

InertCore Plus C18 Technical Data

GL Sciences Inc.



The background features several overlapping circles in shades of grey, red, and blue. Each circle has a smaller white circle inside it, creating a pattern of nested or overlapping shapes.

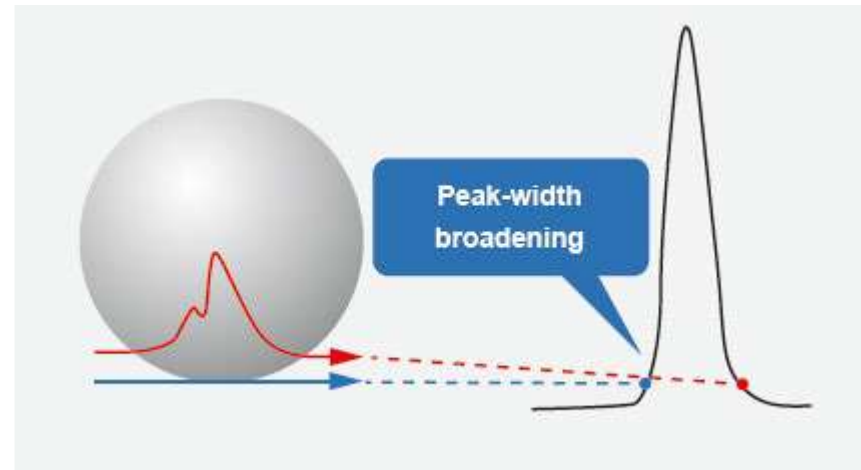
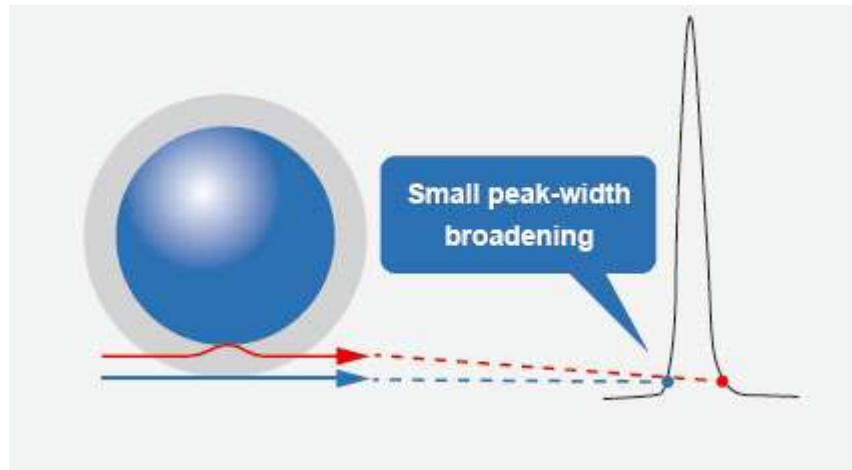
Contents

1. What is InertCore Plus C18? (P3 - P6)
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5. Support documentation (P29 - P33)

Specifications

- Base Material : Core-shell type silica gel
- Particle Size : 2.6 μm
- Solid Core : 2.0 μm
- Surface area : 200 m^2/g
- Pore Size : 90 Å (9 nm)
- Functional Group : Octadecyl
- End-capping : Yes
- Carbon Loading : 15 %
- USP code : L1
- pH Range : 1 - 10
- Max Pressure : 100 MPa (2.1 mm I.D.)
60 MPa (3.0 mm I.D. , 4.6 mm I.D.)

What is core shell?

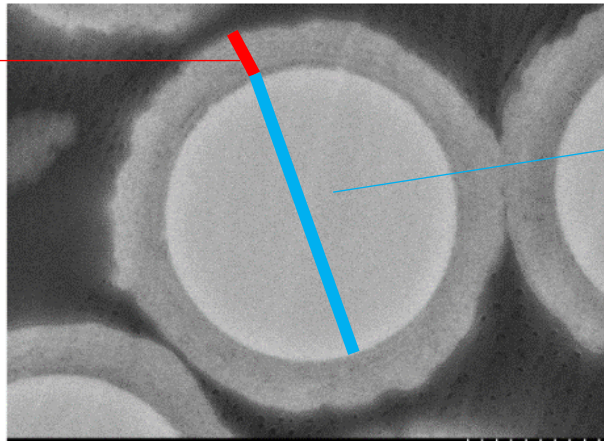


Reduction of diffusion inside the particle
Improvement of theoretical plate number

	Core shell	Fully porous packing material
Particle size distribution	Homogeneous	Inhomogeneous
Pressure	Equivalent to fully porous packing material 3 μ m (Usable in general-purpose HPLC)	High with Sub 2 μ m (UHPLC is required.)
Plate number	Equivalent to Sub 2 μ m	High with Sub 2 μ m

InertCore Plus C18 2.6 μ m

Fully porous shell layer is homogeneous. (0.3 μ m)



Core (2.0 μ m)

Core shell silica

- In-house development

Chemical modification

- Aggregation of modification technology such as Inertsil, InertSustain

Packing

- Packing technology with know-how accumulated over many years

- High theoretical plate number
- Optimization of thickness in shell layer
- Manufactured in-house from silica
- Stable quality

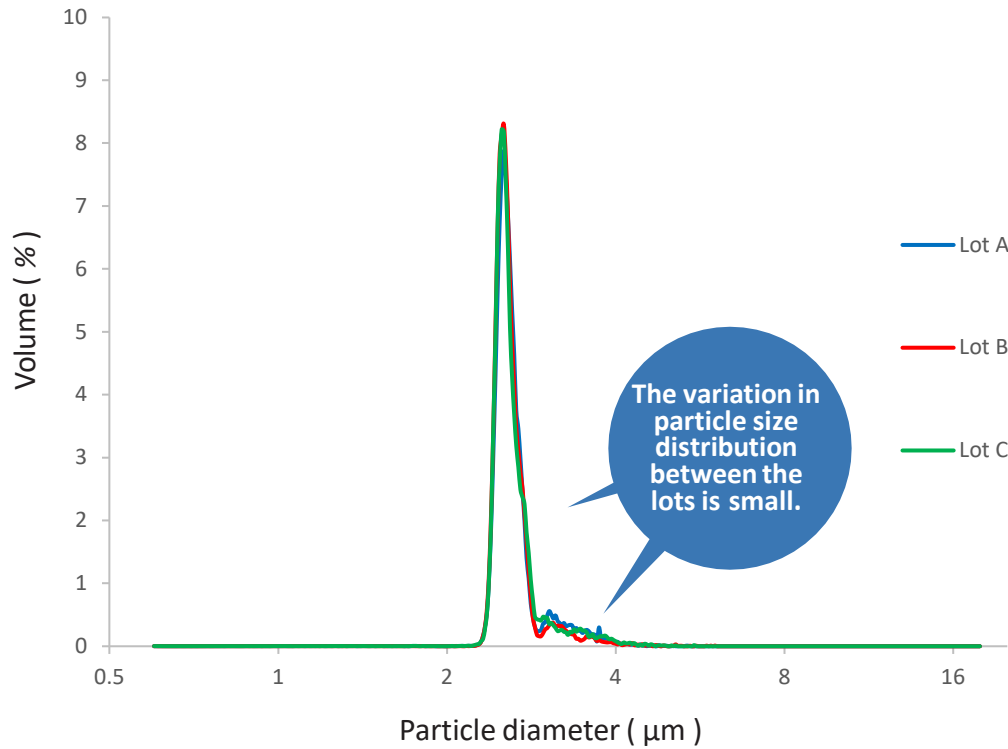
- Inertness, durability
- Strict LOT inspection and control

- High theoretical plate number, durability
- Maintenance of performance by optimized packing technology

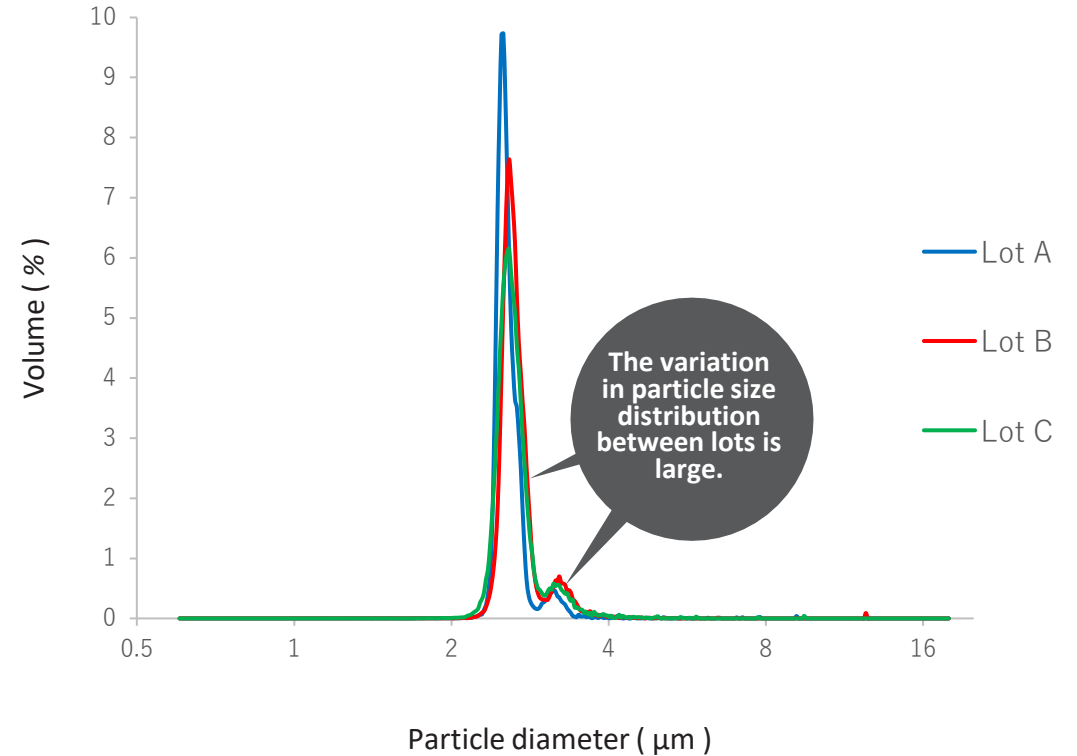
Particle size distribution

Superior reproducibility

InertCore Plus C18



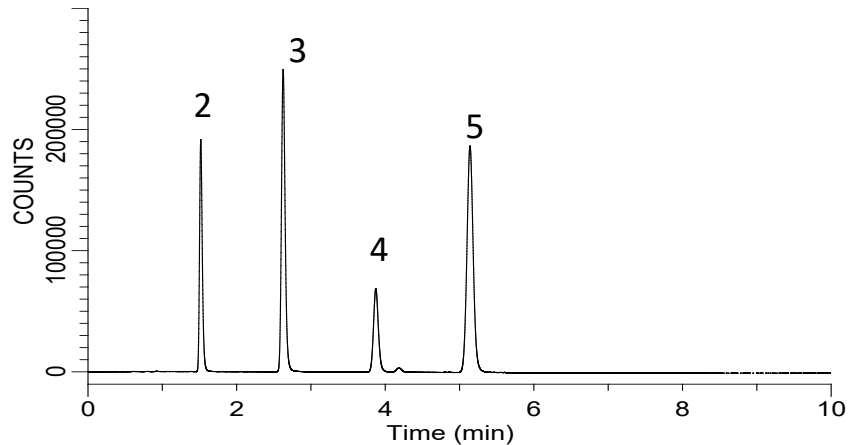
Competitor



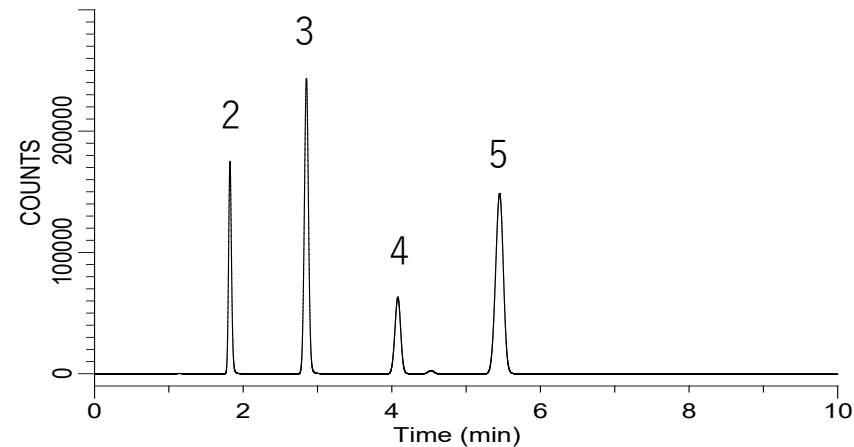
Large variations between the LOTS

Achievement of high theoretical plate number

InertCore Plus C18 2.6 μm



Competitor



Condition

Column Size : 2.6 μm , 100 x 4.6 mm I.D.

Eluent : A) CH_3CN
B) H_2O
A/B = 50/50, v/v

Flow Rate : 1.0 mL/min

Col. Temp. : 40 $^\circ\text{C}$

Detection : UV 254 nm

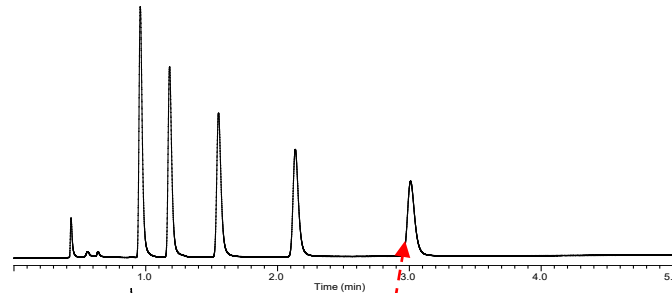
Injection Vol. : 0.5 μL

Sample : 1. Uracil
2. Acetophenone
3. Benzene
4. Toluene
5. Naphthalene

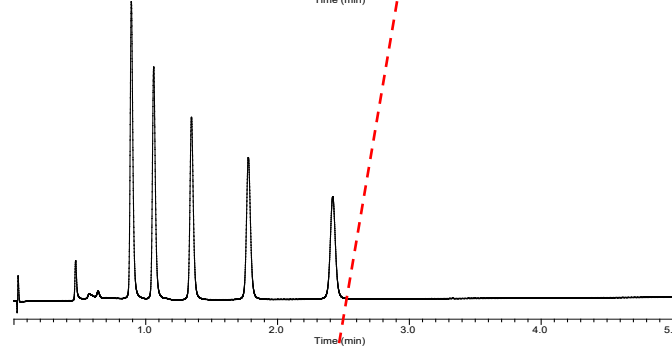
5 Naphthalene	InertCore Plus C18	Competitor
Retention time [min]	5.14	5.45
Symmetry factor	1.08	0.98
Theoretical plates	17,812	12,068
Pressure [MPa]	10.5	11.8

Core shell column with strong retention ability

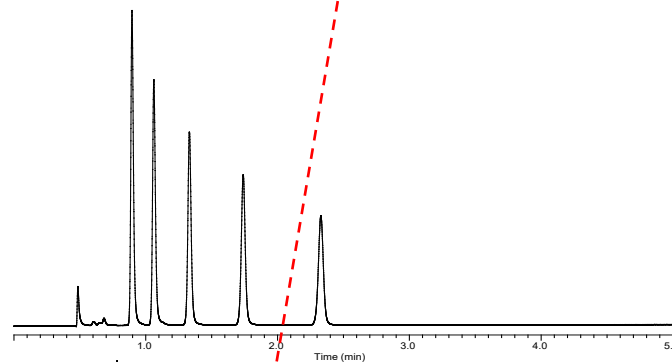
InertCore Plus C18



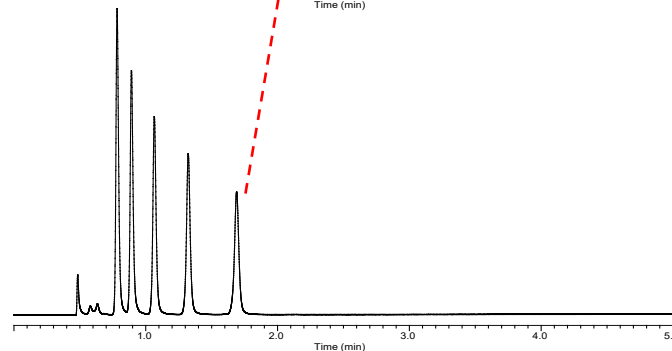
Competitor G



Competitor A



Competitor B



Alkyl benzene

Retention of hydrophobicity

Comparison with other suppliers

Conditions

Column Size : 2.6 μ m, 100 \times 2.1 mm I.D

Eluent : A) CH₃OH

B) H₂O

A) / B) = 80/20, v/v

Flow Rate : 0.4 mL/min

Col. Temp. : 40 °C

Detection : UV 254 nm

Injection Vol. : 0.2 μ L

Sample : 1. Uracil 2. Toluene 3. Ethylbenzene

4. Propylbenzene 5. n-Butylbenzene

6. n-Amylbenzene

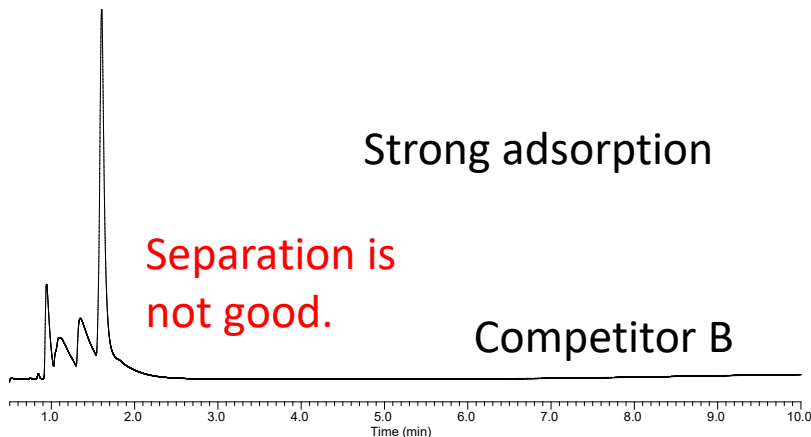
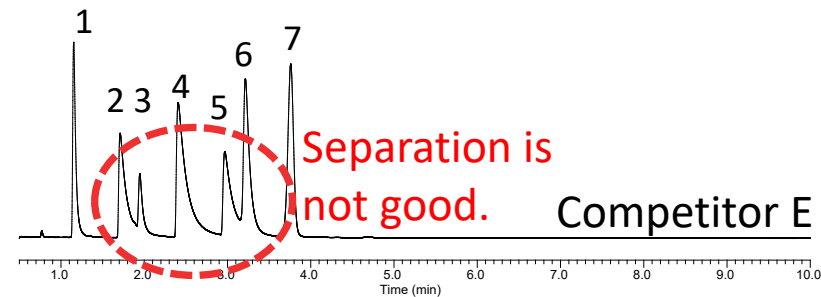
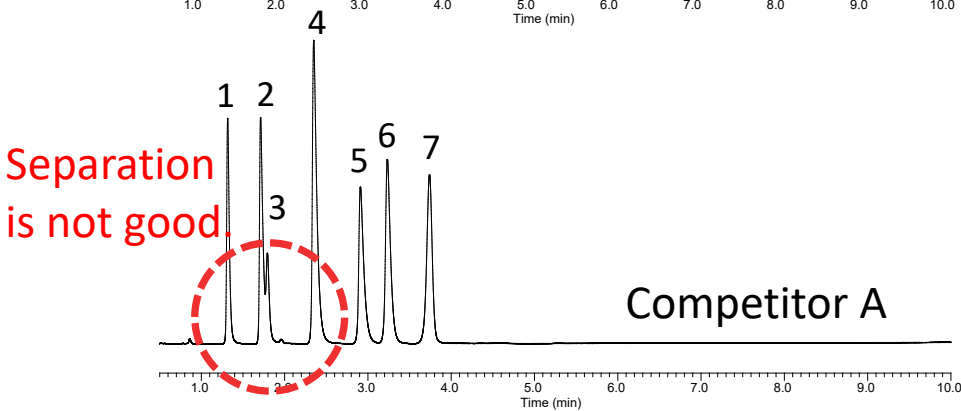
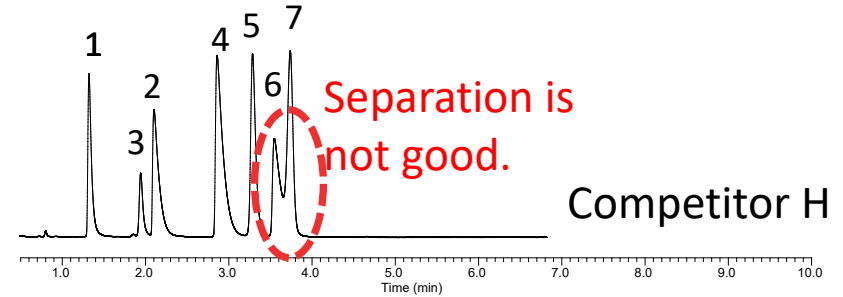
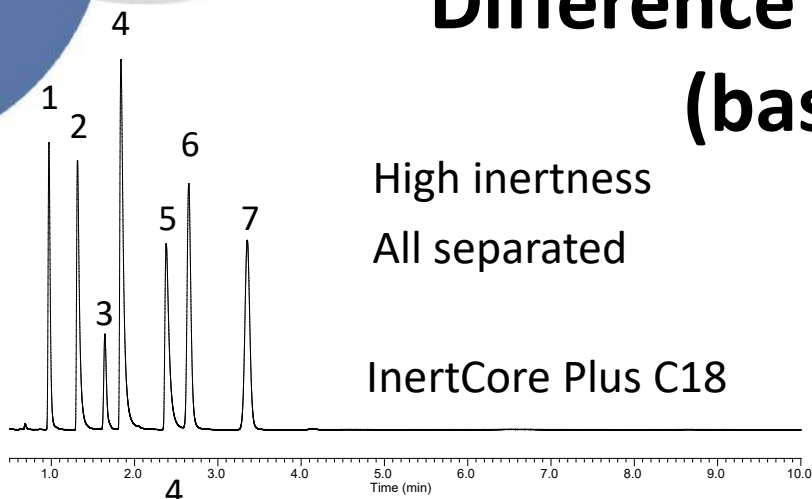
Plot of comparison with other suppliers

Strength of hydrophobicity retention and stereo selectivity



- ◆ InertCore Plus C18 2.6µm
- Competitor A
- Competitor B
- Competitor D
- Competitor E
- Competitor G
- Competitor H
- Competitor C
- Competitor F
- Competitor I

Difference of separation pattern (basic compound)



Condition

Column Size	: 2.6 μ m, 100 \times 2.1 mm I.D
Eluent	: A) 25 mM Phosphate Buffer in H ₂ O (pH 7.0) B) CH ₃ CN A/B = 50/50, v/v
Flow Rate	: 0.4 mL/min
Col. Temp.	: 40 °C
Detection	: UV 220 nm
Injection Vol.	: 0.5 μ L
Sample	: 1. Ketotifen 2. Imipramine 3. Tolperisone 4. Amitriptyline 5. Clomipramine 6. Mianserin 7. Reserpine

Reproducibility between LOTS

Retention of hydrophobicity

Inertness (strong base)

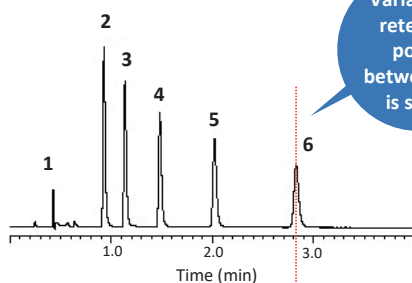
InertCore Plus C18

Competitor

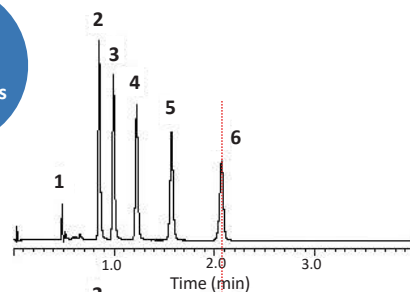
InertCore Plus C18

Competitor

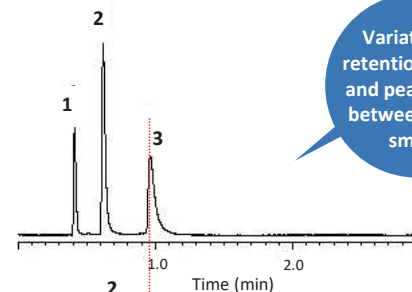
LOT 1



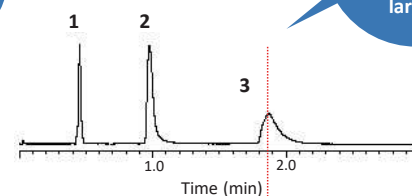
Variation in retention power between lots is small.



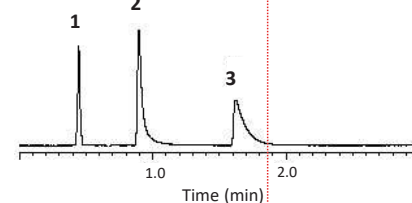
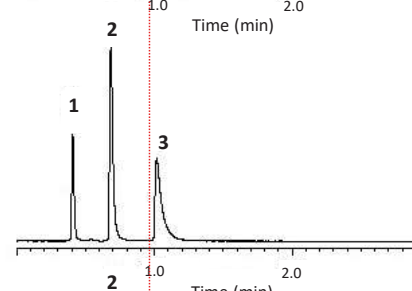
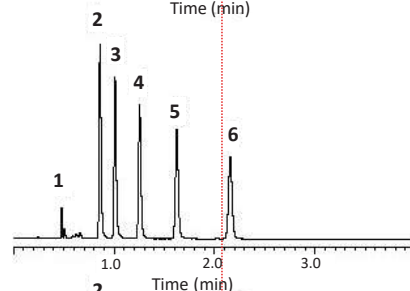
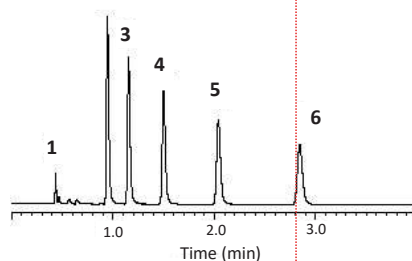
Variation of retention power and peak shape between lots is small.



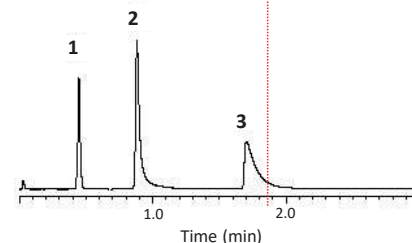
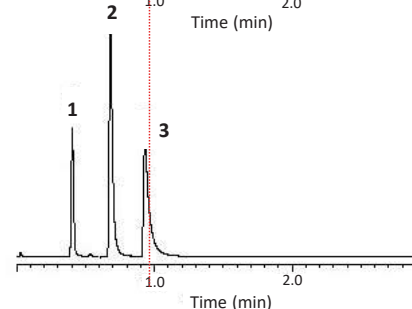
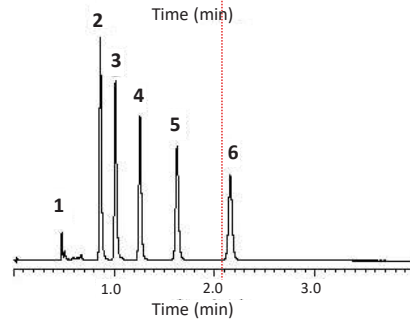
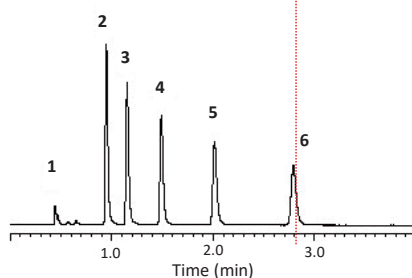
Variation of retention power and peak shape between lots is large.



LOT 2



LOT 3



Conditions

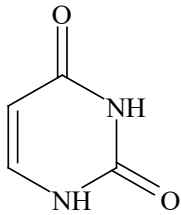
Column Size : 2.6 μ m, 100 \times 2.1 mm I.D.
 Eluent : A) CH₃OH
 B) H₂O
 A/B = 80/20, v/v
 Flow Rate : 0.4 mL/min
 Col. Temp. : 40 $^{\circ}$ C
 Detection : UV 254 nm
 Injection Vol. : 0.2 μ L
 Sample : 1. Uracil 2. Toluene 3. Ethylbenzene
 4. Propylbenzene 5. n-Butylbenzene 6. n-Amylbenzene

Conditions

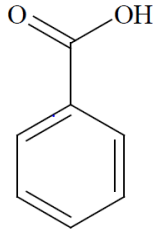
Column Size : 2.6 μ m, 100 \times 2.1 mm I.D.
 Eluent : A) CH₃CN
 B) 25mM K₂HPO₄ (pH 7.0, KH₂PO₄)
 A/B = 40/60, v/v
 Flow Rate : 0.4 mL/min
 Col. Temp. : 40 $^{\circ}$ C
 Detection : UV 230 nm
 Injection Vol. : 0.2 μ L
 Sample : 1. Uracil 2. Berberine chloride
 3. Dextromethorphan

Durability

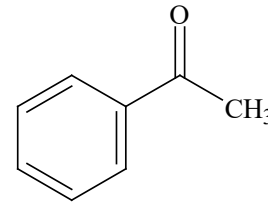
2,000 times continuous injection test
Confirmation of retention time, theoretical plate number,
and symmetry factor



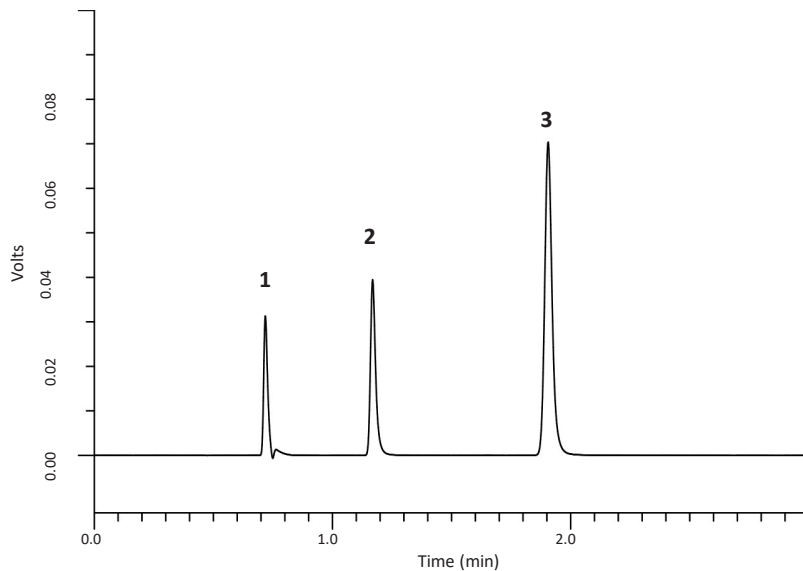
1. Uracil



2. Benzoic acid(Acidity)

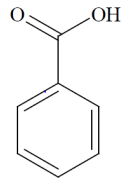


3. Acetophenone (Neutrality)

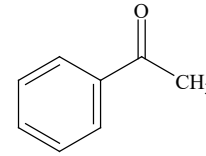


Column Size	: 2.6 μm , 100 x 4.6 mm I.D.	
Eluent	: $\text{CH}_3\text{CN}/0.1\% \text{H}_3\text{PO}_4$ in H_2O = 40/60, v/v	
Flow Rate	: 1.0 mL/min	
Col Temp.	: 40 $^\circ\text{C}$	
Detection	: UV 254 nm	
Injection Vol.	: 10 μL	
Sample	1. Uracil	1 mg/L
	2. Sodium benzoate	20 mg/L
	3. Acetophenone	5 mg/L

Durability



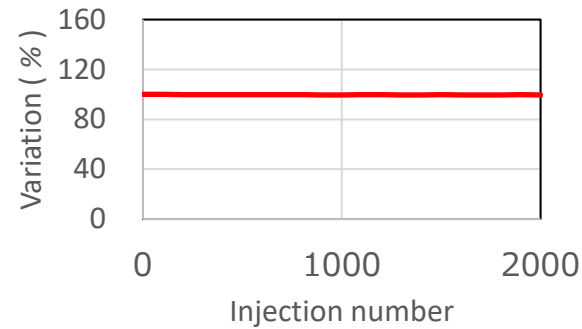
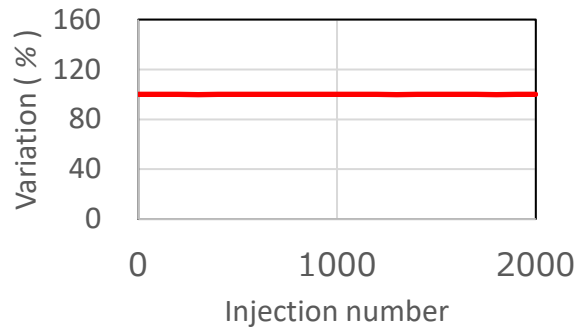
2. Benzoic acid



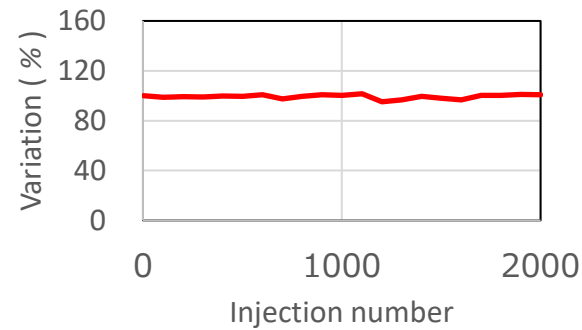
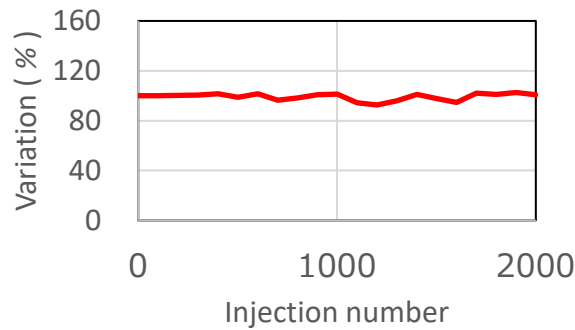
3. Acetophenone

Performance is maintained even after 2000 injections.

Retention time



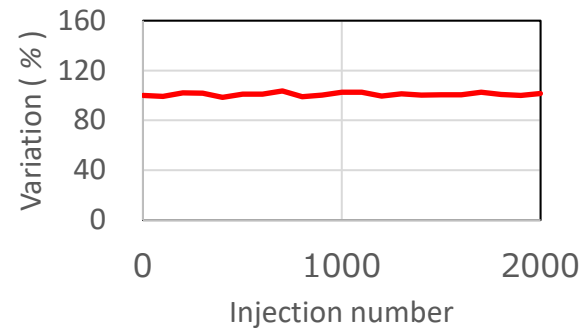
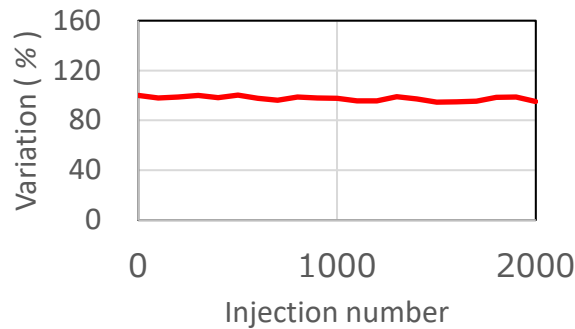
Theoretical plates



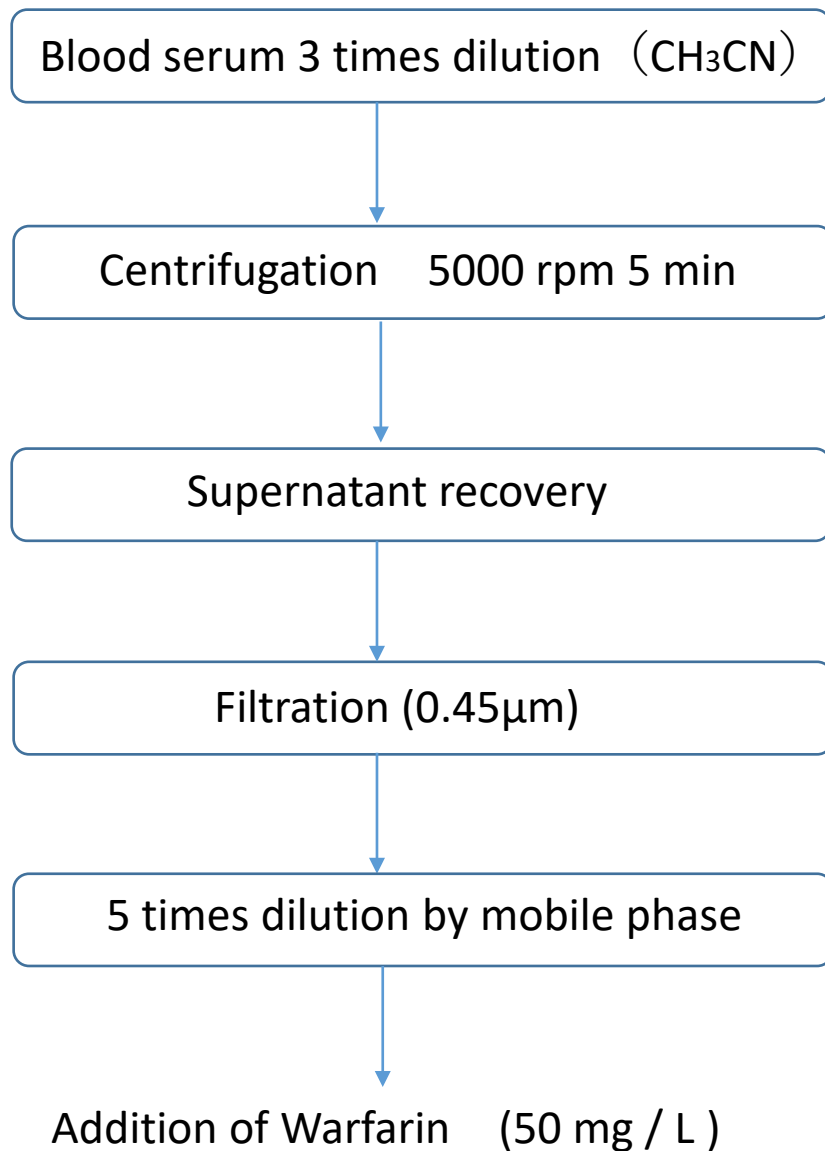
No deterioration even after completion of tests

Optimized packing endurable with injection shock

Symmetry factor



Durability



Through a test of continuous injection of blood serum samples, variation of the plate number of Warfarin and the retention time, in addition to the column pressure, are confirmed.

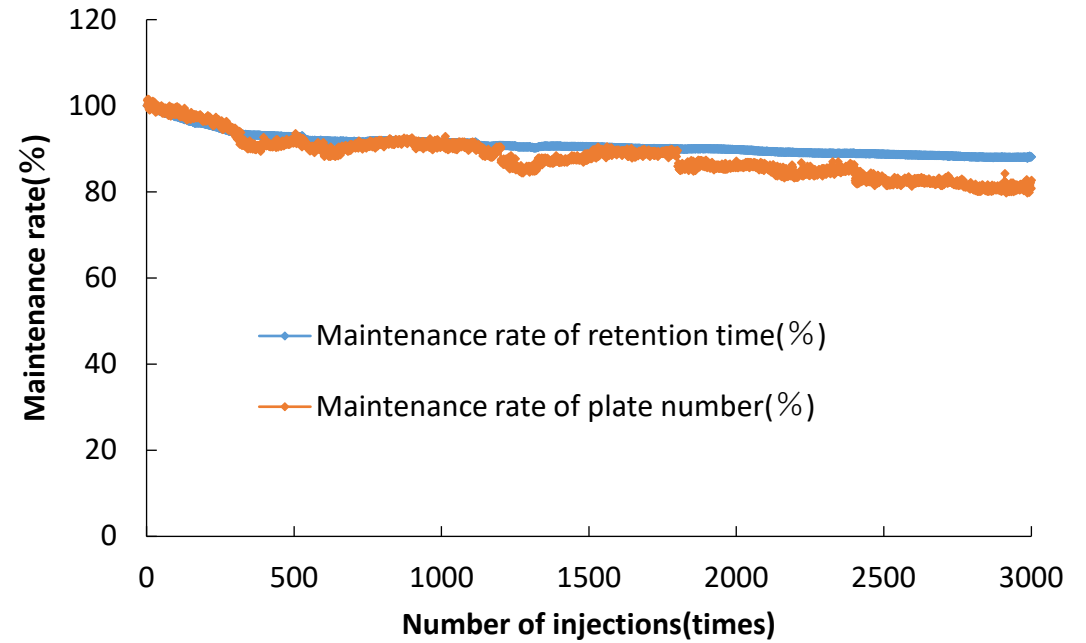
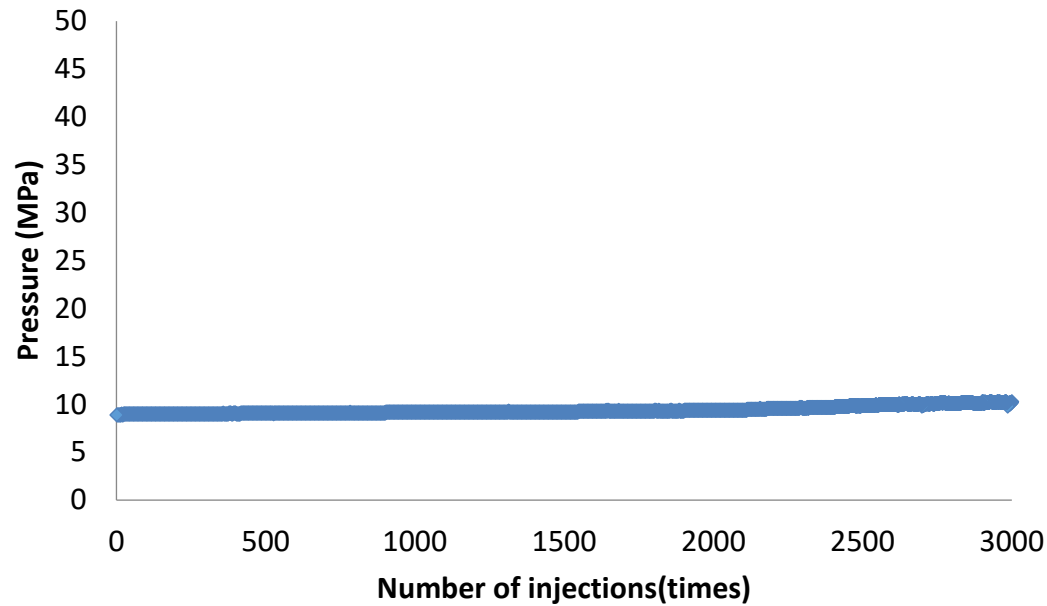
LC conditions

Eluent : CH₃CN/H₂O/CH₃COOH = 40/60/0.3
Flow Rate : 0.1 mL/min
Col. Temp. : 40 °C
Injection Vol. : 0.2 µL

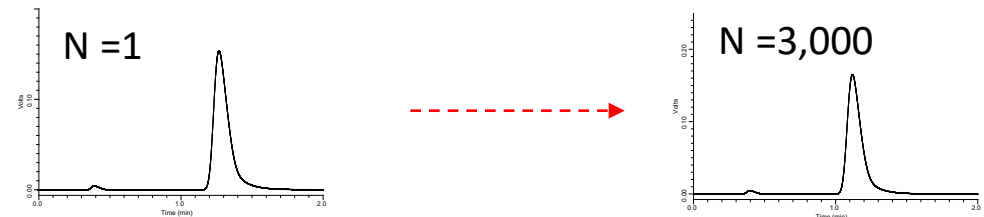
Durability

Warfarin

Pressure(MPa)



After 3000 injections



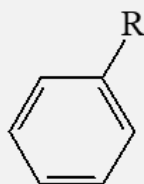
- For the maintenance rate of both retention time and plate number, more than 80% is maintained.
- No pressure rise

Comparison with other suppliers

【Comment on sample and measurement condition】

1. Hydrophobicity retention test

Using alkylbenzene as a sample, the retention ability of the hydrophobic compound for each column is tested.



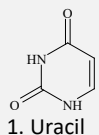
- R: 2. Toluene — CH₃
 3. Ethylbenzene — CH₂CH₃
 4. Propylbenzene — CH₂CH₂CH₃
 5. n-Butylbenzene — CH₂CH₂CH₂CH₃
 6. n-Amylbenzene — CH₂CH₂CH₂CH₂CH₃

Conditions

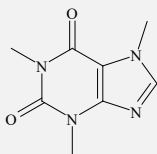
Column Size	: 100 x 2.1mm I.D.
Eluent	: A) CH ₃ OH B) H ₂ O A) / B) = 80/20, v/v
Flow Rate	: 0.4 mL/min
Col. Temp.	: 40 °C
Detection	: UV 254 nm
Injection Vol.	: 0.2 μL
Sample	: 1. Uracil 2. Toluene 3. Ethylbenzene 4. Propylbenzene 5. n-Butylbenzene 6. n-Amylbenzene

2. Selectivity test

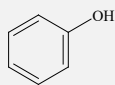
Selectivity of each column is tested.



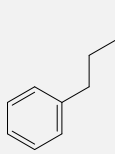
1. Uracil



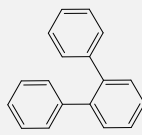
2. Caffeine



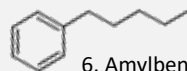
3. Phenol



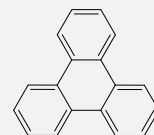
4. Butylbenzene



5. o-Terphenyl



6. Amylbenzene



7. Triphenylene

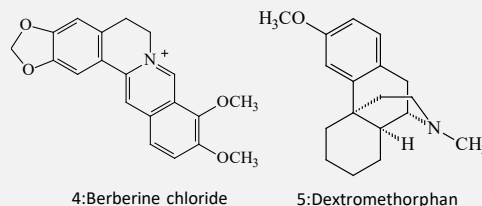
Conditions

Column Size	: 100 x 2.1 mm I.D.
Eluent	: A) CH ₃ OH B) H ₂ O A) / B) = 80/20, v/v
Flow Rate	: 0.4 mL/min
Col. Temp.	: 40 °C
Detection	: UV 254 nm
Injection Vol.	: 0.2 μL
Sample	: 1. Uracil 2. Caffeine 3. Phenol 4. n-Butylbenzene 5. o-Terphenyl 6. n-Amylbenzene 7. Triphenylene

【Comment on sample and measurement condition】

3. Strongly basic compound test

Strongly basic compound such as berberine or dextromethorphan easily cause adsorption because of rich remaining silanol group in the packing material, resulting a bad peak shape.

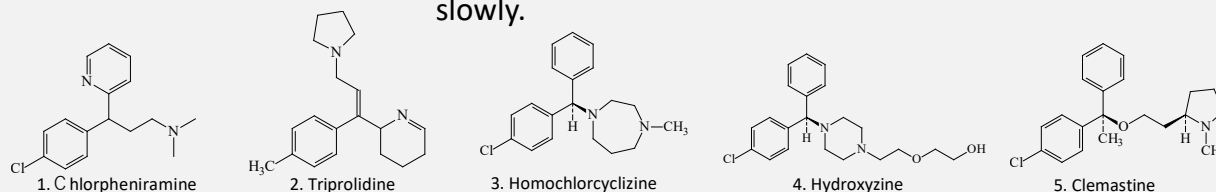


Conditions

Eluent	: A) CH ₃ CN B) 25 mM K ₂ HPO ₄ (pH 7.0, KH ₂ PO ₄) A/B = 30/70, v/v
Flow Rate	: 0.4 mL/min
Col. Temp.	: 40 °C
Detection	: UV 230 nm
Injection Vol.	: 0.2 μL
Sample	: 1. Uracil 2. Berberine chloride 3. Dextromethorphan

4. Basic compound test

The antihistaminic drug is a hardly eluted basic compound. Due to its strong adsorption property, the elution order may change with peak tailing when the column of insufficient end cap is used. Especially, the samples except hydroxyzine may tend to elute very slowly.



Conditions

Eluent	: A) CH ₃ CN B) 25 mM K ₂ HPO ₄ (pH 7.0, KH ₂ PO ₄) A/B = 60/40, v/v
Flow Rate	: 0.4 mL/min
Col. Temp.	: 40 °C
Detection	: UV 220 nm
Injection Vol.	: 0.2 μL
Sample	: 1. Chlorpheniramine 2. Triprolidine 3. Homochlorcyclizine 4. Hydroxyzine 5. Clemastine

5. Acidic compound test

An acidic compound such as formic acid or acetic acid is a compound to adsorb when the surface of packing material shows basicity.

- 1:Formic acid HCOOH
2:Acetic acid CH₃COOH

Conditions

Eluent	: 0.1 % H ₃ PO ₄
Flow Rate	: 0.4 mL/min
Col. Temp.	: 40 °C
Detection	: UV 210 nm
Injection Vol.	: 0.2 μL
Sample	: 1. Formic acid 2. Acetic acid

【Columns to be used】

Column	Supplier	Column size	Particle diameter
InertCore Plus C18	GL Sciences	2.1x100	2.6 μm
Competitor A	P company	2.1x100	2.6 μm
Competitor B	P company	2.1x100	2.6 μm
Competitor C	O company	2.1x100	2.7 μm
Competitor D	A company	2.1x100	2.7 μm
Competitor E	W company	2.1x100	2.7 μm
Competitor F	H company	2.1x100	2.7 μm
Competitor G	T company	2.1x100	2.6 μm
Competitor H	S company	2.1x100	2.7 μm
Competitor I	Y company	2.1x100	2.7 μm

Hydrophobicity retention test

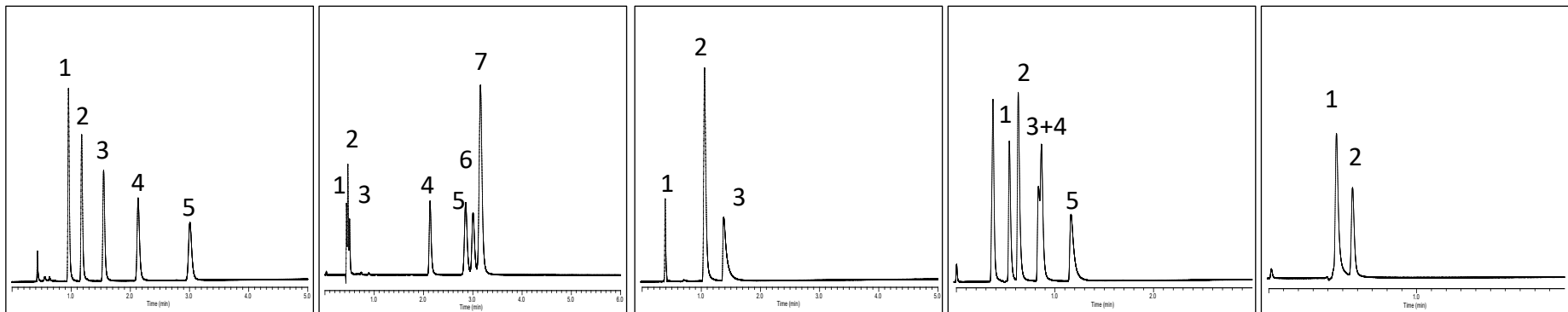
Selectivity test

Strongly basic compound test

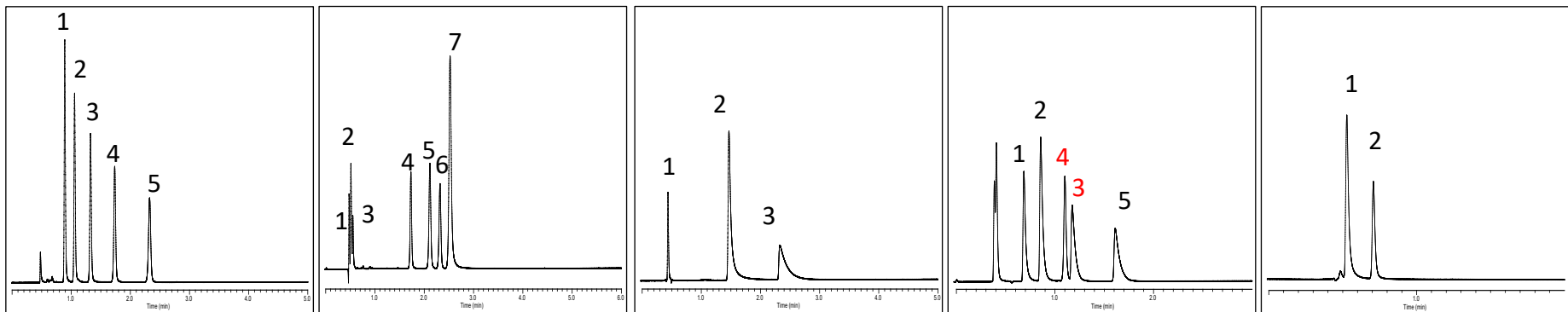
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor A



Hydrophobicity retention test

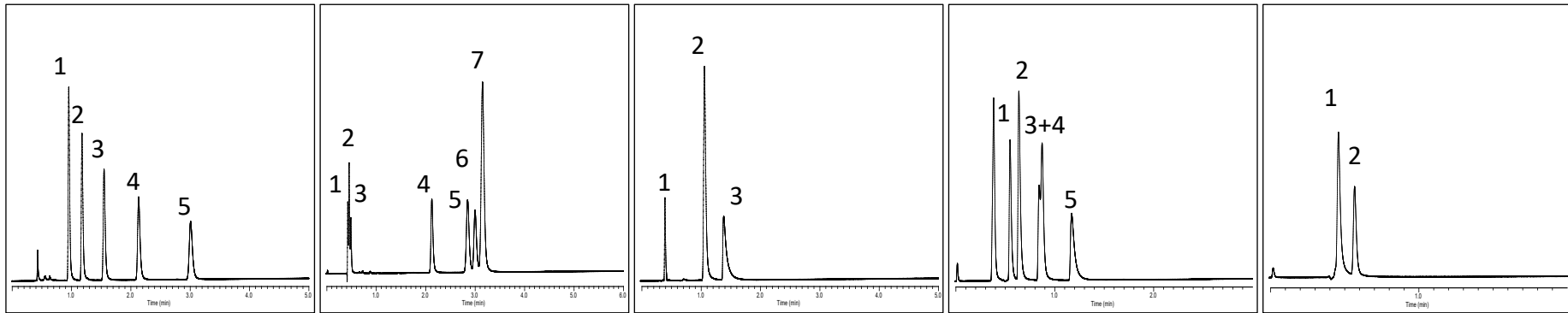
Selectivity test

Strongly basic compound test

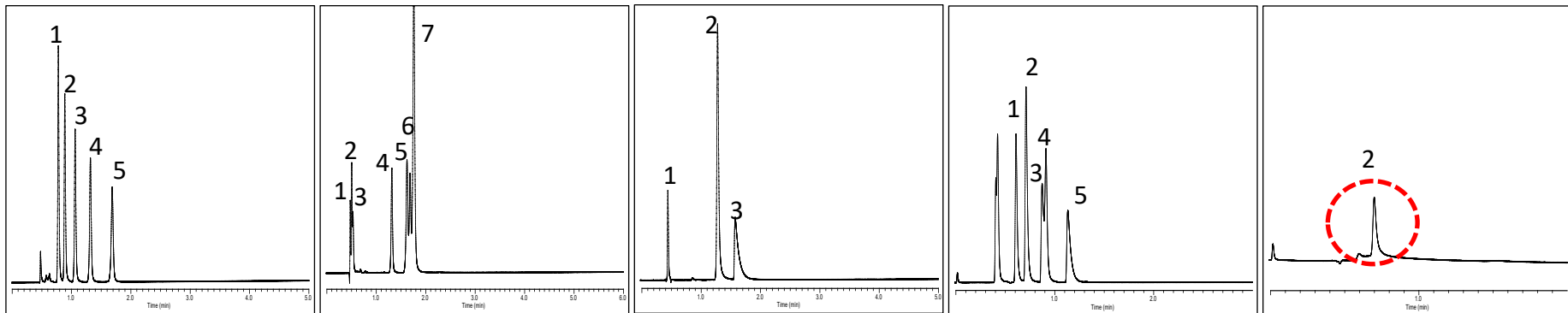
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor B



Hydrophobicity retention test

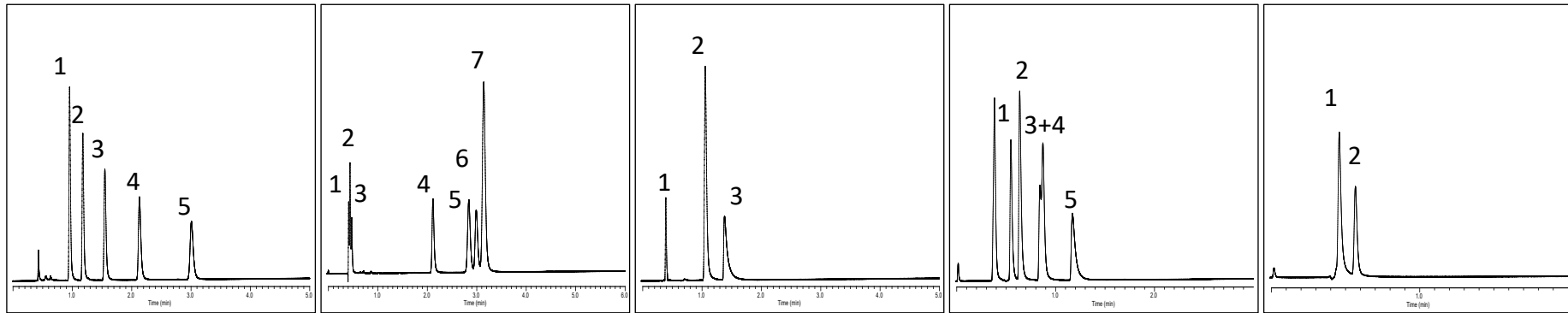
Selectivity test

Strongly basic compound test

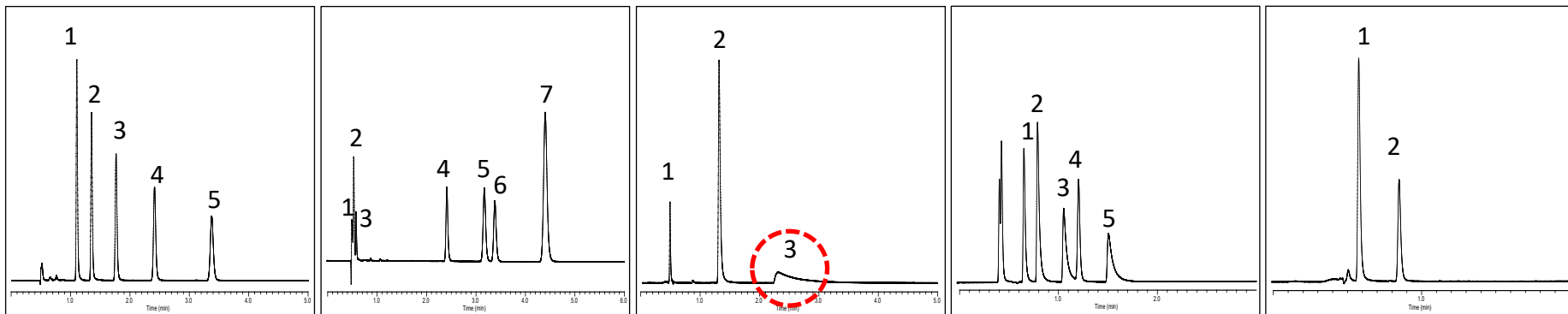
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor C



Hydrophobicity retention test

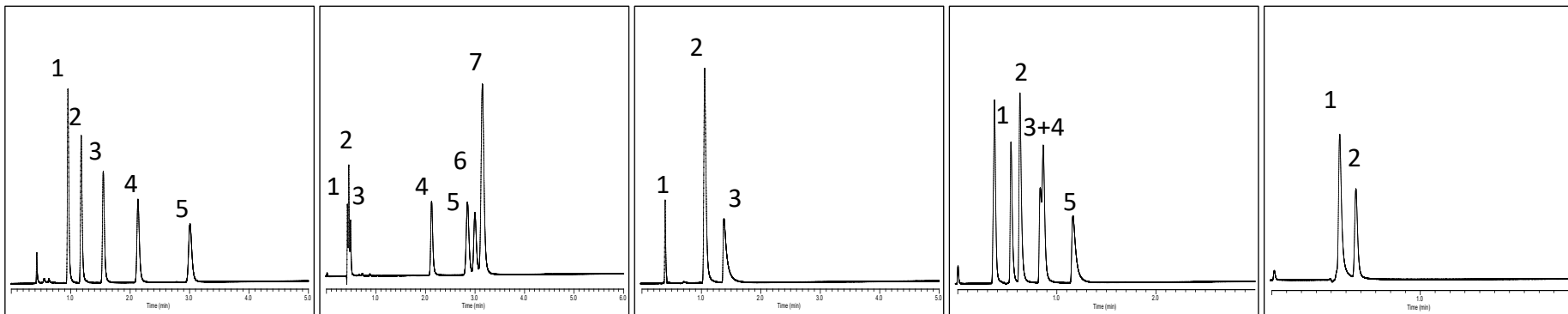
Selectivity test

Strongly basic compound test

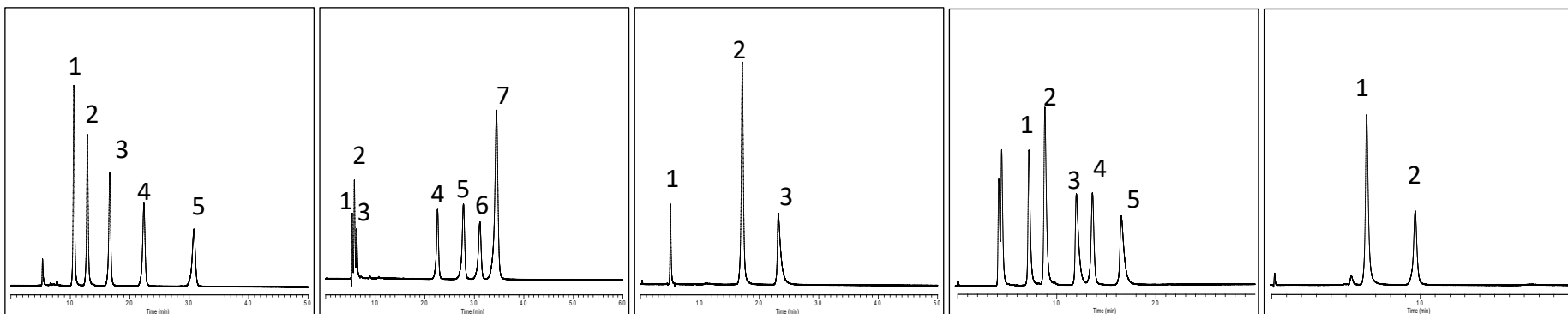
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor D



Hydrophobicity retention test

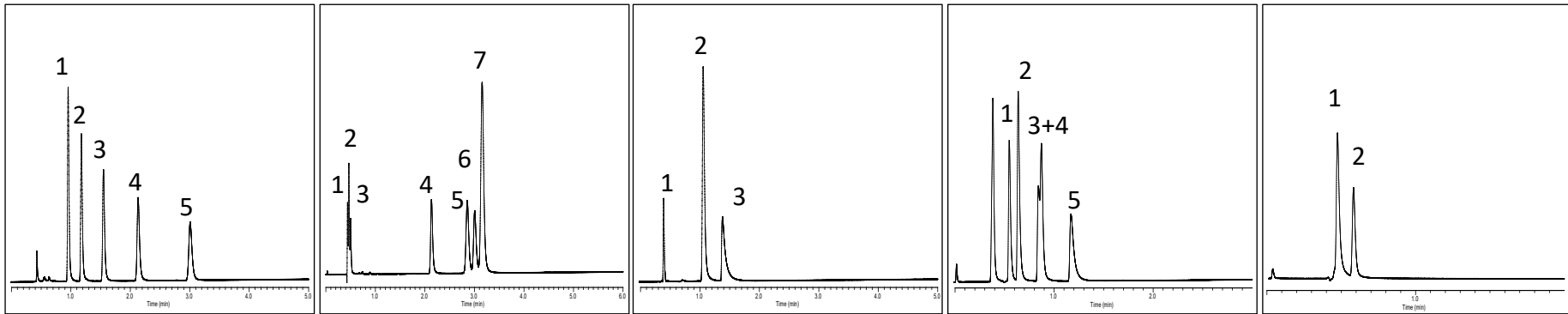
Selectivity test

Strongly basic compound test

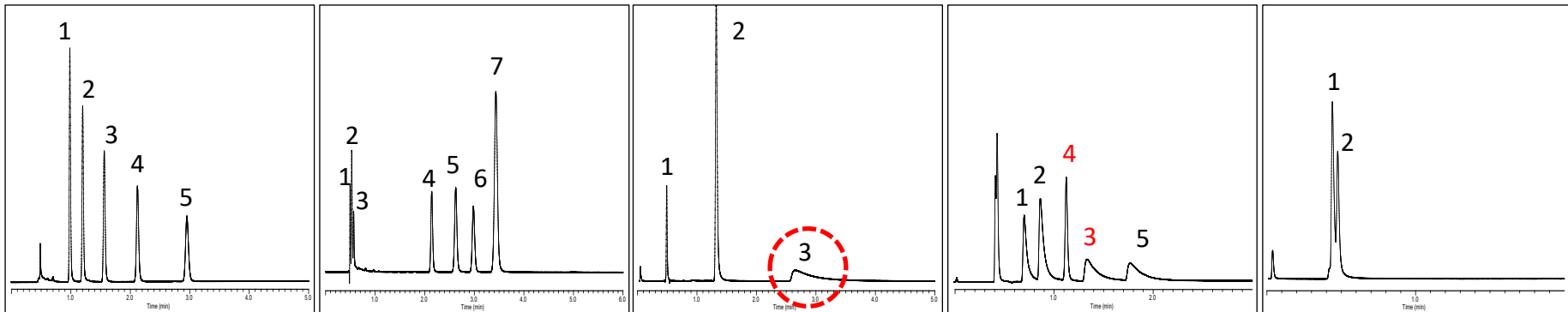
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor E



Hydrophobicity retention test

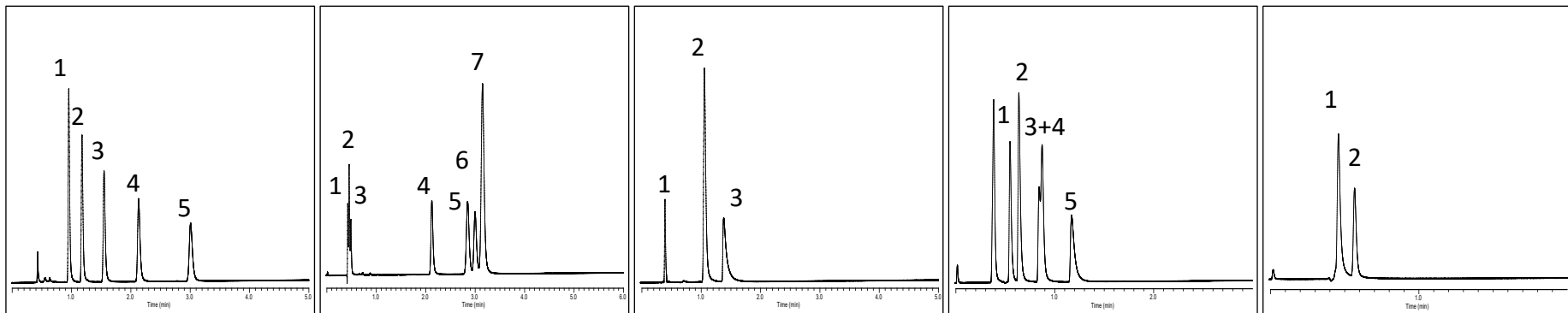
Selectivity test

Strongly basic compound test

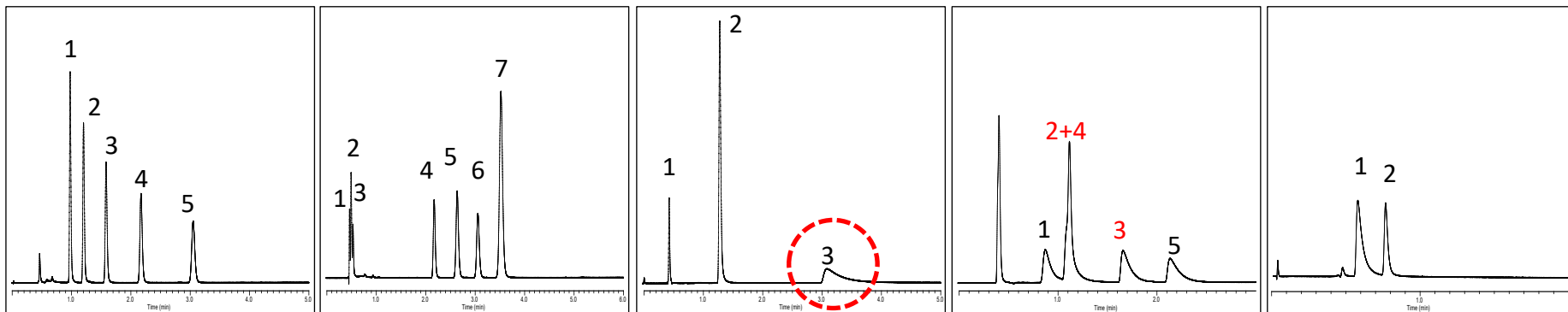
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor F



Hydrophobicity retention test

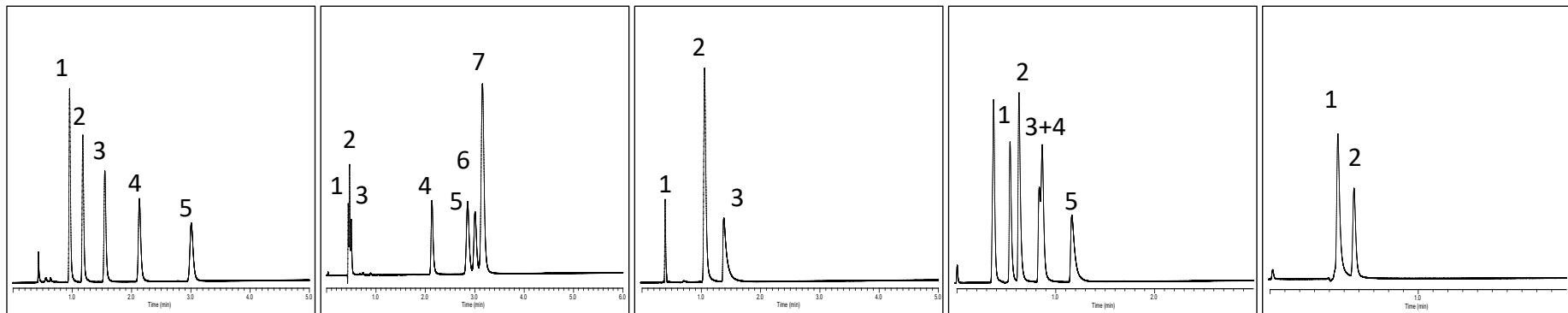
Selectivity test

Strongly basic compound test

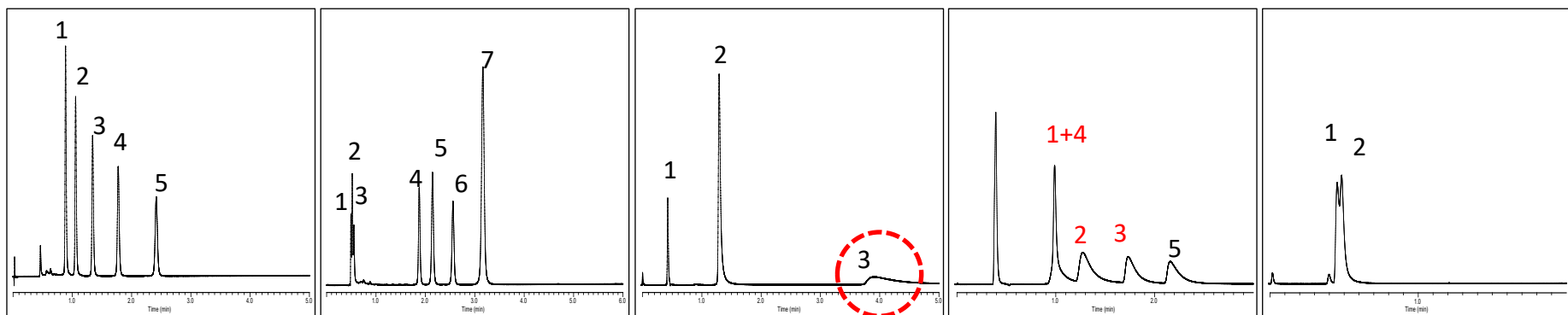
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor G



Hydrophobicity retention test

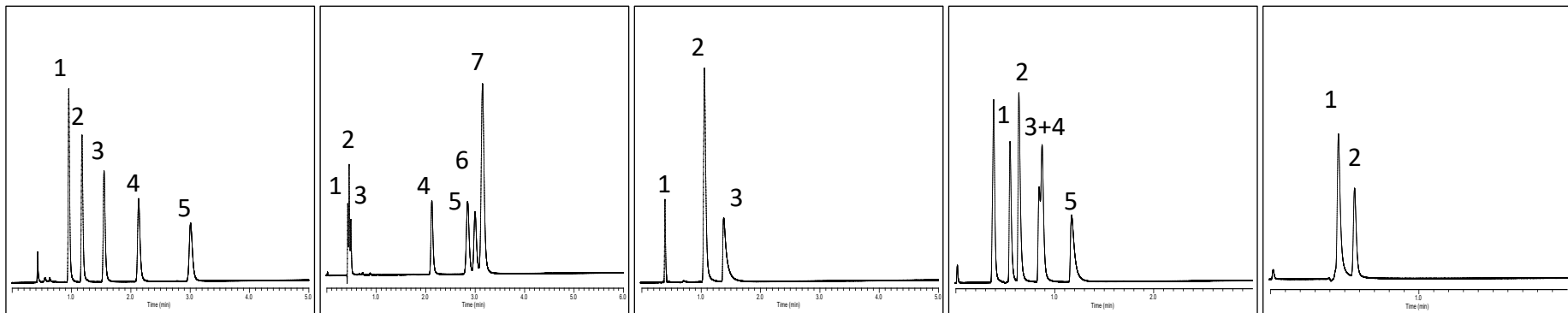
Selectivity test

Strongly basic compound test

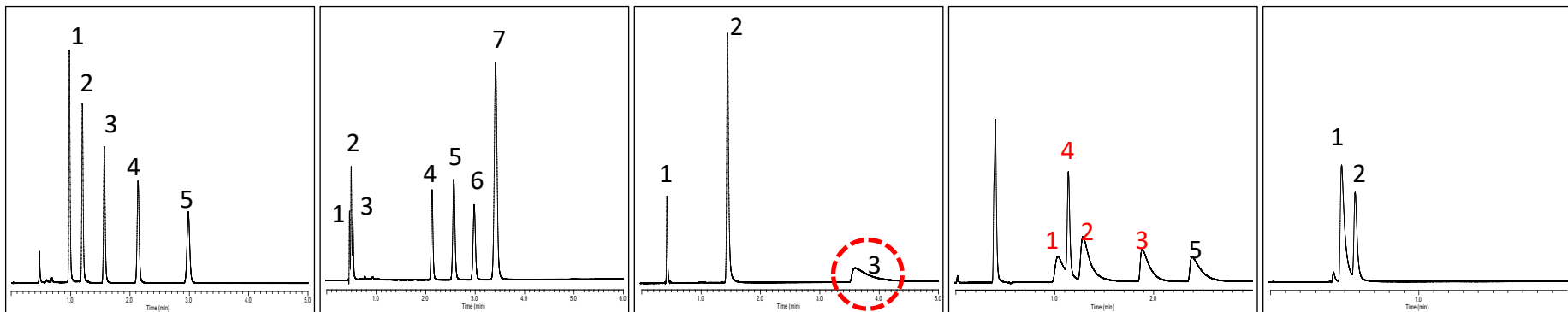
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor H



Hydrophobicity retention test

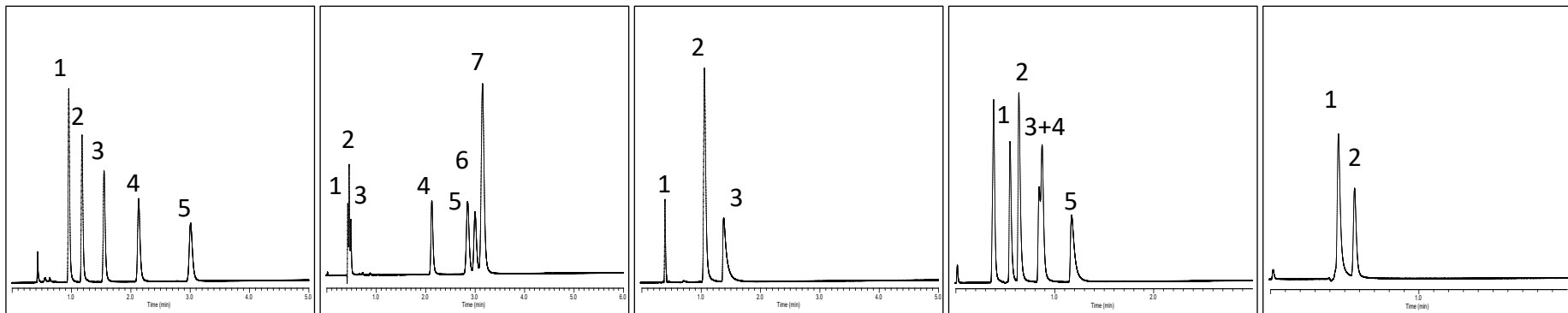
Selectivity test

Strongly basic compound test

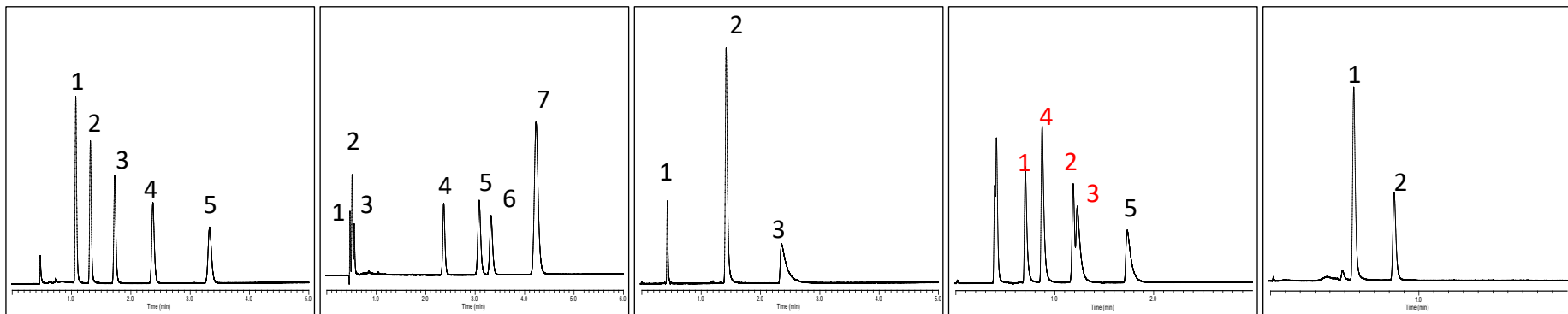
Basic compound test

Acidic compound test

InertCore Plus C18



Competitor I



Support documentation

How to use, recommended when used in HPLC

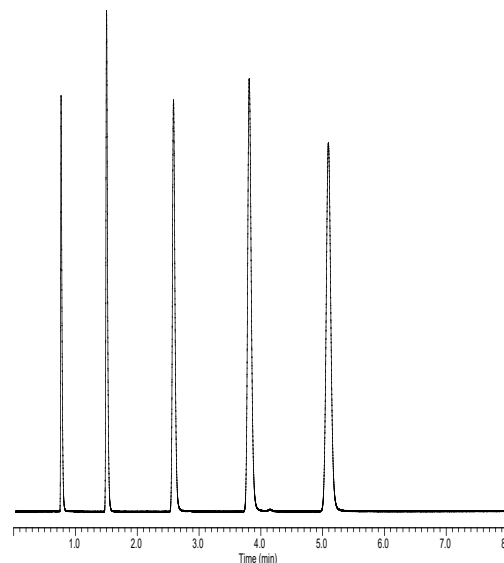
- Core shell type retains less due to smaller surface area as compared with totally porous column.
- Core shell type is influenced very much by dead volume.
 - Reducing the diffusion inside of the system
 - Optimizing the inner diameter of the tubing and cell volume
 - Optimizing the response time of the detector

After optimization of conditions,

HPLC

Semi-micro cell

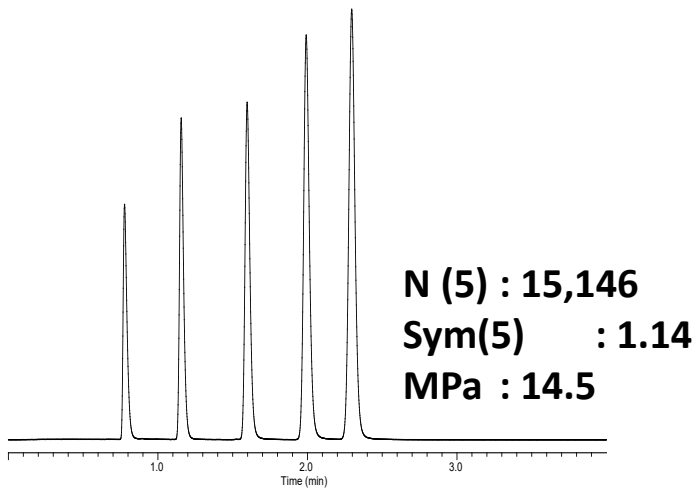
Tubing : 250mm x 0.1mm I.D.



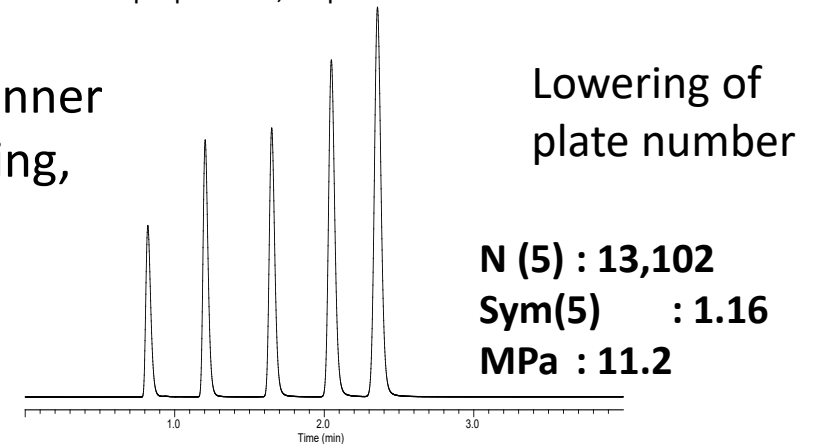
Column Size	: 2.6 μ m, 100 x 4.6 mm I.D.
Eluent	: CH ₃ CN / H ₂ O = 50/50
Flow Rate	: 1.0 mL/min
Col. Temp.	: 40 °C
Detection	: UV 254 nm
Sample Size	: 0.5 μ L
Response time	: 10msec

Points to be noted when using general purpose HPLC (lowering of plate number due to the difference of the tubing)

Column Size : 2.6 μ m, 100 x 4.6 mm I.D.
 Eluent : CH₃CN / H₂O = 65/35, v / v
 Flow Rate : 1.0 mL/min
 Col. Temp. : 40 °C
 Detection : UV 254 nm
 Sample Size : 0.5 μ L
 General purpose cell, response time : 10msec



Using tubing of larger inner diameter or longer tubing,



Lowering of plate number

Inner diameter of tubing (mm I.D.)	Length of tubing (mm)
In / Out	In / Out
0.1 / 0.1	150 / 150

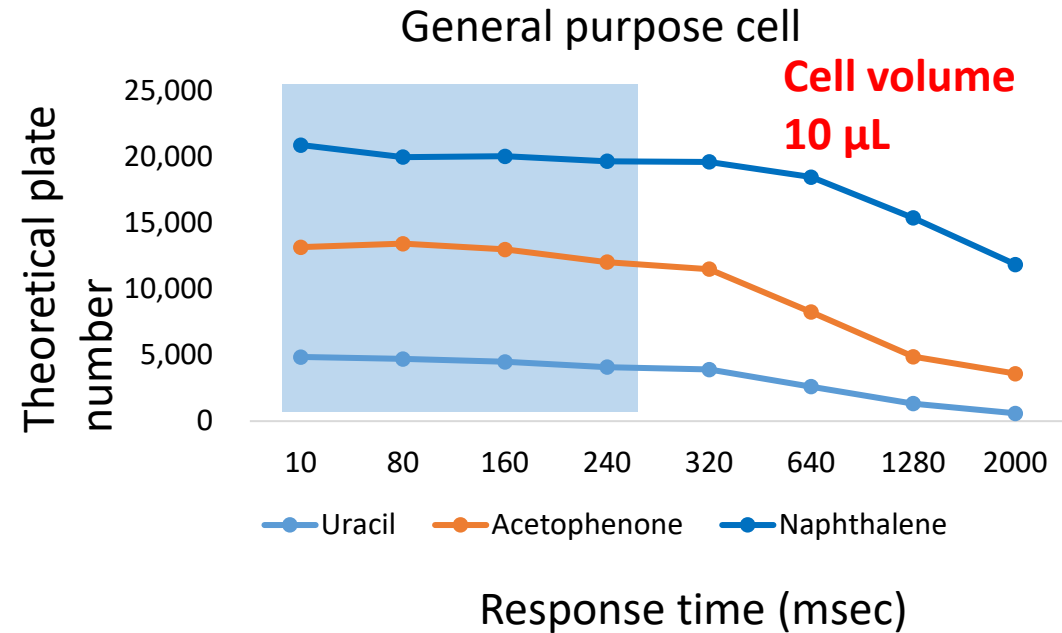
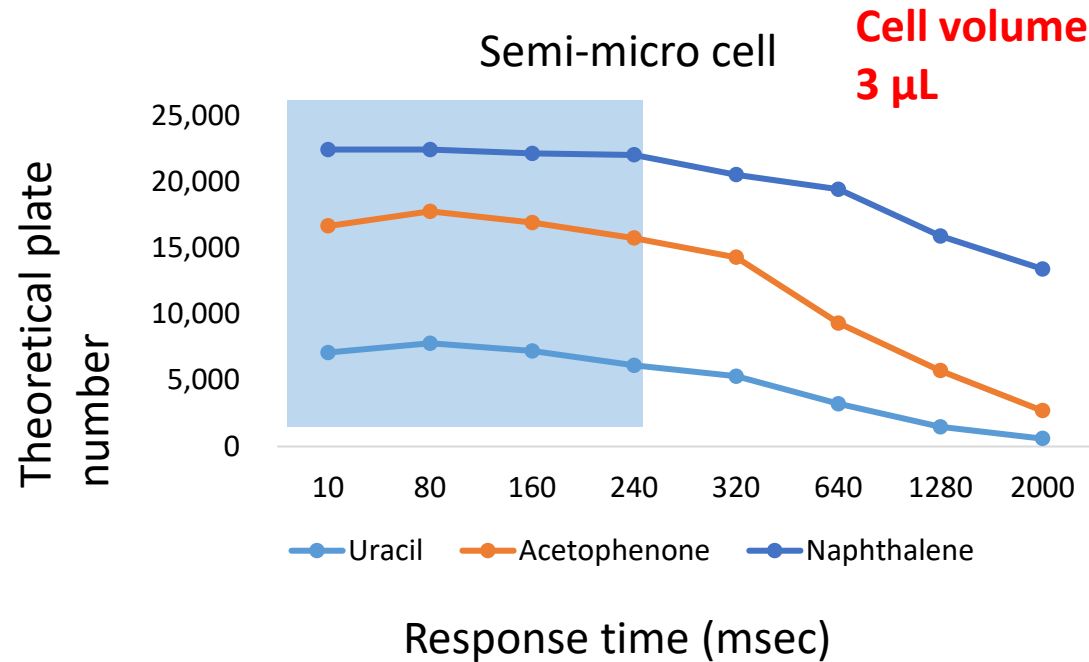
Inner diameter of tubing (mm I.D.)	Length of tubing (mm)
In / Out	In / Out
0.25 / 0.25	500 / 500

• Since core shell column is influenced very much by the dead volume of the system, it is recommended that tubing of an inner diameter 0.1 mm I.D. for the inlet and outlet of the column be used even in the case of general purpose HPLC

The length of tubing needs to be adjusted to be within the easy and usable range due to the limitations arising from the structure of the system.

Change of plate number depending on the response time of the detector

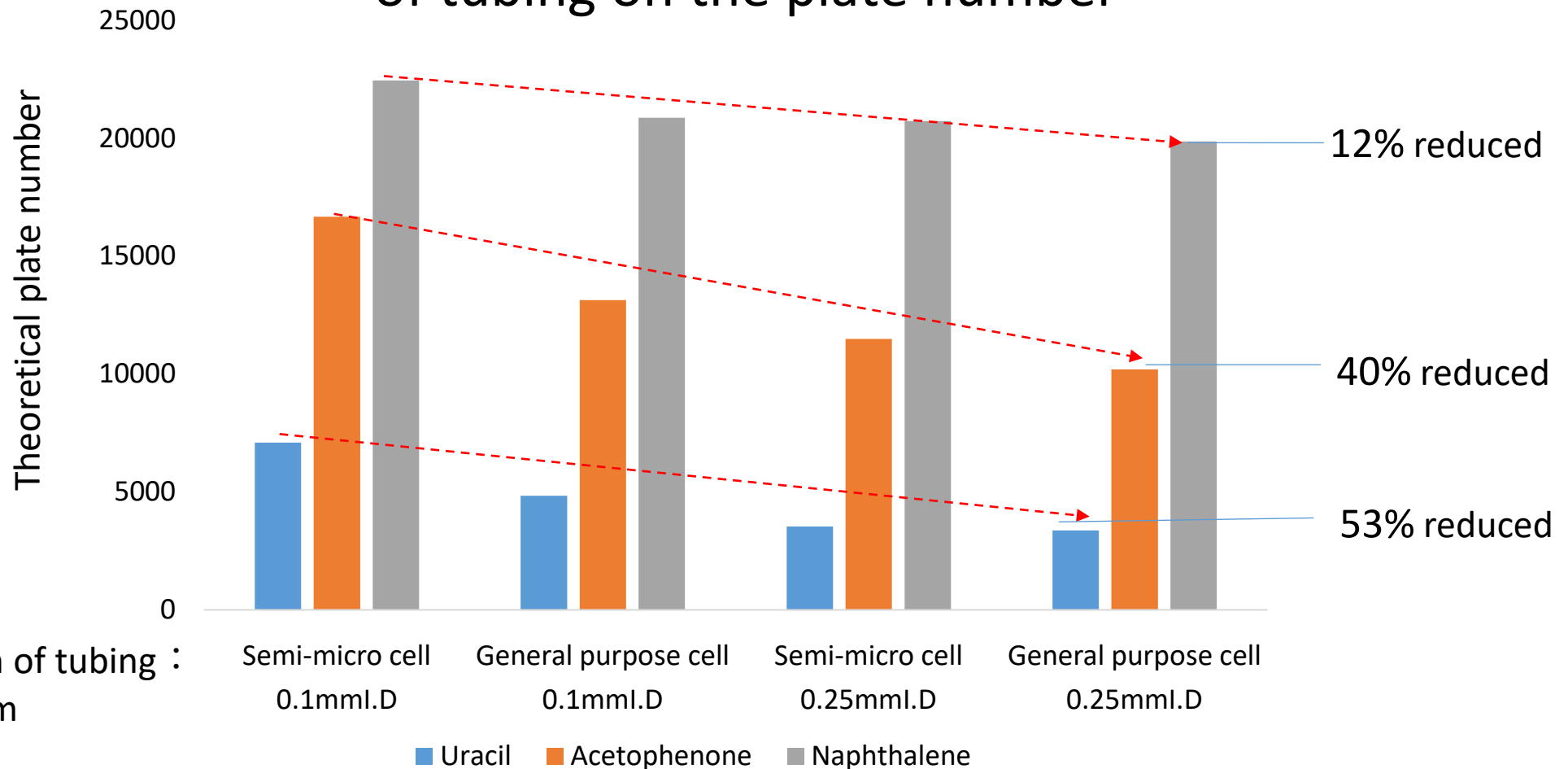
Inner diameter of tubing : 0.1mm I.D.
Length of tubing : 250mm



- A semi-micro cell of small cell volume is recommended for the detector cell in HPLC
- Optimization of the response setting for the reading interval

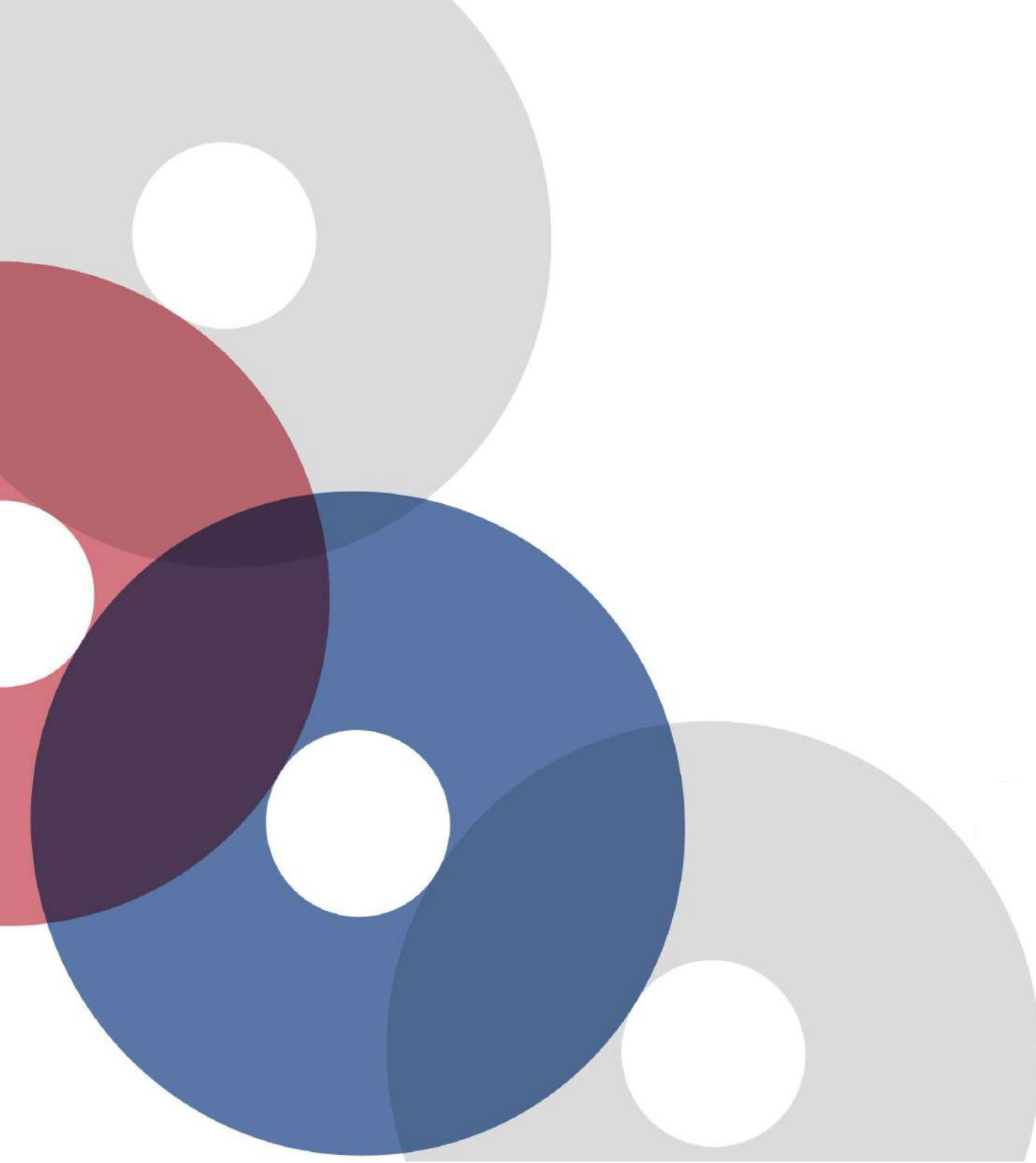
Column Size : 2.6 μ m, 100 x 4.6 mm I.D.)
 Eluent : CH₃CN / H₂O = 50/50 , v / v
 Flow Rate : 1.0 mL/min
 Col. Temp. : 40 °C
 Detection : UV 254 nm
 Sample Size : 0.5 μ L

Influence of cell volume and inner diameter of tubing on the plate number



- The reduction of the plate number is small for the components that have strong retention, resulting in less affects from the system volume.
- For the components that have weak retention which is easily affected by the dead volume, the plate number is greatly affected by the inner diameter of the cell and cell volume.

Column Size : 2.6 μ m, 100 x 4.6 mm I.D.)
 Eluent : CH₃CN / H₂O = 50/50 , v / v
 Flow Rate : 1.0 mL/min
 Col. Temp. : 40 °C
 Detection : UV 254 nm
 Sample Size : 0.5 μ L



Supports all kinds of analysis.

