 and HSR C1 devises end cap processing to solve these problems. The retention of the compound varies depending on the length of the alkyl chain, but one characteristic is that a stress-free, sharp peak is obtained for many compounds.

## Separation and retention under extreme conditioning

It is difficult to separate the components eluted at the front part in the reversed phase column. Therefore, condition examination is also the limit. The 100% water mobile phase shows the maximum retention and the others are only the temperature and the column length. In such extreme conditions, Develosil HSRAQ C18 and HSR C1 are powerful. Even when compared with other company column in ribonucleotide analysis example, retention is stronger and separation degree is good. In particular, retention and resolution in HSR C1 show maximum performance and give beneficial results. If retention and separation can be achieved, organic solvents may be added. Furthermore, by combining conditions such as gradient elution, it is possible to expect med development for improving the sensitivity of LC / MS.

### [Analytical example of ribonucleotides with aqueous 100% mobile phase]

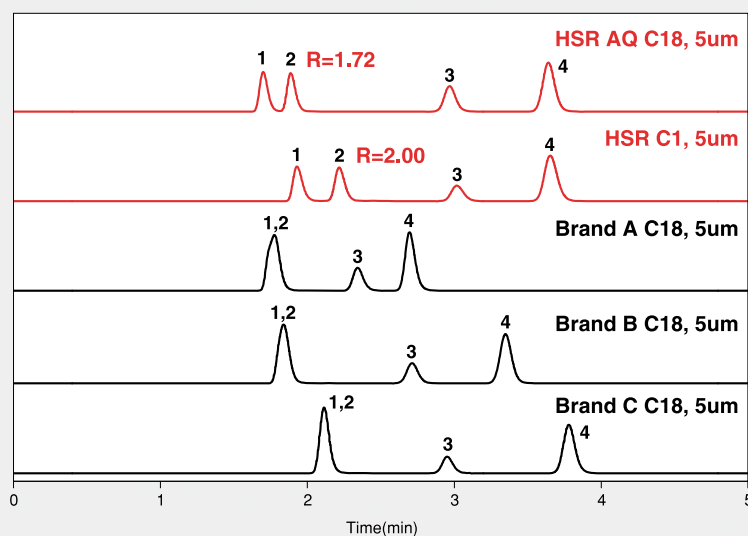


Although HSR AQ C18 and C1 showed good peak shapes for all peaks without using high concentration buffer solution, IMP (2) tended to be broad in other companies' columns.

#### Analytical conditions:

Column	: Develosil HSR AQ C18, 5um Develosil HSR C1, 5um Brand A C18, 5um Brand B C18, 5um Brand C C18, 5um
Column size	: 4.6x150mm
Mobile phase	: 25mM (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub> , pH7.0
Flow rate	: 1.0mL/min
Temperature	: 40°C
Detection	: UV254nm
Injection volume	: 2.0uL
Sample	: 1. CMP (0.50mg/mL) 2. IMP (0.54mg/mL) 3. ATP (0.57mg/mL) 4. ADP (0.53mg/mL) 5. AMP (0.69mg/mL)

### [Separation between highly polar compounds]



Separation between highly polar compounds is also good, making it easier to analyze more components.

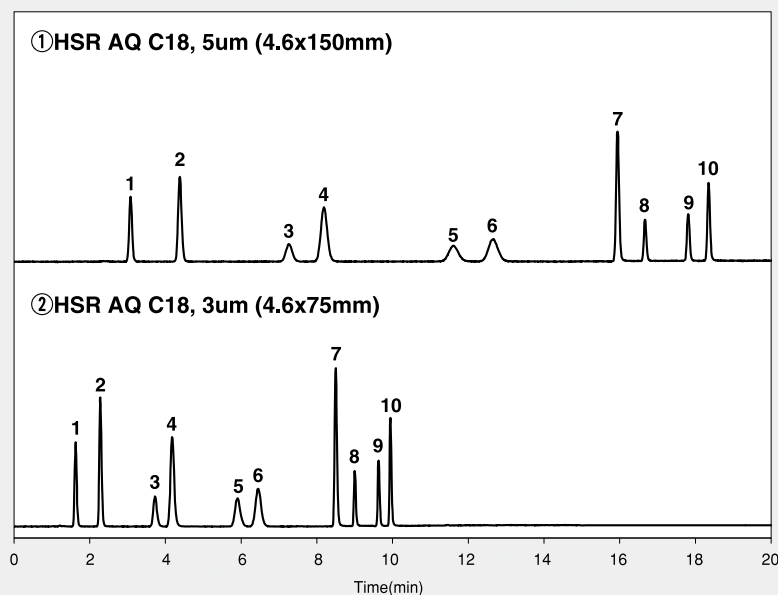
#### Analytical conditions:

Column	: Develosil HSR AQ C18, 5um Develosil HSR C1, 5um Brand A C18, 5um Brand B C18, 5um Brand C C18, 5um
Column size	: 4.6x150mm
Mobile phase	: 0.1%H <sub>3</sub> PO <sub>4</sub>
Flow rate	: 1.0mL/min
Temperature	: 40°C
Detection	: UV210nm
Injection volume	: 2.0uL
Sample	: 1. Cytosine (0.07mg/mL) 2. Allantoin (0.33mg/mL) 3. Ascorbic acid (0.51mg/mL) 4. Uracil (0.22mg/mL)

## Briefly transfer method

Reducing analysis time greatly improves the efficiency of the analyzer. The Develosil series also conducts rigorous evaluations on particle size, so accurate time reduction is possible.

### [Nucleic Acid Related Compound - Example of Method Transfer to Reduce Analysis Time]



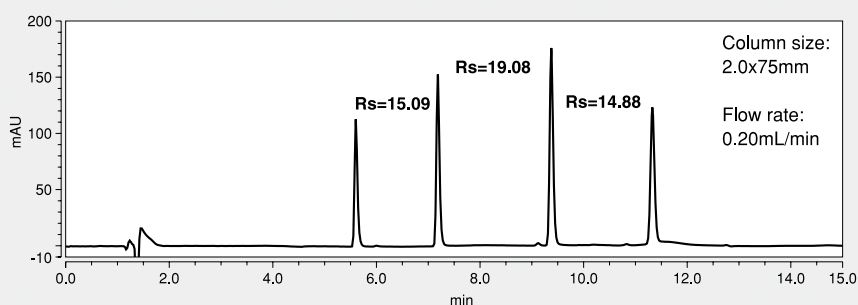
#### Analytical conditions:

Column	: ① Develosil HSR AQ C18, 5µm (4.6x150mm)
	: ② Develosil HSR AQ C18, 3µm (4.6x75mm)
Mobile phase	: A) 50mM HCOONH <sub>4</sub> (pH 7.0) B) Acetonitrile
Gradient	: ① B) 0%-20% (10-20min) : ② B) 0%-20% (5-10min)
Flow rate	: 1.0mL/min
Temperature	: 30°C
Detection	: UV254nm
Sample	: 1. Cytosine (0.05mg/mL) 2. Uracil (0.05mg/mL) 3. Cytidine (0.05mg/mL) 4. Guanine (0.08mg/mL) 5. Uridine (0.06mg/mL) 6. Thymine (0.05mg/mL) 7. Adenine (0.06mg/mL) 8. Guanosine (0.06mg/mL) 9. Thymidine (0.06mg/mL) 10. Adenosine (0.05mg/mL)
Injection volume	: 2.0µL

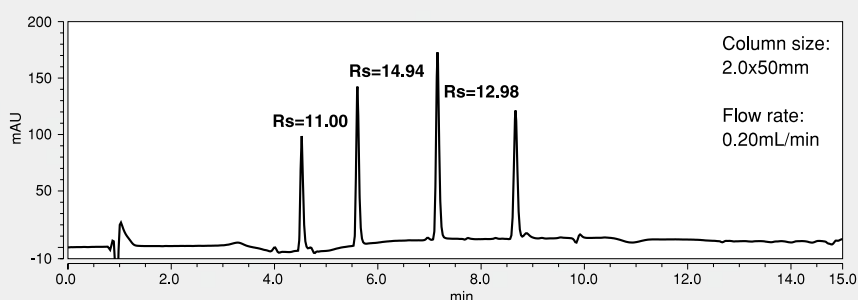
By changing particle size from 5 µm, 4.6 x 150 mm to 3 µm, 4.6 x 75 mm, analysis time can be shortened to about 1/2. In addition, by changing the inner diameter to 3.0 mm or 2.0 mm, solvent saving can be realized. In the Develosil HB series, the column pressure resistance is set to 50 MPa while the particle size is 3 µm. Therefore, in addition to shortening of time + solvent saving, further speeding up becomes possible and efficiency can be improved.



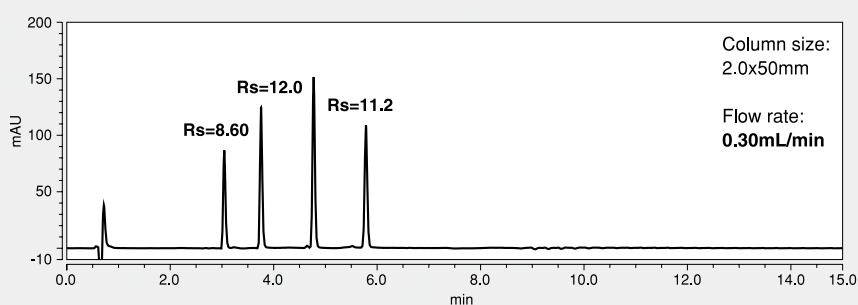
## [Analysis of flavonoids - Transfer to improve throughput]



Time (min)	Flow (mL/min)	%A	%B	Curve
0.00	0.20	100	0	5
7.50	0.20	20	80	5
14.0	0.20	20	80	5
14.1	0.20	100	0	5

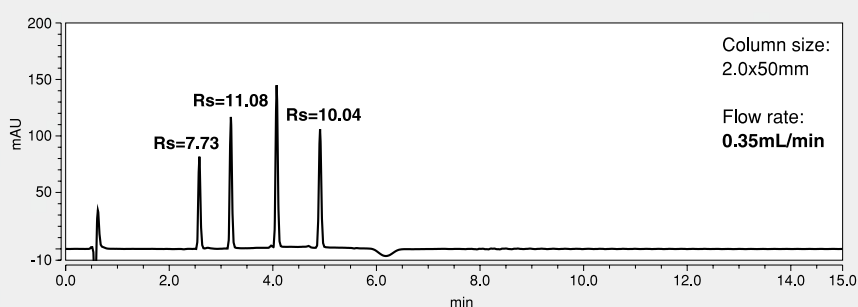


Time (min)	Flow (mL/min)	%A	%B	Curve
0.00	0.20	100	0	5
5.00	0.20	20	80	5
10.0	0.20	20	80	5
10.1	0.20	100	0	5



Time (min)	Flow (mL/min)	%A	%B	Curve
0.00	0.30	100	0	5
3.35	0.30	20	80	5
6.7	0.30	20	80	5
6.75	0.30	100	0	5

※From the condition of 2.0 x 50 mm simulate the particle size 2.0 um by method transfer



Time (min)	Flow (mL/min)	%A	%B	Curve
0.00	0.35	100	0	5
2.85	0.35	20	80	5
5.65	0.35	20	80	5
5.70	0.35	100	0	5

※From the condition of 2.0 x 50 mm simulate the particle size 1.7 um by method transfer

### Analytical conditions:

Column : Develosil HSR AQ C18, 3um

Mobile phase : A) 0.2% HCOOH in Water  
B) 0.2% HCOOH in Acetonitrile

Temperature : 40°C

Detection : UV 254nm

Sample : 1. Puerarin (0.025mg/mL)  
2. Daidzein (0.025mg/mL)  
3. Biochanin A (0.027mg/mL)  
4. Ipriflavone (0.025mg/mL)

Injection volume : 1.0 uL

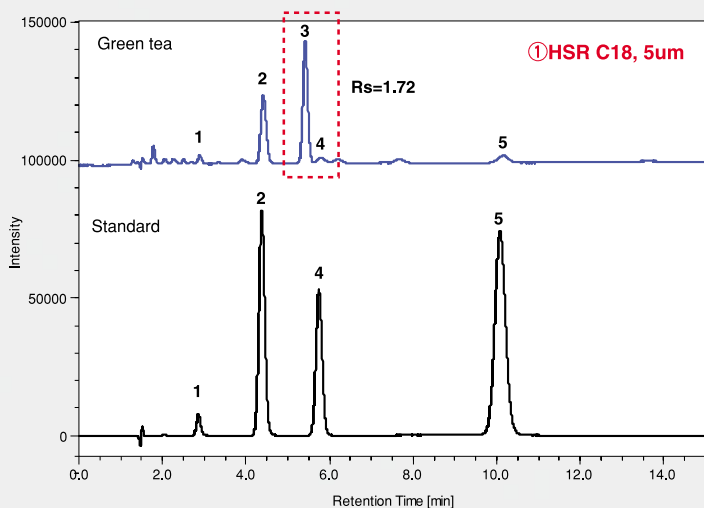
Study on speeding up flavonoid analysis with 3 um particle diameter. By combining flow rate and gradient conditions, analysis time can be greatly shortened and more samples can be analyzed. When using 4.6 x 75 mm column as the starting point, the amount of solvent used can be reduced to about 1/5. In this analysis example, sufficient separation is secured, so further reduction in time can be realized.

※This data uses a semi-micro flow cell, a thin pipe with a small inner diameter so that the dead volume is not as much as possible.

## ● Various applications

In the Develosil HSR series you can obtain valuable data in all fields such as medicine, food and environment.

### [ HSR series Separation comparison of green tea catechins ]



#### Analytical conditions:

Column : ① Develosil HSR C18, 5um (4.6x150mm)  
 : ② Develosil HSR AQ C18, 5um (4.6x150mm)  
 : ③ Develosil HSR C1, 5um (4.6x150mm)

Mobile phase : Methanol/25mM NH<sub>4</sub>H<sub>2</sub>PO<sub>4</sub>(pH 2.0)=25/75

Flow rate : 1.0mL/min

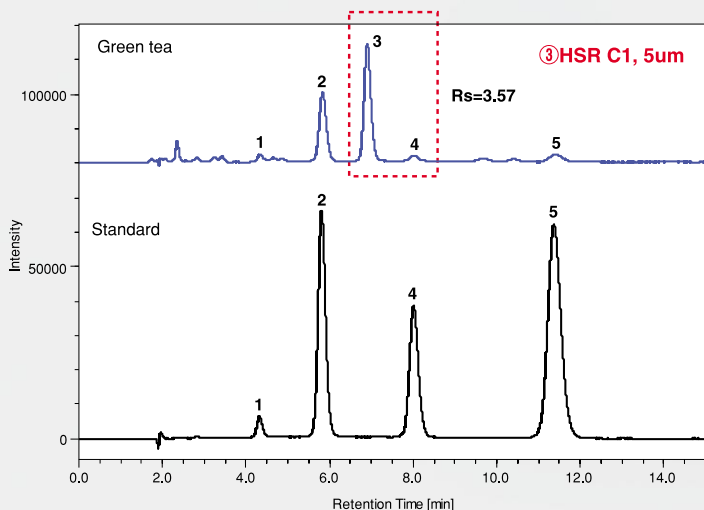
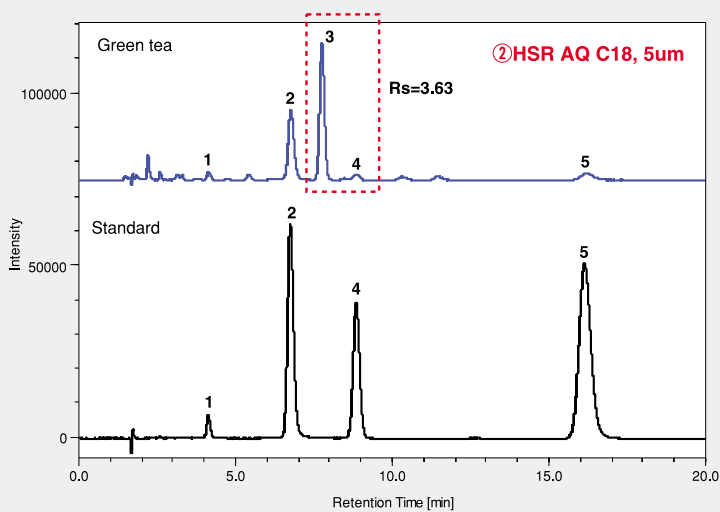
Temperature : 40°C

Detection : UV 280nm

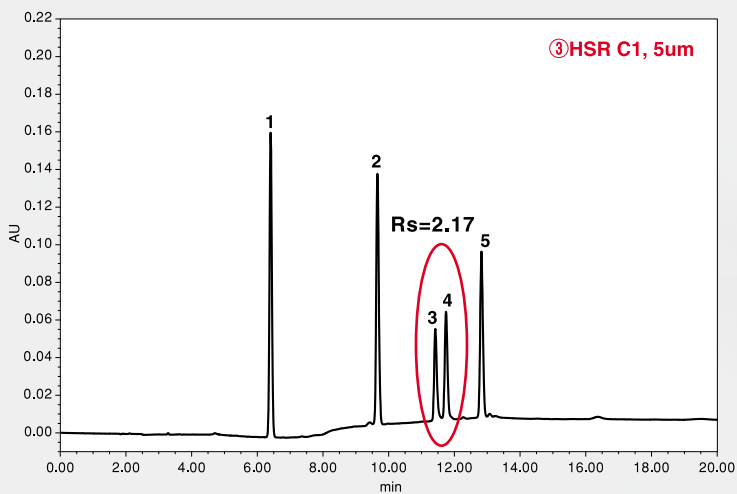
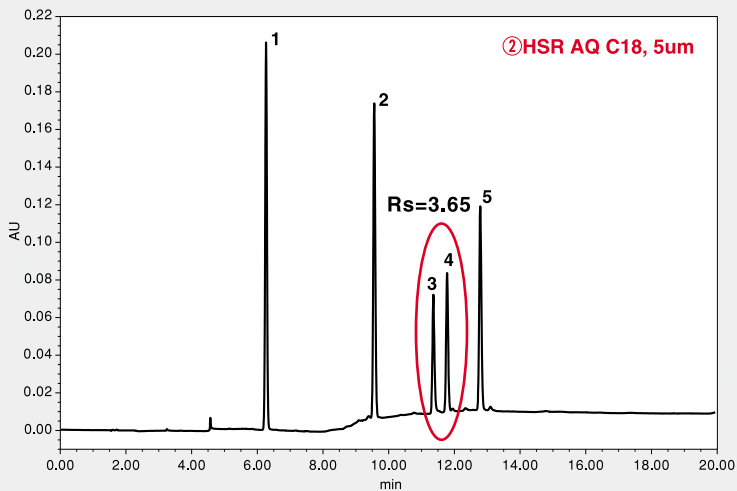
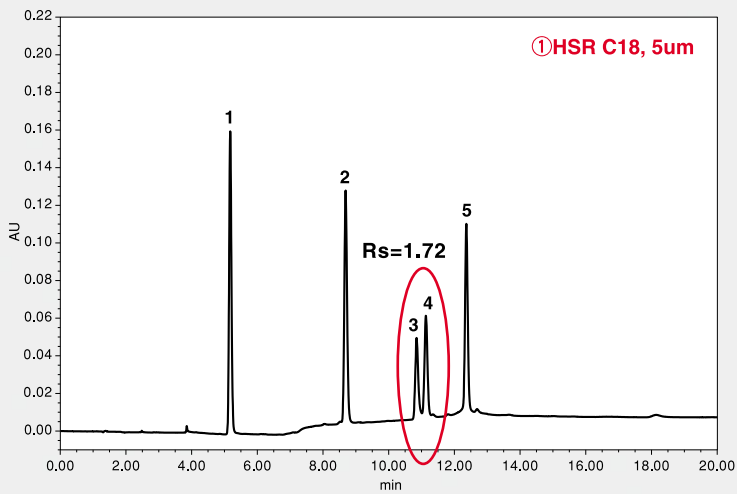
Sample : 1. (-)-Epigallocatechin (0.25mg/mL)  
 2. (-)-Epigallocatechin gallate (0.30mg/mL)  
 3. Caffeine  
 4. (-)-Epicatechin (0.25mg/mL)  
 5. (-)-Epicatechin gallate (0.30mg/mL)

Injection volume : 2.0uL

Separation comparison using three HSR series. HSR AQ C18 and HSR C1 for highly polar compounds show better separation between caffeine-epicatechin.



[ Peptide separation comparison ]



Analytical conditions:

Column : ① Develosil HSR C18, 5um  
 ② Develosil HSR AQ C18, 5um  
 ③ Develosil HSR C1, 5um

Column size : 4.6x150mm

Mobile phase : A) 25mM NaCl (pH3.0)  
 B) Acetonitrile

Flow rate : 1.0mL/min

Temperature : 40°C

Detection : UV230nm

Injection volume : 20.0uL

Sample : 1. Gly-Tyr (0.05mg/mL)  
 2. Val-Tyr-Val (0.05mg/mL)  
 3. Met-Enkephalin (0.05mg/mL)  
 4. Angiotensin II (0.05mg/mL)  
 5. Leu-Enkephalin

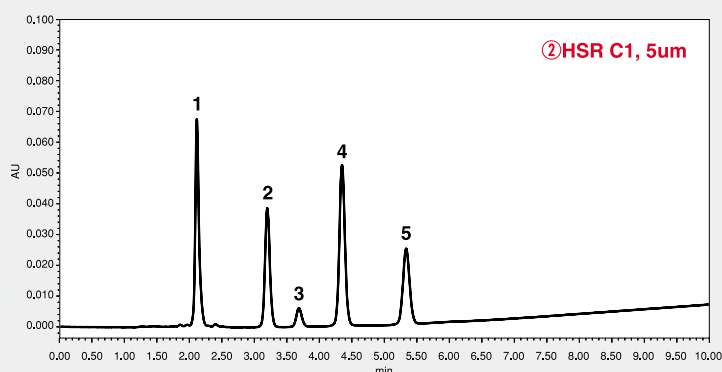
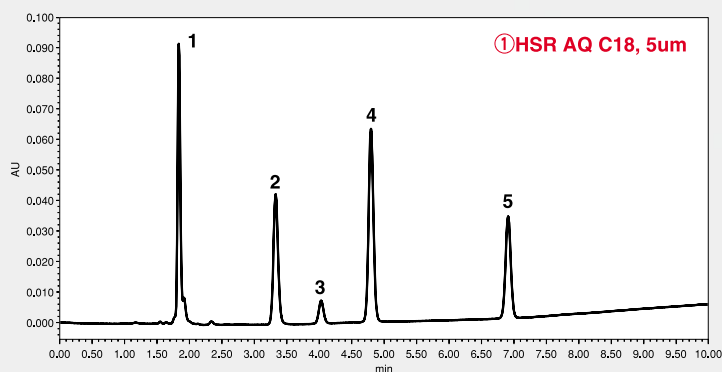
Time (min)	Flow (mL/min)	%A	%B	Curve
0.0	1.0	100	0	5
10.0	1.0	70	30	5
20.0	1.0	70	30	5
20.1	1.0	100	0	5

Comparison of low molecular peptides using three HSR series. HSR C1 shows almost the same retention as ODS and good separation can be obtained in the HSR series even in close peaks such as Met-Enkephalin (3) and Angiotensin II (4). TFA is often added to the mobile phase for analysis of peptides, but it was found that substitution with sodium chloride can also be used when measuring with UV.

※ This data is not subjected to chromatographic subtraction processing.



## [Analysis of purine derivatives]



### Analytical conditions:

Column : ① Develosil HSR AQ C18, 5um (4.6x150mm)

② Develosil HSR C1, 5um (4.6x150mm)

Mobile phase : A) 25mM NH<sub>4</sub>H<sub>2</sub>PO<sub>4</sub> (pH 2.0)

B) Acetonitrile

Gradient : B) 2%-10%(0-10min)

Flow rate : 1.0mL/min

Temperature : 30°C

Detection : UV210nm

Sample : 1. Allantoin (0.42mg/mL)

2. Hypoxanthine (0.11mg/mL)

3. Uric Acid (0.12mg/mL)

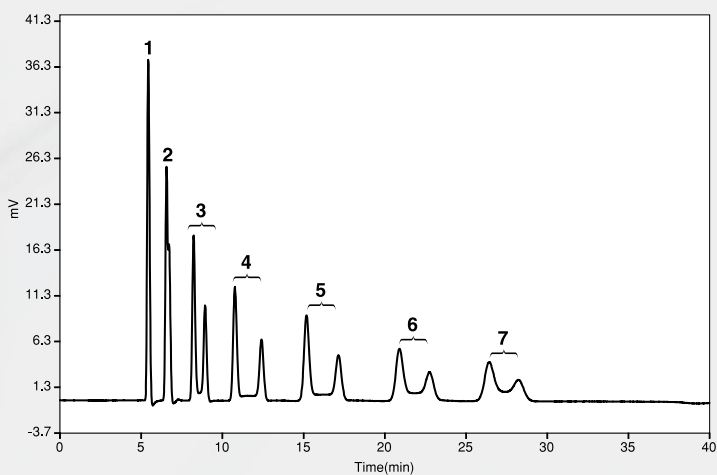
4. Xanthine (0.11mg/mL)

5. Inosine (0.11mg/mL)

Injection volume : 1.0uL

※This data is not subjected to chromatographic subtraction processing.

## [Analysis of maltooligosaccharide (G1-G7)]



### Analytical conditions:

Column : Develosil HSR AQ C18, 5um (4.6x250mm)

Mobile phase : Water

Flow rate : 1.0mL/min

Temperature : 30°C

Detection : RI

Sample : 1. Glucose (1.32mg/mL)

2. Maltose (1.12mg/mL)

3. Maltotriose (1.07mg/mL)

4. Maltotetraose (1.10mg/mL)

5. Malthexaose (1.19mg/mL)

6. Maltopentaose (1.08mg/mL)

7. Maltoheptaose (1.06mg/mL)

Injection volume : 10.0uL

NH<sub>2</sub> columns are often used for saccharide analysis, but HSR AQ C18 achieves separation of G1 to G7.

**Price list**

**Develosil HSR AQ C18**

Part number	Product name	Particle size (um)	Category	i.d. (mm)	Length (mm)	Price (Yen)
73-320050W	HSR AQ C18-3	3	Semi-micro	2.0	50	40,000
73-320075W				2.0	75	42,000
73-320100W				2.0	100	45,000
73-320150W				2.0	150	55,000
73-320250W				2.0	250	67,000
73-520050W	HSR AQ C18-5	5	Semi-micro	2.0	50	37,000
73-520075W				2.0	75	39,000
73-520100W				2.0	100	42,000
73-520150W				2.0	150	52,000
73-520250W				2.0	250	62,000
73-330050W	HSR AQ C18-3	3	Analysis column (Conventional Column)	3.0	50	40,000
73-330075W				3.0	75	42,000
73-330100W				3.0	100	45,000
73-330150W				3.0	150	55,000
73-330250W				3.0	250	67,000
73-346050W				4.6	50	40,000
73-346075W				4.6	75	42,000
73-346100W				4.6	100	45,000
73-346150W				4.6	150	55,000
73-346250W				4.6	250	67,000
73-530050W	HSR AQ C18-5	5	Analysis column (Conventional Column)	3.0	50	37,000
73-530075W				3.0	75	39,000
73-530100W				3.0	100	42,000
73-530150W				3.0	150	52,000
73-530250W				3.0	250	62,000
73-546050W				4.6	50	37,000
73-546075W				4.6	75	39,000
73-546100W				4.6	100	42,000
73-546150W				4.6	150	52,000
73-546250W				4.6	250	62,000
73-580250W			Semi-preparative	8.0	250	110,000
73-5P1250W				10.0	250	160,000
73-5P2250W			Preparative	20.0	250	320,000

**Develosil HSR AQ C18 Guard column**

Part number	Product name	Particle size (um)	Category	i.d. (mm)	Length (mm)	Price (Yen)
<b>Cartridge type</b>						
HO00015010C	Guard cartridge holder		Holder for the guard cartridge for i.d. 1.0mm,1.5mm and 2.0mm	1.5	10	18,000
HO00040010C	Guard cartridge holder		Holder for the guard cartridge for i.d. 4.0mm,4.6mm and 6.0mm	4.0	10	13,000
73-515010W	HSR AQ C18-S Guard cartridge set Holder(1piece)+cartridge 10x1.5mm(1piece)	5	The gured column for i.d. 1.0mm,1.5mm and 2.0mm	1.5	10	25,500
73-515010C	HSR AQ C18-S Guard cartridge <b>[4/pk]</b>	5	The cartridge for exchange for i.d. 1.0mm,1.5mm and 2.0mm	1.5	10	30,000
73-540010W	HSR AQ C18 Guard cartridge set Holder(1piece)+cartridge 10x4.0mm(1piece)	5	The gurad column for i.d. 4.0mm,4.6mm and 6.0mm	4.0	10	24,000
73-540010C	HSR AQ C18 Guard cartridge <b>[4/pk]</b>	5	The cartridge for exchange for i.d. 4.0mm,4.6mm and 6.0mm	4.0	10	30,000
<b>Filling type</b>						
73-580010W	HSR AQ C18-5	5	The gurad column for i.d. 8.0mm and 10.0mm	8.0	10	20,000
73-5P2050W	HSR AQ C18-5	5	The gurad column f or i.d. 20.0mm	20.0	50	110,000

## Develosil HSR C1

Part number	Product name	Particle size (um)	Category	i.d. (mm)	Length (mm)	Price (Yen)
74-320050W	HSR C1-3	3	Semi-micro	2.0	50	40,000
74-320075W				2.0	75	42,000
74-320100W				2.0	100	45,000
74-320150W				2.0	150	55,000
74-320250W				2.0	250	67,000
74-520050W	HSR C1-5	5	Semi-micro	2.0	50	37,000
74-520075W				2.0	75	39,000
74-520100W				2.0	100	42,000
74-520150W				2.0	150	52,000
74-520250W				2.0	250	62,000
74-330050W	HSR C1-3	3	Analysis column (Conventional Column)	3.0	50	40,000
74-330075W				3.0	75	42,000
74-330100W				3.0	100	45,000
74-330150W				3.0	150	55,000
74-330250W				3.0	250	67,000
74-346050W				4.6	50	40,000
74-346075W				4.6	75	42,000
74-346100W				4.6	100	45,000
74-346150W				4.6	150	55,000
74-346250W				4.6	250	67,000
74-530050W	HSR C1-5	5	Analysis column (Conventional Column)	3.0	50	37,000
74-530075W				3.0	75	39,000
74-530100W				3.0	100	42,000
74-530150W				3.0	150	52,000
74-530250W				3.0	250	62,000
74-546050W				4.6	50	37,000
74-546075W				4.6	75	39,000
74-546100W				4.6	100	42,000
74-546150W				4.6	150	52,000
74-546250W				4.6	250	62,000
74-580250W			Semi-preparative	8.0	250	110,000
74-5P1250W				10.0	250	160,000
74-5P2250W			Preparative	20.0	250	320,000

## Develosil HSR C1 Guard column

Part number	Product name	Particle size (um)	Category	i.d. (mm)	Length (mm)	Price (Yen)
<b>Cartridge type</b>						
HO00015010C	Guard cartridge holder		Holder for the guard cartridge for i.d. 1.0mm,1.5mm and 2.0mm	1.5	10	18,000
HO00040010C	Guard cartridge holder		Holder for the guard cartridge for i.d. 4.0mm,4.6mm and 6.0mm	4.0	10	13,000
74-515010W	HSR C1-S Guard cartridge set Holder(1piece)+cartridge 10x1.5mm(1piece)	5	The gured column for i.d. 1.0mm,1.5mm and 2.0mm	1.5	10	25,500
74-515010C	HSR C1-S Guard cartridge 【4/pk】	5	The cartridge for exchange for i.d. 1.0mm,1.5mm and 2.0mm	1.5	10	30,000
74-540010W	HSR C1 Guard cartridge set Holder(1piece)+cartridge 10x4.0mm(1piece)	5	The gurad column for i.d. 4.0mm,4.6mm and 6.0mm	4.0	10	24,000
74-540010C	HSR C1 Guard cartridge 【4/pk】	5	The cartridge for exchange for i.d. 4.0mm,4.6mm and 6.0mm	4.0	10	30,000
<b>Filling type</b>						
74-580010W	HSR C1-5	5	The gurad column for i.d. 8.0mm and 10.0mm	8.0	10	20,000
74-5P2050W	HSR C1-5	5	The gurad column f or i.d. 20.0mm	20.0	50	110,000

- All Develosil columns have Waters compatible end-fitting.
- It has prepared a variety of column sizes at our company. Column size that is not listed in the price list, please consult.

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2016.03.08

Japanese

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