

UHPLC column for Ultra-High-Speed High-Pressure Separation

7

CAPCELL PAK
IF2

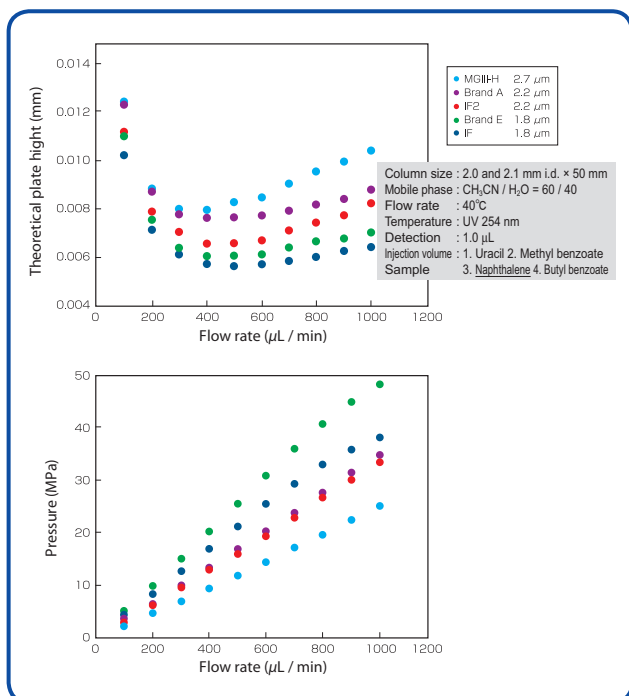
Durability is an indispensable quality to columns for ultra-high-speed high-pressure separation. A short lifetime under high pressure, and therefore, a high column cost would make high-pressure separation less attractive to chromatographers.

CAPCELL PAK C₁₈ IF2

In response to such customer's needs, CAPCELL PAK C₁₈ IF2 has been developed. IF2 enables excellent peak shape of basic compounds as well as the separation efficiency, while showing unsurpassed durability, hence offers the best choice for real ultra-high-speed, high-pressure separation

Properties

| Function group | Pore size (nm) | Average Particle size (μm) | Specific surface area (m ² /g) | C% | Density (μmol/m ²) | Applicable pH range |
|-----------------|----------------|----------------------------|---|------|--------------------------------|---------------------|
| C ₁₈ | 8 | 2.2 | 480 | 15.5 | 1.5 | 2-9 |

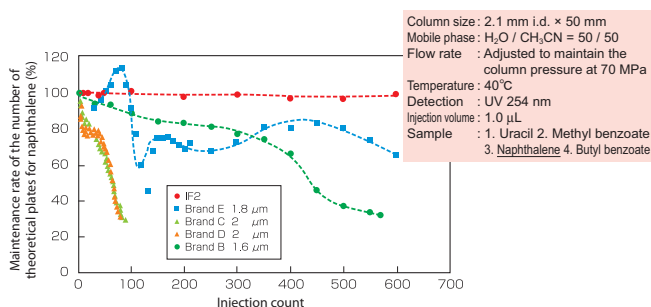


van Deemter Plots

Unsurpassed Durability against Pressure up to 100 MPa

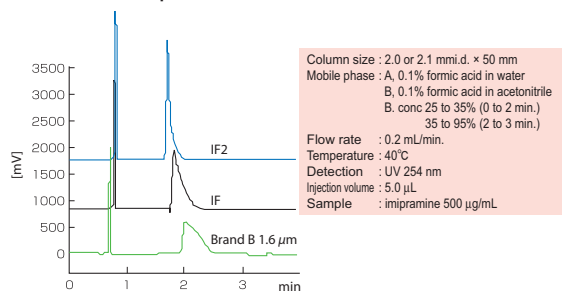
The graph below shows the durability comparison measured under a pressure of 70 MPa by adjusting the flow rate of each column. Among the columns whose specifications of withstand pressure are known as more than 70MPa, CAPCELL PAK IF2 with pressure resistance up to 100 MPa, shows outstanding durability as a UHPLC column truly ideal for ultra-high-speed high-pressure separation.

Packing technology is an important process that determines the quality of the column. To achieve such excellent durability, we used considerable ingenuity in the packing of the CAPCELL PAK IF2.



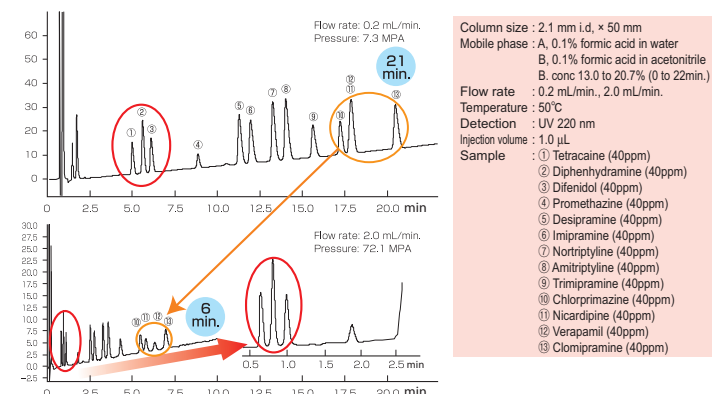
Higher Loadability than Existing Products

We injected 50-time more concentrated imipramine to compare the peak shape. The CAPCELL PAK IF2, which is suitable for the separation of basic compounds, sharply elutes even high concentrations of basic compounds.



Quick and Sharp Elution of Basic Compounds

The CAPCELL PAK IF2 showing sharp peaks for basic analytes, provides excellent peak shape and separation efficiency even at ten-time greater flow rate, while enables the analytes to elute quickly.



CAPCELL PAK C₁₈ IF2 S2

| Catalog No | Inner Diameter (mm) | Length (mm) |
|------------|---------------------|-------------|
| 92883 | 2.1 | 20 |
| 92885 | 2.1 | 50 |
| 92887 | 2.1 | 100 |

UHPLC column for Ultra-High-Speed LC-MS analysis

With the improved performance of mass spectrometers, the requirements for columns are divided into two properties: capability of fast crude separation and a superior separation efficiency that enables highly-sensitive analysis of a smaller amount of samples. Both of them require high pressure resistance.

CAPCELL PAK C₁₈ MGIII-H

CAPCELL PAK MGIII-H is an evolution of MGIII in response to such needs. MGIII-H enables operation pressure up to 50 MPa, showing outstanding durability, hence offers improved high-speed LC-MS of basic compounds with flexible pressure resistance.

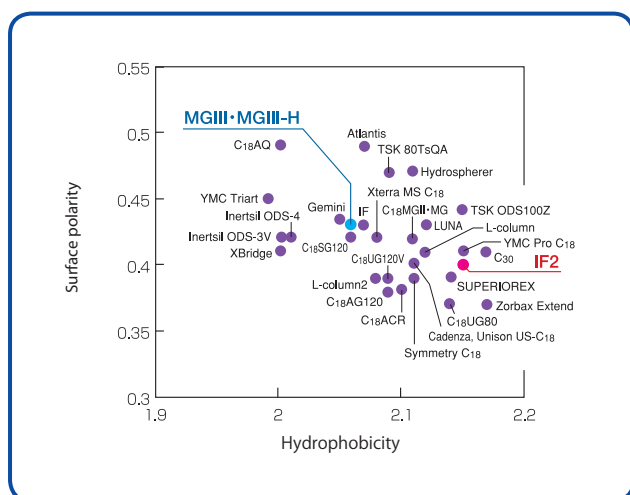


Properties

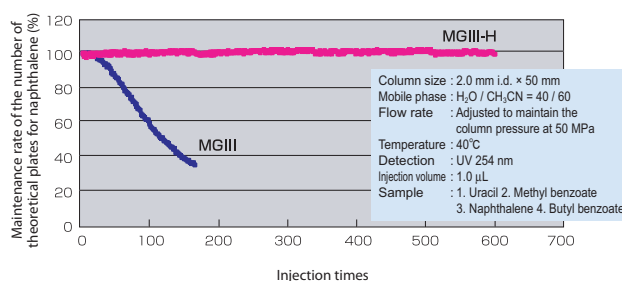
| Function group | Pore size (nm) | Average Particle size (μm) | Specific surface area (m ² /g) | C% | Density (μmol/m ²) | Applicable pH range |
|-----------------|----------------|----------------------------|---|----|--------------------------------|---------------------|
| C ₁₈ | 10 | 2.7 | 300 | 15 | 2.3 | 2-9 |

Unsurpassed Durability against Pressure up to 100 MPa

The durability is determined under 50 MPa by adjusting the flow rate of each column. The CAPCELL PAK MGIII-H maintains the number of theoretical plates even after 600 times of injection, so can be used with confidence.

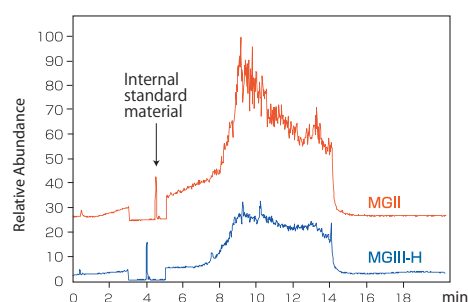


Parameter map



Minimized Bleeding

As another effect of the special preconditioning, the background (bleeding) most affecting the high sensitivity range has been drastically reduced.



Specifications for MG Series Columns

We conduct strict control by adding the symmetry of the peak shape and the retention coefficient for amitriptyline, which is sensitive to silanol, to the specifications.

| Test item | Column | MGIII | MGII | MG |
|-----------------------------------|--|--|-----------------------------|-----------------------------|
| Pyridine/Pheno | As (Py): 0.90-1.50 As (Ph): 0.90-1.20 | As (Py): 0.90-1.50 As (Ph): 0.90-1.20 | Shipment standard specified | Shipment standard specified |
| Quinizarin | As: 0.90-1.40 | — | — | — |
| Amitriptyline (neutral condition) | — | — | As: 0.90-1.30 | — |
| Amitriptyline (acidic condition) | As: 0.90-1.30 k: 1.3-1.6 | — | — | — |

Excellent Reproducibility for Basic Compounds under Acidic Conditions

The lot-to-lot reproducibility is an issue for isocratic analysis under acidic conditions, which is often conducted as the LC-MS analysis of basic compounds. The MGIII-H is developed with special conditioning similarly to that of the MGIII during the manufacturing processes, therefore can provide promised performance with confidence.

CAPCELL PAK C₁₈ MGIII-H S3

| Catalog No | Inner Diameter (mm) | Length (mm) |
|------------|---------------------|-------------|
| 92782 | 2.0 | 20 |
| 92784 | 2.0 | 50 |
| 92786 | 2.0 | 100 |

CAPCELL PAK C₁₈ MGIII

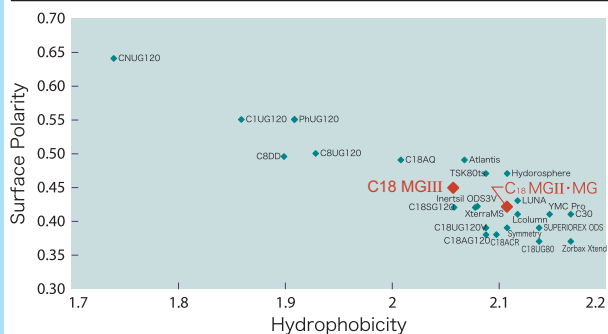
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The CAPCELL PAK C₁₈ MGIII, the third generation of the MG series, is developed to overcome the column-to-column variation in retention of basic compounds under an acidic condition. The quality of MGIII will help develop improved methods in various LC-MS applications.

Characteristics and parameter mapping

| Function group | Pore size (nm) | Particle size (μm) | Specific surface (m ² /g) | C% | Density (μmol/m ²) | pH | USP |
|-----------------|----------------|--------------------|--------------------------------------|----|--------------------------------|------|-----|
| C ₁₈ | 10 | 5 | 260 | 15 | 2.7 | 2-10 | L1 |
| C ₁₈ | 10 | 3 | 300 | 15 | 2.3 | 2-10 | L1 |



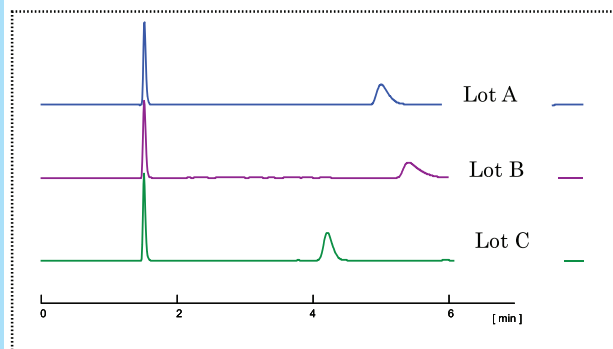
Comparison of Shiseido HPLC columns

| Feature | MGIII | MGII | MG | UG120 | ACR | AQ |
|--|-------|------|-----|-------|-----|-----|
| High-purity silica | | ✓✓ | | | ✓✓ | |
| Highly basic compounds (under acidic mobile phases) | ✓✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| Highly basic compounds (under neutral mobile phases) | ✓✓ | ✓✓✓ | n/a | n/a | n/a | n/a |
| LC-MS/MS | ✓✓✓ | ✓✓ | ✓ | ✓ | ✓ | ✓ |
| Multi-component analysis | ✓✓ | ✓✓ | ✓✓ | ✓ | ✓✓ | ✓✓ |
| High-polarity compounds | ✓✓ | ✓✓ | ✓✓ | ✓ | ✓ | ✓✓✓ |
| Pyridine/phenol test | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| Quinizarin | ✓✓ | — | — | — | — | — |
| Acidic durability | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓✓ | ✓✓ |
| Basic durability | ✓✓ | ✓✓✓ | ✓✓✓ | ✓✓✓ | ✓✓✓ | ✓✓ |
| Semi-preparative scale | — | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |
| 3-μm particle type | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓ |

✓✓✓: excellent ✓✓: good(applicable) n/a: not applicable

The problem in the analysis of basic compounds under an acidic condition

The following figure is an example of column-to-column variation under an acidic condition. The compound used here was amitriptyline, a highly basic compound used for the USP evaluation method. The results were obtained under an isocratic condition (0.1% formic acid/methanol). Retention times of the three columns (Column A, anonymous) were found very different under the mobile phase that was one of the most common in LC-MS. The similar tendency was observed in many other columns.

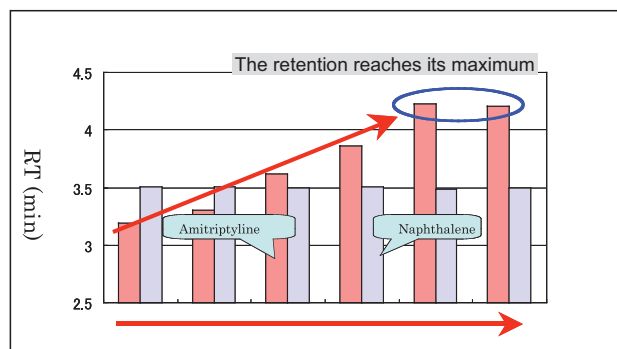


Lot variation under an acidic condition

HPLC Conditions

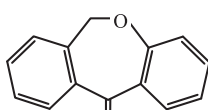
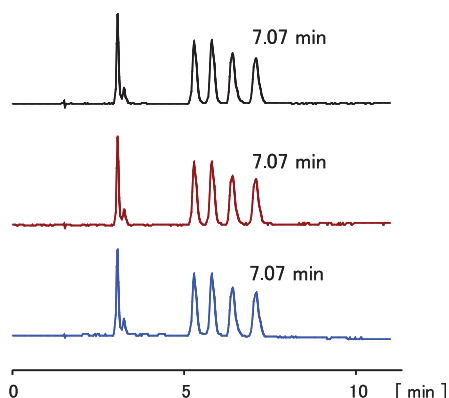
| | |
|---------------------|---|
| Column | : Column A 4.6 mm i.d. x 150 mm |
| Mobile phase | : CH ₃ OH / H ₂ O / HCOOH = 500 / 500 / 1 |
| Flow rate | : 1 mL/min |
| Temperature | : 40 °C |
| Detection | : UV, 254 nm |
| Inj.vol. | : 5 μL |
| Sample dissolved in | : H ₂ O (50 μg/mL) |

Based on our previous studies, we found the responsible factor was related to the synthetic byproducts and the residues of impurities from reagents used for the synthetic process. We accordingly applied a special pre-conditioning process to the column production, which provided the stable retention to both amitriptyline and naphthalene.

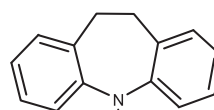


Optimization of pre-conditioning (PC) time

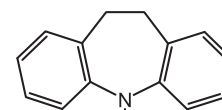
MGIII...excellent reproducibility under an acidic condition



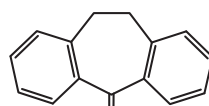
1. Doxepine (M.W. 279.4)



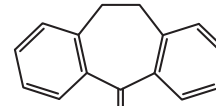
2. Imipramine (M.W.280.4)



3. Desipramine (M.W. 266.4)



4. Amitriptyline (M.W. 277.4)

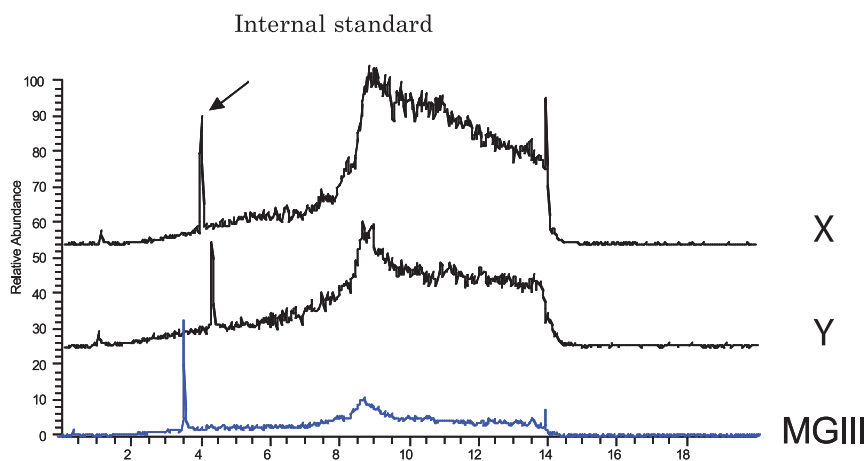


5. Nortriptyline (M.W. 184.2)

| | |
|---------------------|---|
| Column | : CAPCELL PAK C ₁₈ MGIII S5 4.6 mm i.d. x 150 mm |
| Mobile phase | : CH ₃ OH / H ₂ O / HCOOH=450 / 550 / 1 |
| Flow rate | : 1 mL/min |
| Temperature | : 40 °C |
| Detection | : UV, 254 nm |
| Inj.vol. | : 1 μL |
| Sample dissolved in | : H ₂ O (50 μg/mL) |

MGIII...low-bleeding column

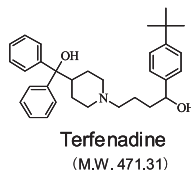
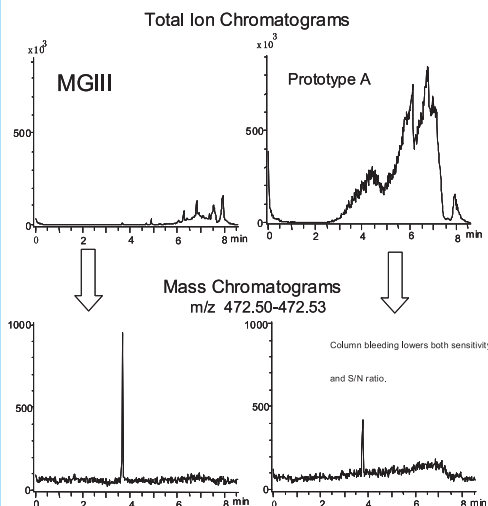
Total ion chromatograms (TICs) were compared among different Shiseido columns under a validated gradient condition. The PC process was found to reduce the amount of column bleeding to a large extent, especially in the region for highly hydrophobic compounds.



Comparison of column bleeding

“Column bleeding” influences LC-MS sensitivity (Ion suppression)

Column bleeding not only interferes an analyte signal by its components with close m/z values, but may lower an intensity of the analyte peak itself. The effect of column bleeding has been extensively studied throughout the development of the MGIII series.

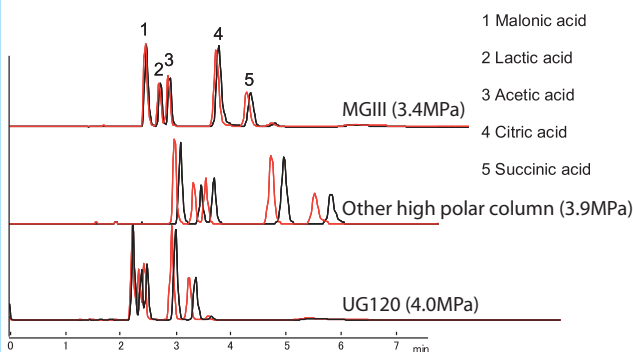


Column size : 2.0 mm i.d. x 50 mm
 Mobile phase : A) 0.1 vol % HCOOH
 B) CH₃CN
 B 10% (0min) -> 100% (5.0 min) -> 100%
 (6.0 min) -> 10% (6.1 min) Gradient
 Flow rate : 200 μ L/min
 Temperature : 40 $^{\circ}$ C
 Detection : MS ESI Positive
 Inj. vol. : 2 μ L
 Sample dissolved in: Methanol (10 ng/mL)

Influence of column bleeding on ion intensity of analyte (Ion suppression)

MGIII...wide usage from high-polarity compounds to low-polarity ones

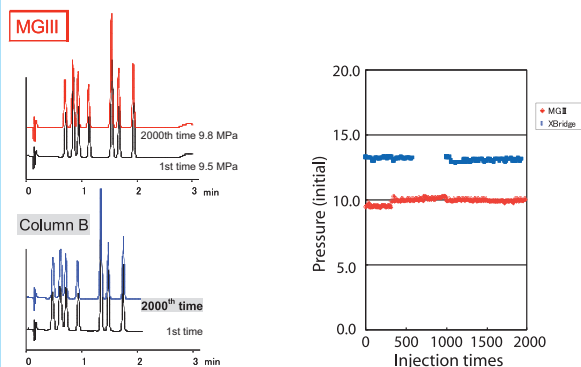
MG Series columns used to be categorized as “medium polar”. MGIII, being treated with the PC process, has a higher polarity than previous MG columns. Separation of small organic acids was attempted to evaluate the polarity of MGIII, in comparison with another Shiseido column and one of the competitor’s high-polarity columns.



Column size : 2.0&2.1 mm i.d. x 150 mm
 Mobile phase : 0.1 vol% H₃PO₄ / CH₃CN = 99.5 / 0.5
 Flow rate : 200 μ L/min
 Temp. : 40 $^{\circ}$ C
 Detection : UV 210 nm
 Inj. vol. : 2.0 μ L
 Sample dissolved in : Mobile phase (500 μ g/mL)

Separation of organic acids

MGIII...low pressure and high durability



Pressure change in continuous operations

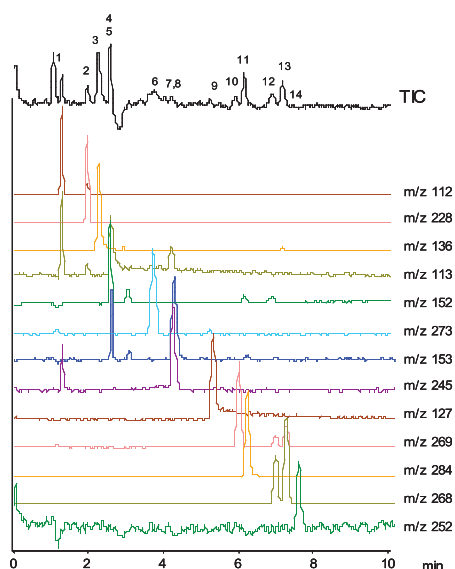
- Low pressure and high durability. A similar separation efficiency to be obtained with 25% less pressure.
- A new end fitting design (filter pore size, shape of through pore) to meet the new column specifications.
- A new process to finish the inner wall of the empty column.

LC-MS analysis of fourteen nucleic acid-related compounds

MGIII is suitable for separations of polar compounds. Nucleic acid-related compounds, which are generally considered hard to retain in C₁₈ columns, were also well separated with MGIII.

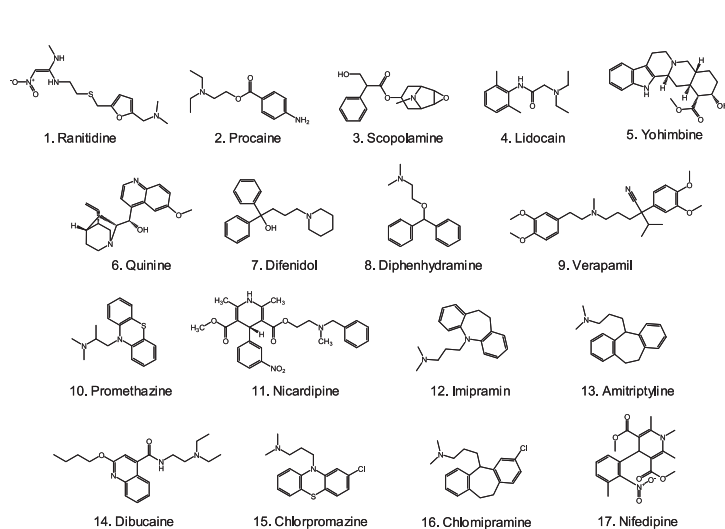
LC-MS Conditions

Column : CAPCELL PAK C₁₈ MGIII S5 ; 2.0 mm i.d. x 150 mm
 Mobile phase : A) 0.1 vol% CH₃COOH B) CH₃OH
 B 2% (0 min) -> 20% (10 min) -> 2% (10 min) Gradient
 Flow rate : 200 μL/min
 Temperature : 40 °C
 Detection : MS ESI Positive
 Inj.vol. : 2 μL
 Sample : guanine (1000 μg/mL in 0.1 mol/L KOH), xanthin (1000 μg/mL in 0.1 mol/L NaOH), uridine (500 μg/mL in 1% HCOOH), deoxyadenosine (1000 μg/mL in 1% HCOOH) and other solutions (1000 μg/mL in 1% HCOOH) were mixed together, and diluted to 1 mL with water.
 Sonication (30 min) is necessary to dissolve some of the compounds.

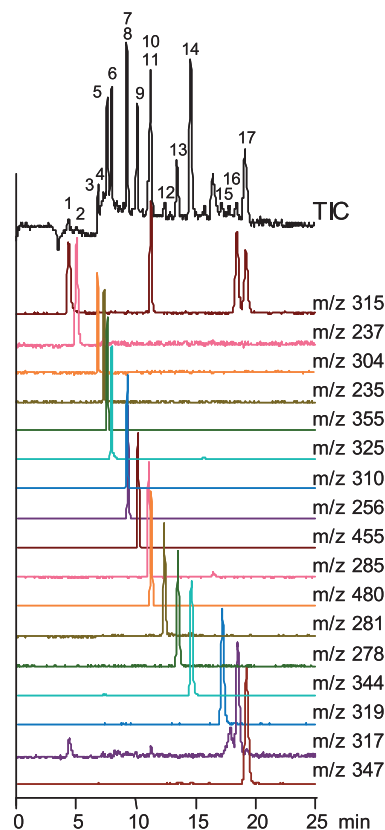


1. Cytosine (MW. 111.1)
2. Deoxycytidine (MW. 227.2)
3. Adenine (MW. 135.1)
4. Uracil (MW. 112.1)
5. Guanine (MW. 151.1)
6. Hypoxanthine (MW. 136.1)
7. Xanthine (MW. 152.1)
8. Uridine (MW. 244.2)
9. Thymine (MW. 126.1)
10. Inosine (MW. 268.2)
11. Guanosine (MW. 283.2)
12. Adenosine (MW. 267.2)
13. Deoxyguanosine (MW. 267.2)
14. Deoxyadenosine (MW. 251.2)

Simultaneous separation of seventeen basic compounds with MGIII column



Column : CAPCELL PAK C₁₈ MGIII S5 ; 2.0 mm i.d. x 250 mm
 Mobile phase : A) 10 mmol/L HCOONH₄ contained 0.1 vol% HCOOH B) CH₃OH
 B 20% (0 min) -> 20% (3 min) -> 55% (3 min) -> 55% (25 min) -> 20% (25 min) Gradient
 Flow rate : 200 μL/min
 Temperature : 40 °C
 Detect : MS ESI Positive
 Inj.vol. : 2 μL
 Sample : Methanol (Diphenhydramine: 10 μg/mL, Other sixteen compounds: 2 μg/mL)



CAPCELL PAK C₁₈ MGII

13

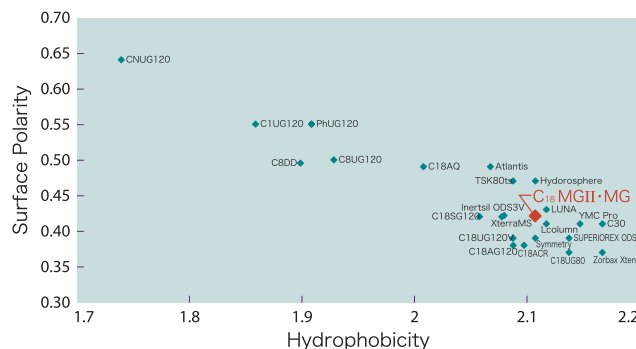


CAPCELL PAK MG II is based on high-purity silica support, being one of the MG series columns. MG II is designed to provide excellent peak shapes for basic compounds under neutral mobile phase conditions. Its outstanding "silanol-shielding" material was generated by the original polymer-coating technology.

Characteristics and parameter mapping

The general characteristics of CAPCELL PAK C₁₈ MG II are same as that of MG. MG II is an easy-to-use column with moderate hydrophobicity and moderate surface polarity.

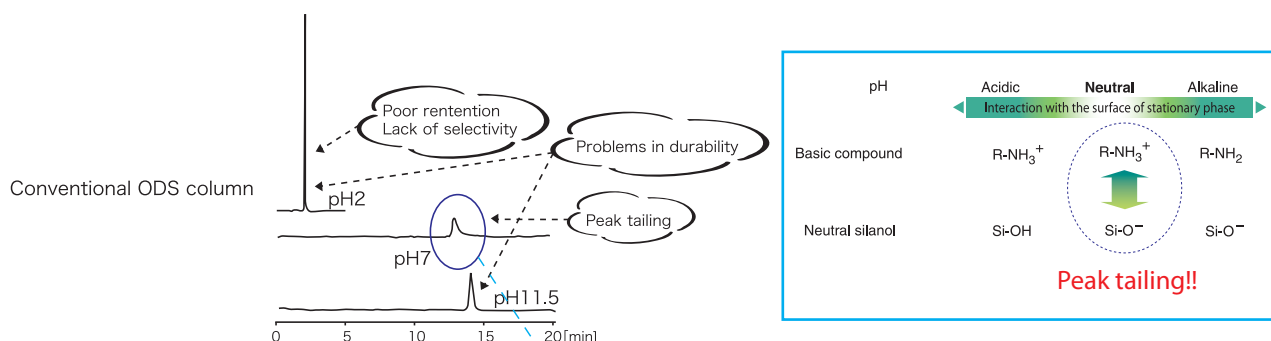
| Function group | Pore size (nm) | Particle size (μm) | Specific surface area (m ² /g) | Carbon% | Alky group density (μmol/m ²) | pH | USP |
|-----------------|----------------|--------------------|---|---------|---|------|-----|
| C ₁₈ | 10 | 5 | 260 | 15 | 2.7 | 2-10 | L1 |
| C ₁₈ | 10 | 3 | 300 | 15 | 2.3 | 2-10 | L1 |



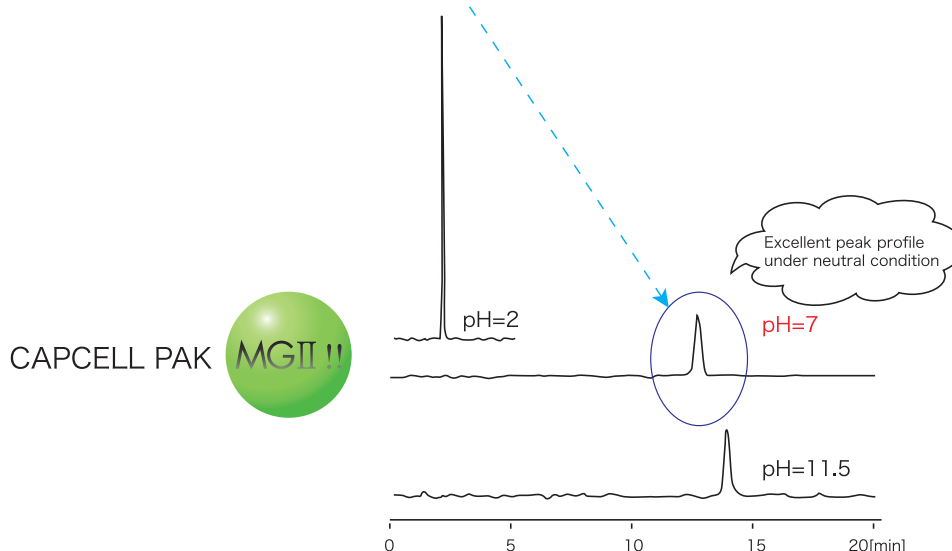
Why do we need a good column to be used under neutral mobile phase conditions?

Many physiologically active compounds and their metabolites possess a basic nature. Chromatographers keep on seeking a good column for such compounds, free from peak shape deterioration caused by silica's acidity, the inherent nature of silica-based columns.

<Problems in analysis of basic compounds under acidic, basic, and neutral condition>



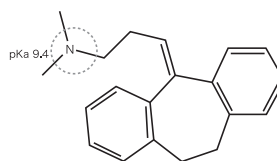
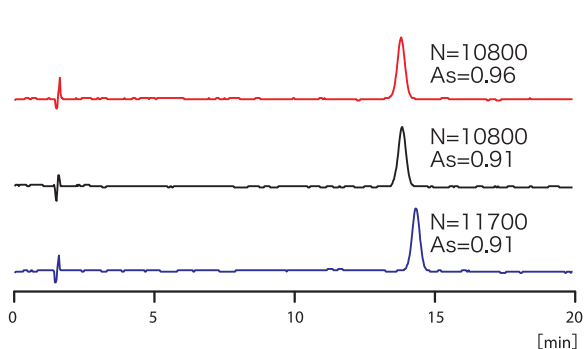
"CAPCELL PAK C₁₈ MG II" is the solution for analysis of basic compounds under neutral condition



- Advantage 1** → Possible to avoid lowering pH for compounds unstable at acidic conditions.
- Advantage 2** → Beginning a mobile phase optimization at neutral pH makes the process simple, especially in LC-MS.
- Advantage 3** → Good for compounds that show the highest ion intensity at neutral pH in LC-MS.

Excellent reproducibility

In addition to "Standard of Silica" and "Standards for Parameters of Packing Materials" (both documented by Shiseido), a test with amitriptyline is used to quality-control the production of MG II.



Amitriptyline

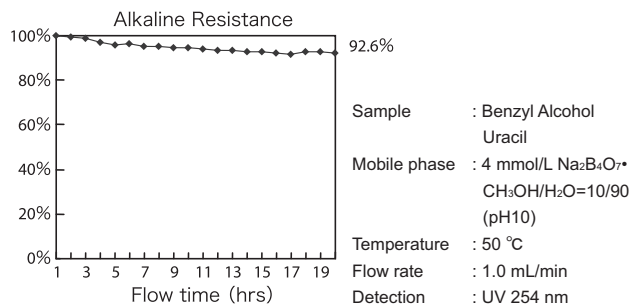
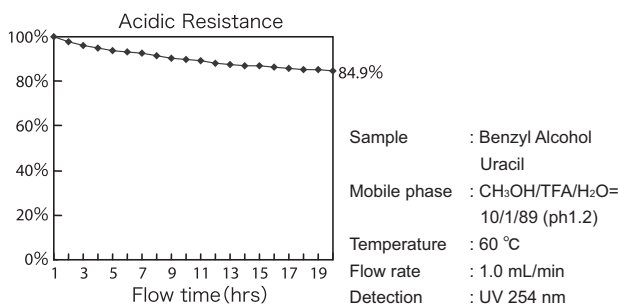
| | |
|----------------|---|
| Sample | : Amitriptyline 50 ppm |
| Injection Vol. | : 5 μ L |
| Mobile Phase | : CH ₃ OH/20 mmol/L phosphate buffer=75/25 |
| Temperature | : 40 °C |
| Flow rate | : 1.0 mL/min |
| Detection | : UV 254 nm |

GLP/GMP Support Column

CAPCELL PAK C₁₈ MG II, a GLP/GMP support column, is attached with a test chromatogram and a certificate of performance for packing materials used for it. In addition, it is possible to request three columns from three different production lots for a validation purpose.

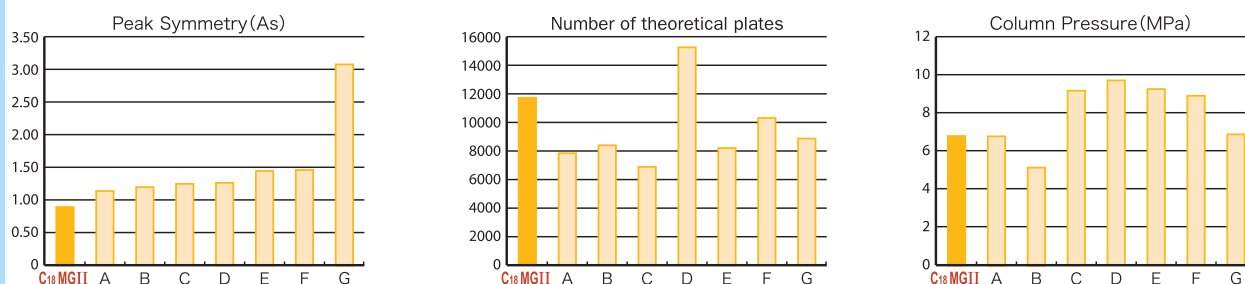
Wide pH range from 2 to 10

CAPCELL PAK C₁₈ MG II is a column having excellent performance and durability. The graphs below show the results of the durability test under acidic and basic conditions, indicating that CAPCELL PAK C₁₈ MG II can be used in a wide pH range.



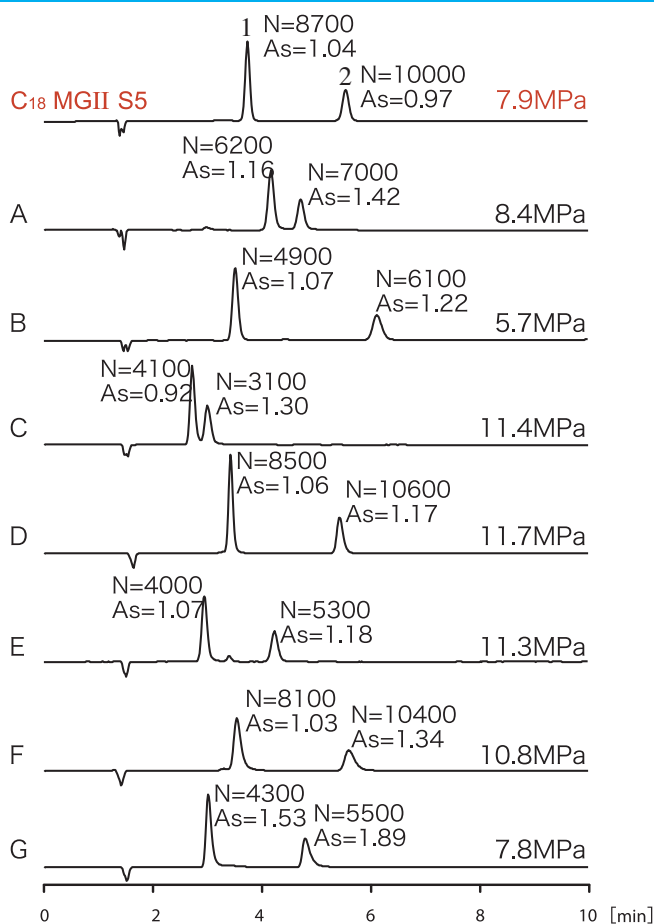
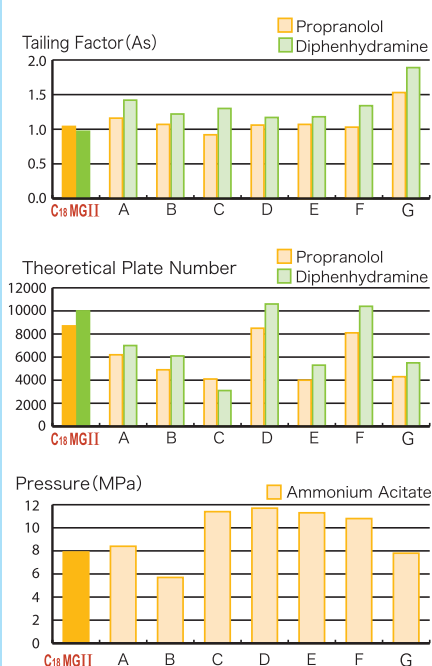
Shielding silanol groups at the highest level

The graphs below show the comparisons among columns of other suppliers in terms of tailing factor (As), Number of theoretical plates, and pressure (MPa) of amitriptyline, which are the indicators of the influences of residual silanol. As for MG II, good values were obtained in the three comparative factors. The results indicate that MG II is the best choice for analysis of basic compounds, and has achieved the highest level in shielding silanol groups.



Analysis using volatile salts

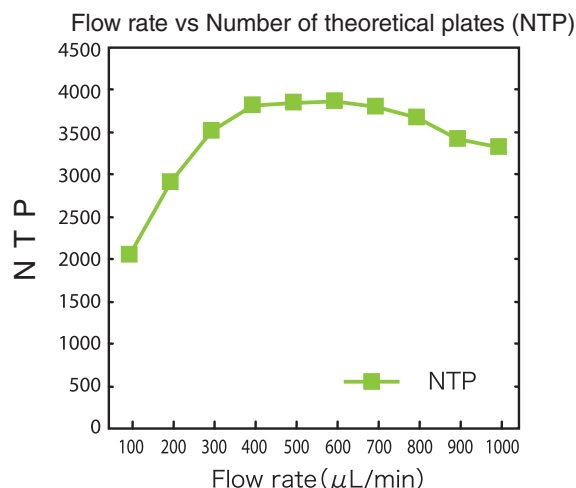
Basic compounds were analyzed with different columns using ammonium acetate, which is a neutral salt often used in LC-MS. Compared with other columns, CAPCELL PAK C₁₈ MG II showed the top level on peak symmetry and number of theoretical plates. In addition, MG II also showed low column pressure, which is one of the features common to all the CAPCELL PAK columns.



Column size : 4.6 mm i.d. x 150 mm
 Mobile phase : 10 mmol/L NH₄AcO, MeOH/H₂O=60/40, pH 7.35
 Flow rate : 1.0 mL/min
 Detection : UV 254 nm
 Injection Vol. : 5 μ L
 Temperature : 40 °C
 Sample : 1. Propranolol (100 ppm)
 2. Diphenhydramine (200 ppm)

3- μm particles for high-throughput analysisCAPCELL PAK C₁₈ MGII S3 Provides the solution to meet the high-throughput demand.

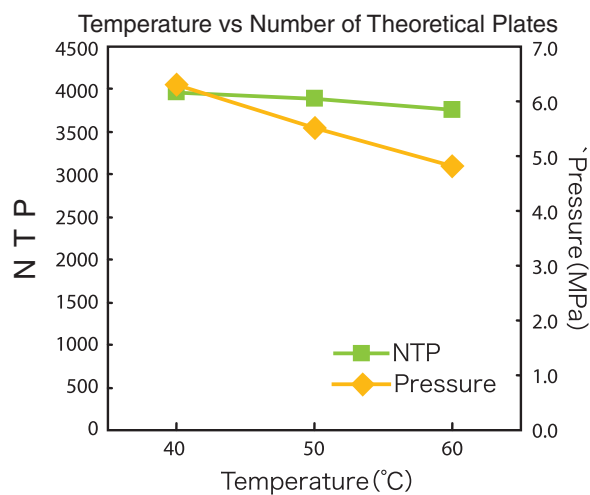
The largest number of theoretical plates is obtained around twice the normal flow rate (200 $\mu\text{L}/\text{min}$ for 2-mm column) and is nearly maintained in the zone of higher flow rates. (Recommended column pressure: 15 MPa or less, Maximum operating pressure: 20 MPa)



Run at more than twice the normal flow rate

- The run time is shortened in inverse proportion to the flow rate!
- Number of theoretical plates increases too!

Sample : Naphthalene
 Injection Vol. : 5 μL
 Column : C₁₈ MGII S-3
 2.0 mm i.d. \times 35 mm
 Mobile phase : CH₃CN/H₂O=50/50
 Temperature : 40 $^{\circ}\text{C}$
 Detection : UV 254 nm



Raise the temperature.

- Lowering pressure and increasing number of theoretical plates!

Sample : Naphthalene
 Injection Vol. : 5 μL
 Column : C₁₈ MGII S-3
 2.0 mm i.d. \times 35 mm
 Mobile phase : CH₃CN/H₂O=50/50
 Flow rate : 400 $\mu\text{L}/\text{min}$
 Detection : UV 254 nm
 Temperature : 40 $^{\circ}\text{C}$, 50 $^{\circ}\text{C}$, 60 $^{\circ}\text{C}$

Popular Column Dimension

| Partial Number | Function Group | Grade | Pore Size (\AA) | Particle Size (μm) | Length (mm) | I.D. (mm) |
|----------------|-----------------|-------|----------------------------|---------------------------------|-------------|-----------|
| 92469 | C ₁₈ | MGII | 100 | 3 | 100 | 2.0 |
| 92470 | C ₁₈ | MGII | 100 | 3 | 150 | 2.0 |
| 92479 | C ₁₈ | MGII | 100 | 3 | 50 | 4.6 |
| 92480 | C ₁₈ | MGII | 100 | 3 | 75 | 4.6 |
| 92481 | C ₁₈ | MGII | 100 | 3 | 100 | 4.6 |
| 92482 | C ₁₈ | MGII | 100 | 3 | 150 | 4.6 |

| Partial Number | Group | Grade | Pore Size (\AA) | Particle Size (μm) | Length (mm) | I.D. (mm) |
|----------------|-----------------|-------|----------------------------|---------------------------------|-------------|-----------|
| 92519 | C ₁₈ | MGII | 100 | 5 | 100 | 2.0 |
| 92520 | C ₁₈ | MGII | 100 | 5 | 150 | 2.0 |
| 92521 | C ₁₈ | MGII | 100 | 5 | 250 | 2.0 |
| 92531 | C ₁₈ | MGII | 100 | 5 | 100 | 4.6 |
| 92532 | C ₁₈ | MGII | 100 | 5 | 150 | 4.6 |
| 92533 | C ₁₈ | MGII | 100 | 5 | 250 | 4.6 |

CAPCELL PAK C₁₈ MG

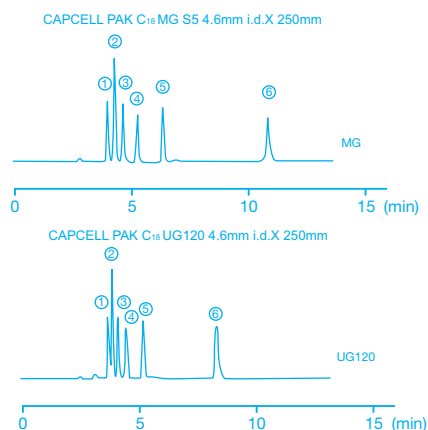
17



MG stands for Miracle Grade. The enhancement of hydrophobicity had previously been considered to conflict with the enhancement of surface polarity. This miraculous packing material, however, achieved an exquisite balance through the fine control of polymer coating and alkyl group introduction.

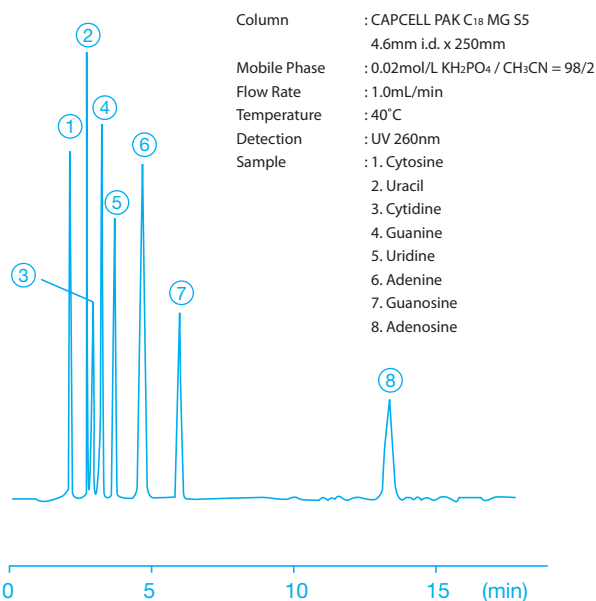
A wide range of compounds (acidic, neutral, and basic compounds, low-polarity to high-polarity compounds, and others) can be efficiently separated. This column is the optimum "first choice", being free of specific selectivity, easy-to-use, available in the pH range 2-10, and extremely durable.

Organic acids

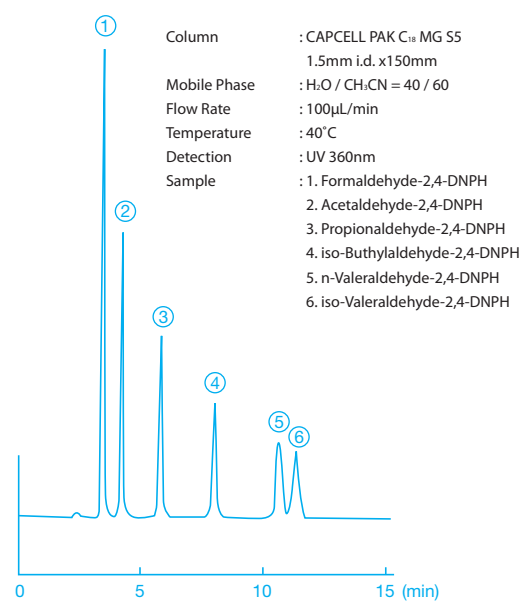


Column : 4.6mm i.d. x 250mm
 Mobile Phase : 0.1vol% H₃PO₄ / CH₃CN = 97.5 / 2.5
 Flow Rate : 1.0mL/min
 Temperature : 40°C
 Detection : UV 210nm
 Sample : 1. Malonic acid
 2. Lactic acid
 3. Acetic acid
 4. Citric acid
 5. Succinic acid
 6. Propionic acid

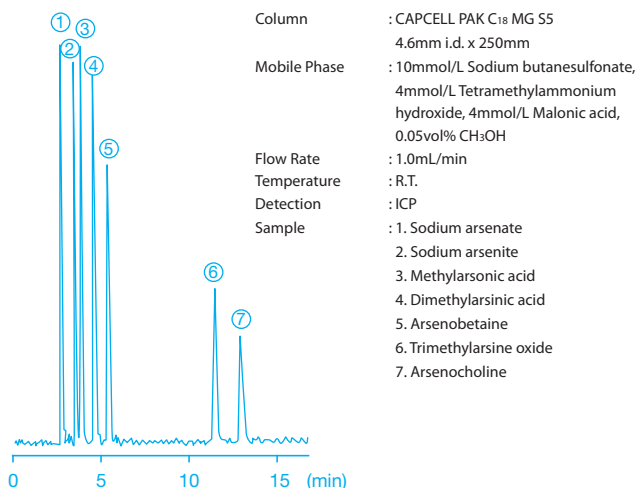
Nucleic acid bases, Nucleosides



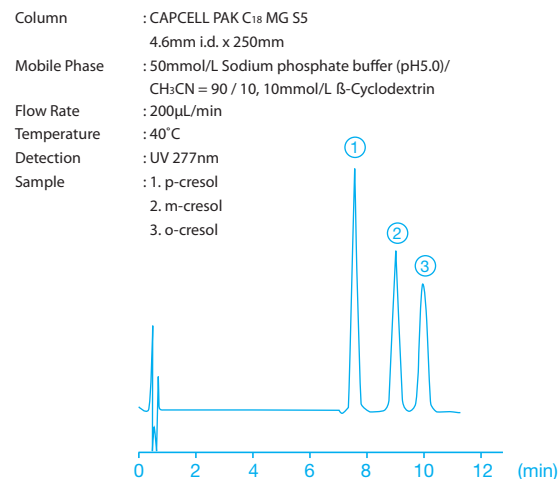
DNPH-aldehydes



Analysis of Arsenic Compounds by LC/ICP



Cresols



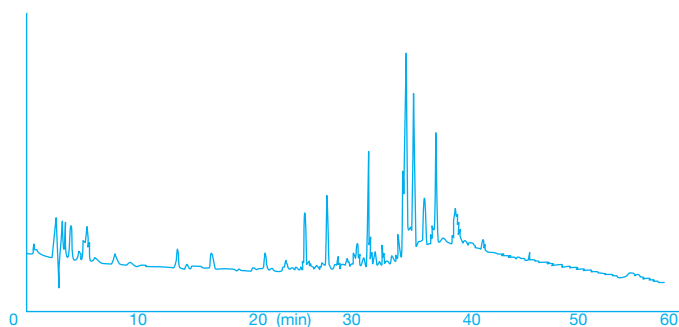
Capillary Columns

The MG S5 and S3 are now available in 0.5mm and 0.3mm i.d. !!

The MG phase is now available in capillary columns to meet the highest sensitivity and resolution, demanded typically in the field of proteomics.

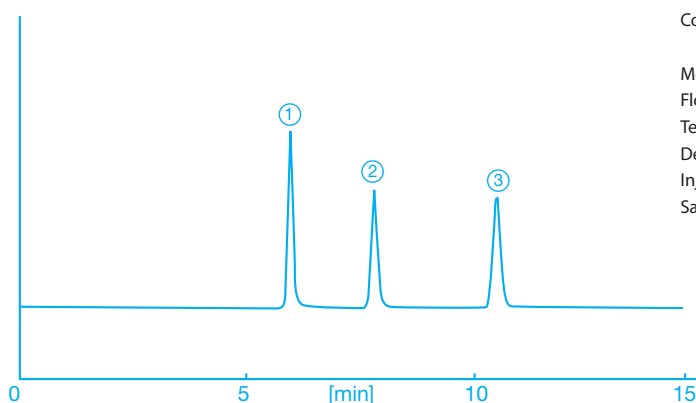
At 150mm length, S5 (5 μ m) and S3 (3 μ m) offer NTP (number of theoretical plates) of over 10,000 and 14,000 respectively.

Peptide Mapping with high Resolution



HPLC Conditions
 Column : CAPCELL PAK C₁₈ MG S3 0.3mm i.d. x 150mm
 Mobile phase : A: 0.05vol% TFA, H₂O
 B: 0.05vol% TFA, CH₃CN
 B: 10%(0min) → 50%(45min) → 50%(60min)
 Flow rate : 5 μ L/min
 Temperature : RT
 Detection : UV 210 nm
 Injection : 60nL
 Sample : Tryptic digest of casein

High NTP and Excellent Peak Symmetry



Column : CAPCELL PAK C₁₈ MGS3
 0.3mm i.d. x 150mm
Mobile phase : H₂O / CH₃CN= 25 / 75(v/v)
Flow rate : 5 μ L/min
Temperature : RT
Detection : UV 254nm
Injection : 60nL
Sample : 1. Ethyl benzene
 2. n-Propyl benzene
 3. n-Butyl benzene

Column Dimension

| phase | type | size | i.d.(mm) | length (mm) |
|-----------------|------|-----------|----------|-------------|
| C ₁₈ | MG | 5 μ m | 0.3 | 150 |
| | | | 0.5 | |
| | | 3 μ m | 0.3 | |
| | | | 0.5 | |

CAPCELL PAK UG (C₁₈, C₈, Ph, CN, NH₂, SCX)

19

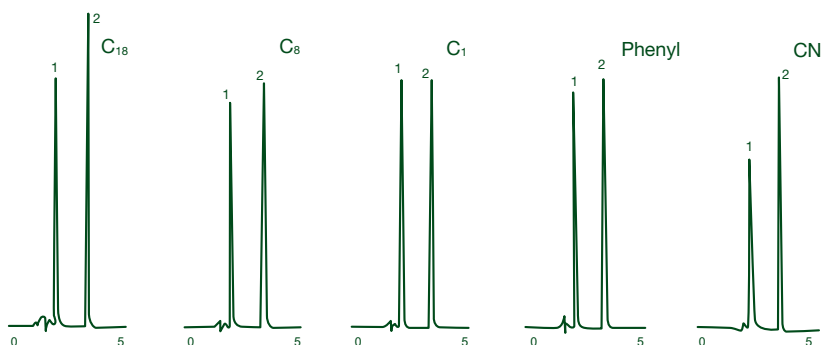


The CAPCELL PAK UG type utilizes a high-purity silica with low metal impurity (<5ppm), that gives a fast separation of basic and polar compounds with sharp symmetrical peaks.

Excellent surface inertness

PYRIDINE/PHENOL TEST

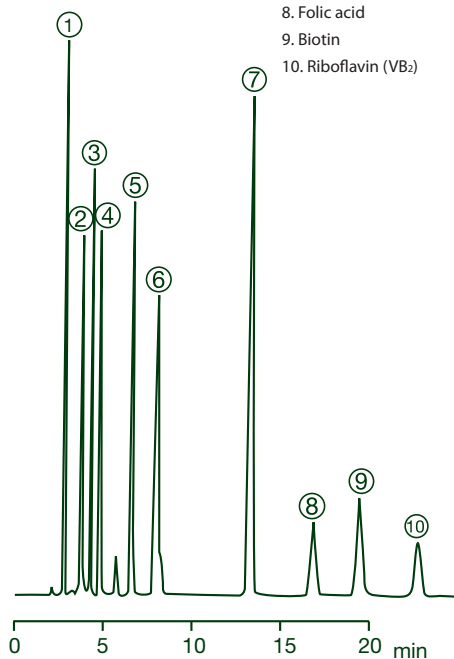
Column : CAPCELL PAK UG120 4.6mm i.d. x 150mm
 Mobile Phase : CH₃CN/H₂O = 30/70
 Flow Rate : 1.0mL/min
 Temperature : 40°C
 Detection : UV 254nm
 Sample : 1. Pyridine
 2. Phenol



C₁₈ UG

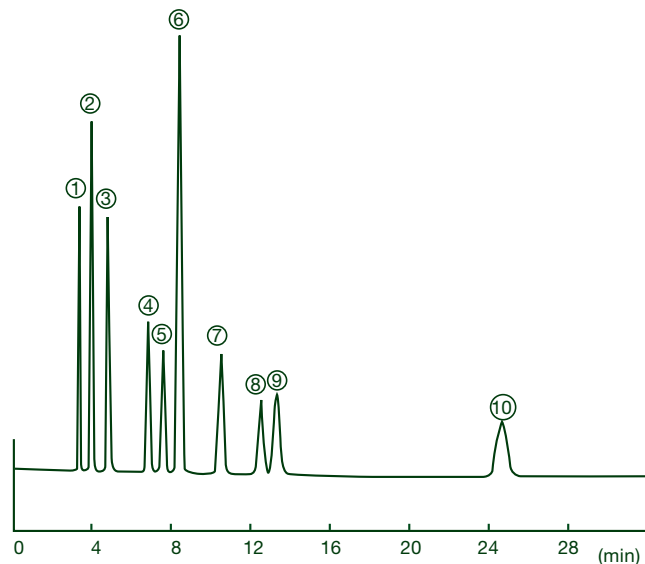
Water soluble vitamins

Column : CAPCELL PAK C₁₈ UG120 S5
 4.6mm i.d. x 150mm
 Mobile Phase : (5mmol/L Sodium hexanesulfonate
 + 20mmol/L H₃PO₄, pH2.3) /
 CH₃CN = 91 / 9
 Flow Rate : 1.0mL/min
 Temperature : 40°C
 Detection : UV 210nm
 Sample : 1. L-Ascorbic acid
 2. Nicotinic acid
 3. Nicotinamide
 4. Sodium pantothenate
 5. Pyridoxine hydrochloride
 6. Riboflavin phosphate
 7. Thiamine
 8. Folic acid
 9. Biotin
 10. Riboflavin (VB₂)



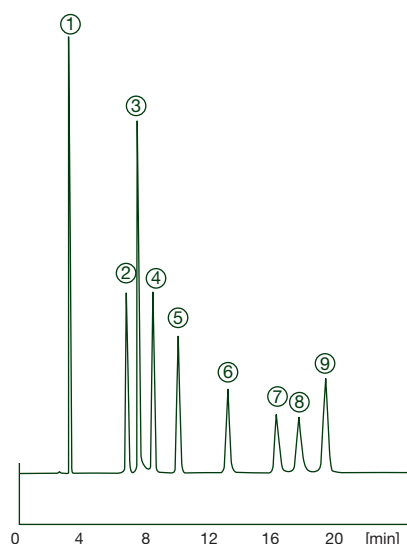
Antiseptics

Column : CAPCELL PAK C₁₈ UG120 S5
 4.6mm i.d. x 150mm
 Mobile Phase : 0.05mol/L NaH₂PO₄, pH4.5 / MeOH /
 CH₃CN = 50 / 35 / 15, 4mmol/L
 Cetyltrimethyl ammonium chloride
 Flow Rate : 1.0mL/min
 Temperature : 40°C
 Detection : UV 235nm
 Sample : 1. Methylparaben
 2. p-Hydroxy benzoic acid
 3. Ethylparaben
 4. Dehydroacetic acid
 5. n-Propylparaben
 6. Sorbic acid
 7. Benzoic acid
 8. Iso-Butylparaben
 9. n-Butylparaben
 10. Salicylic acid



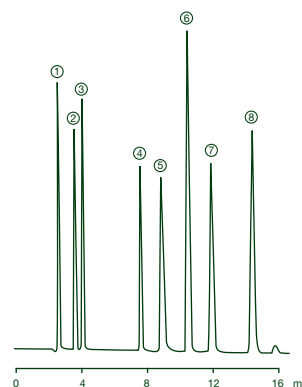
Acidic hair dyes

| | |
|--------------|---|
| Column | : CAPCELL PAK C ₁₈ UG120 S5 4.6mm i.d. x 150mm |
| Mobile Phase | : 50mmol/L Sodium 1-octanesulfonate / CH ₃ OH = 60 / 40 (pH2.5, H ₃ PO ₄) |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 280nm |
| Sample | : 1. Resorcin 2. p-Aminophenol 3. p-Nitro-o-phenylenediamine 4. m-Aminophenol 5. o-Aminophenol 6. m-Phenylenediamine 7. p-Phenylenediamine 8. p-Toluenediaminosulfonate 9. p-Amino-o-cresol |



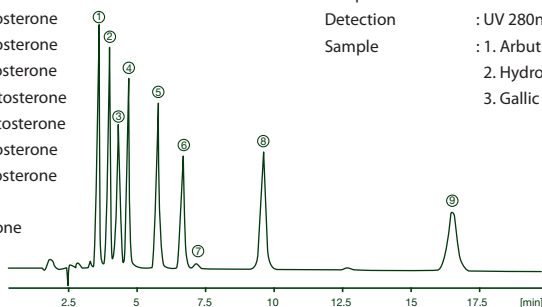
Ingredients of cold medicines

| | |
|--------------|--|
| Column | : CAPCELL PAK C ₁₈ UG120 S5 4.6mm i.d. x 150mm |
| Mobile Phase | : 0.05mol/L NaH ₂ PO ₄ / CH ₃ CN = 20 / 80 (pH2.5, H ₃ PO ₄) |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 280nm |
| Sample | : 1. Potassium guaiacolsulfonate 2. Acetaminophen 3. Caffeine 4. Salicylamide 5. Chlorpheniramine maleate 6. Phenol(I.S.) 7. Aspirin 8. Ethenzamide |



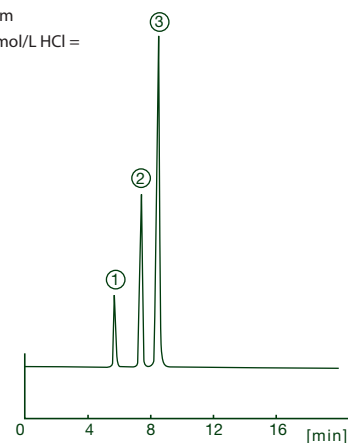
Metabolites of testosterone

| | |
|--------------|---|
| Column | : CAPCELL PAK C ₁₈ UG120 S3 4.6mm i.d. x 150mm |
| Mobile Phase | : H ₂ O / CH ₃ OH / THF = 55 / 38 / 7 |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : 1. 6 α -Hydroxytestosterone 2. 7 α -Hydroxytestosterone 3. 6 β -Hydroxytestosterone 4. 16 α -Hydroxytestosterone 5. 16 β -Hydroxytestosterone 6. 2 α -Hydroxytestosterone 7. 2 β -Hydroxytestosterone 8. Androsterone 9. Methyltestosterone |



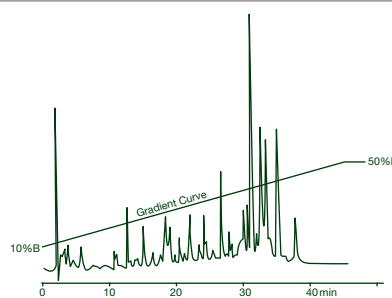
Active ingredients of bearberry leaf

| | |
|--------------|--|
| Column | : CAPCELL PAK C ₁₈ UG120 S5 4.6mm i.d. x 150mm |
| Mobile Phase | : H ₂ O / CH ₃ OH / 0.1mol/L HCl = 94 / 5 / 1 |
| Flow Rate | : 0.6mL/min |
| Temperature | : 20°C |
| Detection | : UV 280nm |
| Sample | : 1. Arbutin 2. Hydroquinone 3. Gallic acid |



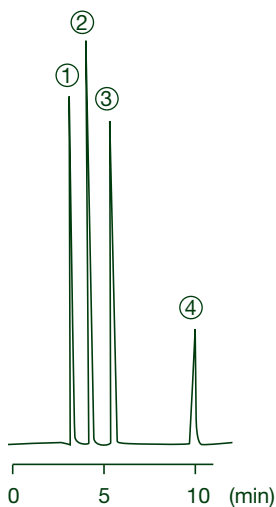
Tryptic digest of casein (peptide mapping)

| | |
|--------------|--|
| Column | : CAPCELL PAK C ₁₈ UG120 S5 1.0 mm i.d. x 250 mm |
| Mobile Phase | : A : 0.1vol% TFA, H ₂ O B : 0.1vol% TFA, CH ₃ CN B 10% - 50% (45min) Gradient |
| Flow Rate | : 70 μ L/min |
| Temperature | : 35°C |
| Detection | : UV 210nm |
| Sample | : 1. Tryptic digest of casein |



C₈ UG120

Suitable for quick separation of polar compounds, which used to be retained too long in other C₁₈ phases.



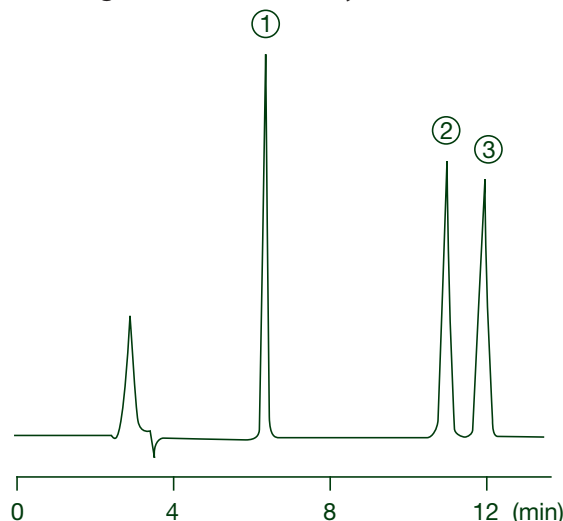
| | |
|--------------|---|
| Column | : CAPCELL PAK C ₈ UG120 S5 4.6mm i.d. x 150mm |
| Mobile Phase | : 0.1vol% H ₃ PO ₄ / CH ₃ OH = 70 / 30 |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : 1. Hydroquinone 2. Resorcin 3. Catechol 4. Phenol |

Ph UG120

Used for obtaining a different selectivity for analytes possessing an aromatic moiety.

Antiepileptics

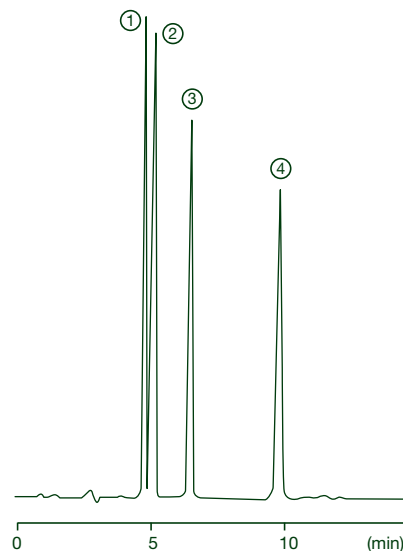
| | |
|--------------|---|
| Column | : CAPCELL PAK Ph UG120 S5 4.6mm i.d. x 150mm |
| Mobile Phase | : { 50mmol/L Na ₂ HPO ₄ + 50mmol/L KH ₂ PO ₄ (pH6.8) } / CH ₃ CN = 70 / 30 |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : 1. Phenobarbital 2. Carbamazepine 3. Phenytoin |

**CN UG120**

A phase having the least retentive nature of all reversed phases and a different selectivity brought by cyano groups.

Steroids

| | |
|--------------|---|
| Column | : CAPCELL PAK CN UG120 S5 4.6mm i.d. x 150mm |
| Mobile Phase | : CH ₃ CN / H ₂ O = 35 / 65 |
| Flow Rate | : 1.0mL/min |
| Temperature | : 35°C |
| Detection | : UV 242nm |
| Sample | : 1. Cortisol 2. Cortisone 3. Corticosterone 4. Testosterone |

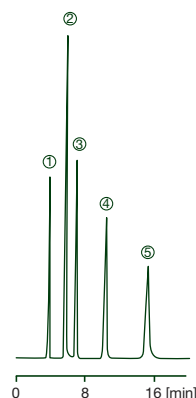


NH₂ UG80

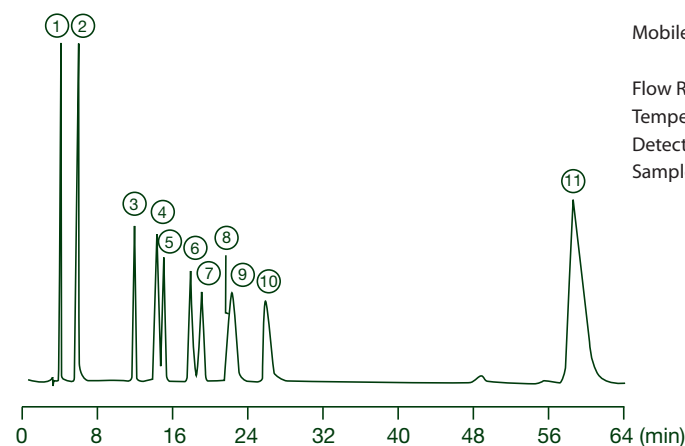
To be used as a normal phase under a water/organic mobile phase, or a weak anion exchanger under an acidic buffer.

Nucleotides

| | |
|--------------|--|
| Column | : CAPCELL PAK NH ₂ UG80 S5 4.6mm i.d. x 250mm |
| Mobile Phase | : 0.05mol/L (NH ₄) ₂ HPO ₄ (pH3.0) |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : 1. 5'-CMP 2. 5'-AMP 3. 5'-UMP 4. 5'-IMP 5. 5'-GMP |

**SCX UG80**

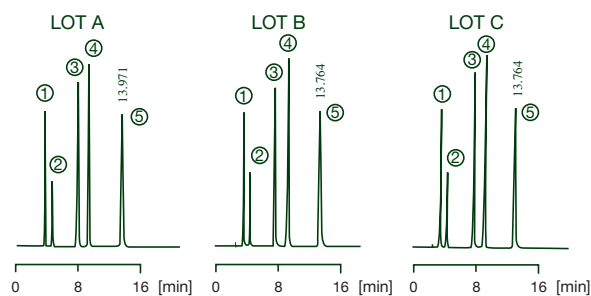
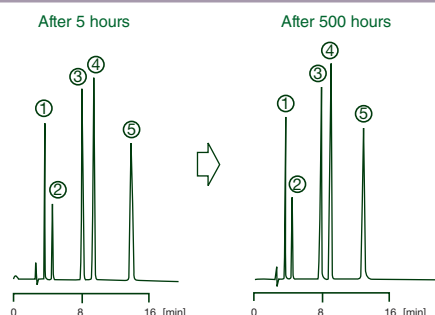
A strong cation exchanger used for basic compounds.

Determination of biogenic amines

| | |
|--------------|---|
| Column | : CAPCELL PAK SCX UG80 4.6mm i.d. x 150mm |
| Mobile Phase | : 0.2mol/L CH ₃ COONa + 0.02mol/L CH ₃ COOH (pH5.6) |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : 1. Dopa 2. Creatinine 3. Norepinephrine 4. Epinephrine 5. Octopamine 6. Normetanephrine 7. Dopamine 8. Isoproterenol 9. Metanephrine 10. Tyramine 11. Serotonin |

Excellent lot-to-lot reproducibility

| | |
|--------------|--|
| Column | : CAPCELL PAK SCX UG80 4.6mm i.d. x 150mm |
| Mobile Phase | : 0.2mol/L NH ₄ H ₂ PO ₄ (pH3.5) |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : 1. Uracil 2. Thymine 3. Guanine 4. Cytosine 5. Adenine |

**Highly durable**

| | |
|--------------|--|
| Column | : CAPCELL PAK SCX UG80 4.6mm i.d. x 150mm |
| Mobile Phase | : 0.2mol/L NH ₄ H ₂ PO ₄ (pH3.5) |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : 1. Uracil 2. Thymine 3. Guanine 4. Cytosine 5. Adenine |

CAPCELL PAK C₁₈ ACR

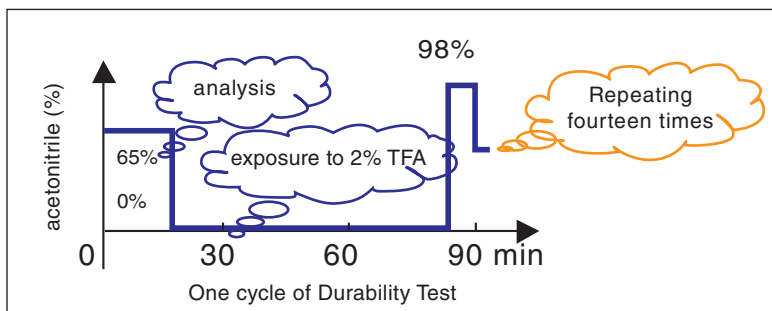
23



CAPCELL PAK C₁₈ ACR was synthesized through a modified polymer-coating technique, and intended to show an outstanding durability under an acidic mobile phase. Its performance was proven in the evaluation method originally designed for acidic resistance.

* ACR Capillary Columns are also available

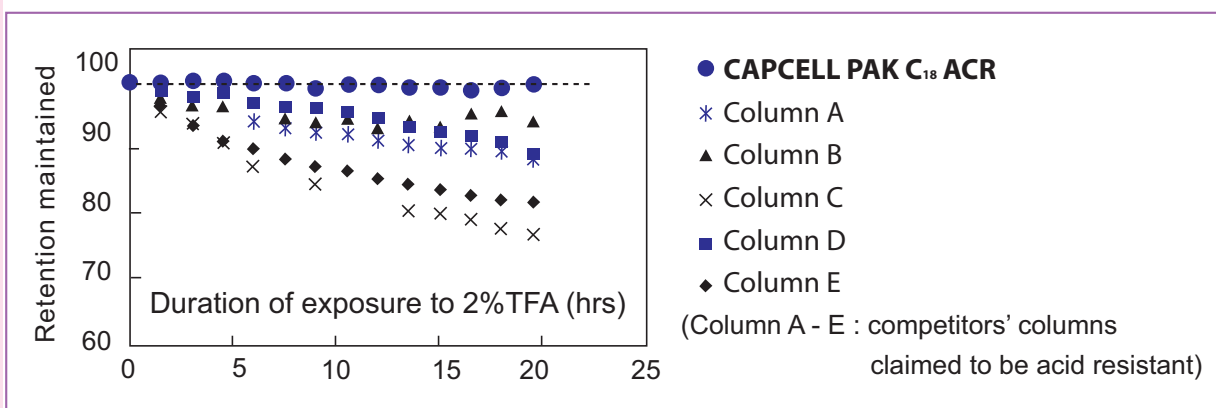
Acidic resistance test



HPLC conditions
 Column : C₁₈ ACR 4.6mm i.d.x150mm
 Mobile phase : A: 2vol% TFA in H₂O (pH1)
 B: 2vol% TFA in CH₃CN
 B: 65%(20min) - 0%(60min) - 98%(5min) - 65%(5min)
 Flow rate : 1.0mL/min
 Temperature : 60°C
 Detection : UV 254 nm
 Injection : 7μL
 Sample : uracil, amylbenzene



Comparison of Acidic Resistance



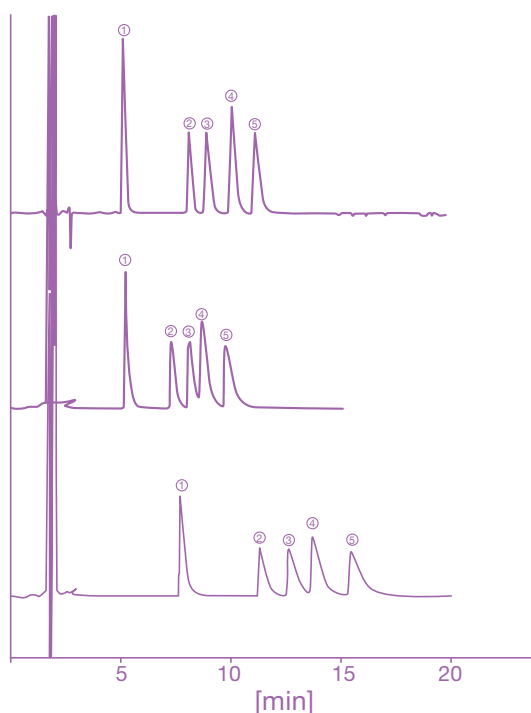
CAPCELL PAK C₁₈ ACR compared to other CAPCELL PAK C₁₈ phases

| Type | Surface Area m ² /g | Pore Volume mL/g | Pore Size nm | Particle Diameter μm | Carbon Content % |
|-------|-----------------------------------|---------------------|-----------------|-------------------------|---------------------|
| ACR | 340 | 0.8 | 8 | 5 | 18 |
| MG | 260 | 0.9 | 10 | 5 | 15 |
| UG120 | 300 | 1.0 | 12 | 5 | 15 |
| UG80 | 340 | 0.8 | 8 | 5 | 18 |

ACR Applications

Basic Compounds...Tricyclic antidepressants

Peaks of tricyclic antidepressants, highly basic compounds, are known to be easily affected by residual silanols of a stationary phase. The tendency is pronouncing under acidic mobile phases commonly used in LC-MS. The following comparison is performed between CAPCELL PAK C₁₈ ACR and Column F, one of the major commercial columns, using five typical antidepressants. The ACR column shows a good baseline separation for these compounds, while Column F shows a very unstable retention behavior, influenced by a slight change in organic content in a mobile phase. The inertness of the ACR column was explained by its completely polymer-coated surface structure.



CAPCELL PAK C₁₈ ACR
Mobile Phase
0.1vol% HCOOH, CH₃CN / H₂O = 25 / 75

Column F
Mobile Phase
0.1vol% HCOOH, CH₃CN / H₂O = 33 / 67

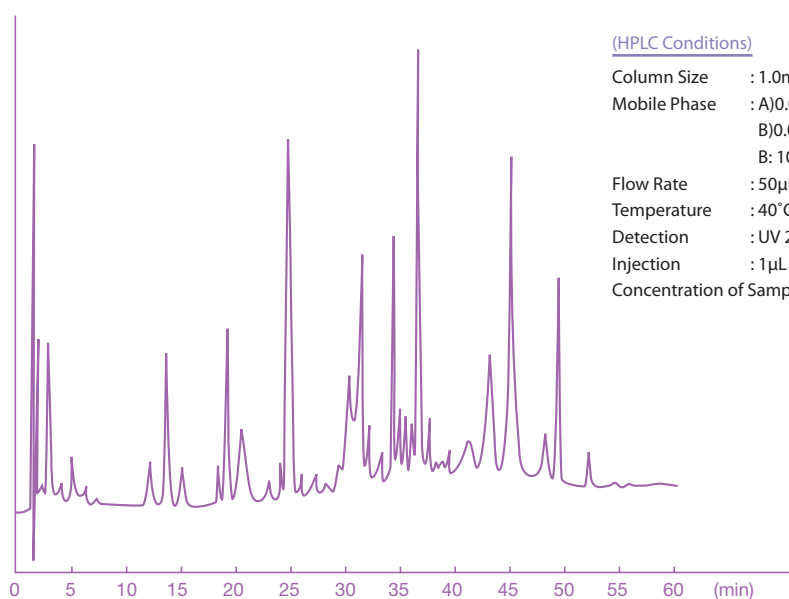
Column F
Mobile Phase
0.1vol% HCOOH, CH₃CN / H₂O = 32 / 68

(HPLC Conditions)

Column Size : 4.6mm i.d.x150mm
Flow Rate : 1.0mL/min
Temperature : 40°C
Detection : UV 210nm
Samples : ① Doxepine
 ② Desipramine
 ③ Imipramine
 ④ Nortriptyline
 ⑤ Amitriptyline

Peptide Mapping

Tryptic digest of fetuin



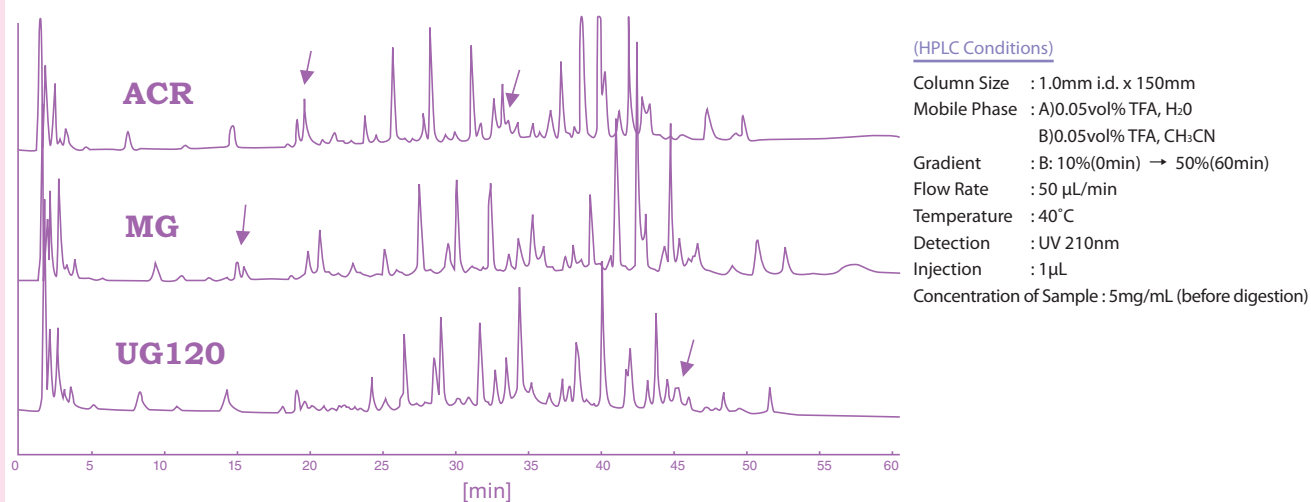
(HPLC Conditions)

Column Size : 1.0mm i.d. x 150mm
Mobile Phase : A) 0.05%vol TFA, H₂O
 B) 0.05%vol TFA, CH₃CN
 B: 10%(0min) → 50%(60min)
Flow Rate : 50μL/min
Temperature : 40°C
Detection : UV 210nm
Injection : 1μL
Concentration of Sample : 7.5mg/mL (before digestion)



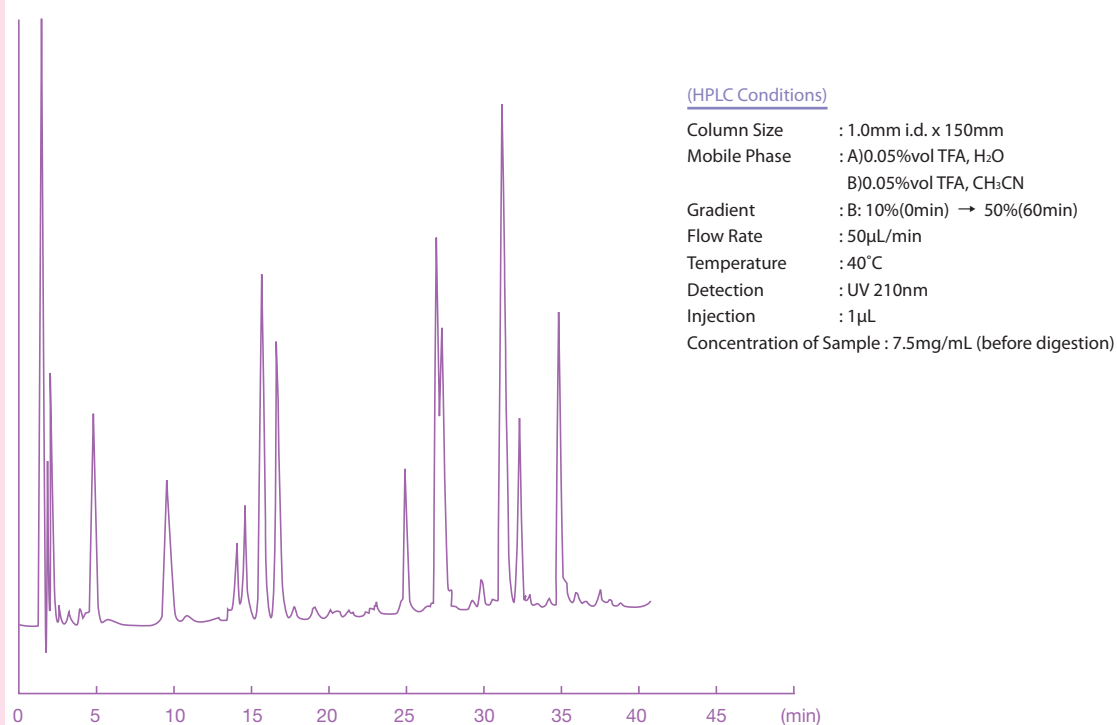
Tryptic digest of casein

Profiles of tryptic digest of casein obtained with **CAPCELL PAK ACR, MG, and UG120** are compared as shown below. Acidic mobile phases are commonly used in peptide mapping based on reversed-phase chromatography.



Some selectivity differences (indicated with arrows) were observed among these columns.

Tryptic digest of cytochrome C



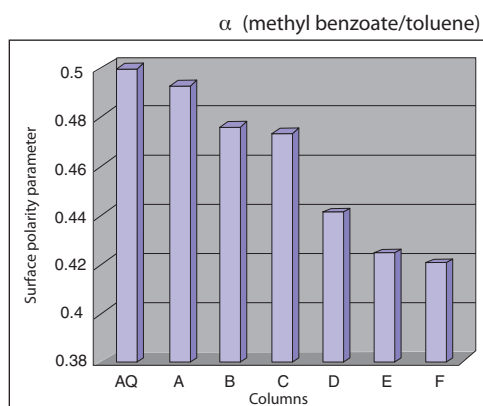
CAPCELL PAK C₁₈ AQ

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CAPCELL PAK C₁₈ AQ was intended for separating highly polar compounds under water (buffer) rich mobile phase. Its C₁₈ group density was designed to be small, and shows a relatively small carbon content. The surface excess of organic solvent molecules on the stationary phase is adequately limited, and a stable retention of analytes can be obtained even under an aqueous mobile phase.

Surface polarity parameter of typical reversed-phase C₁₈ columns



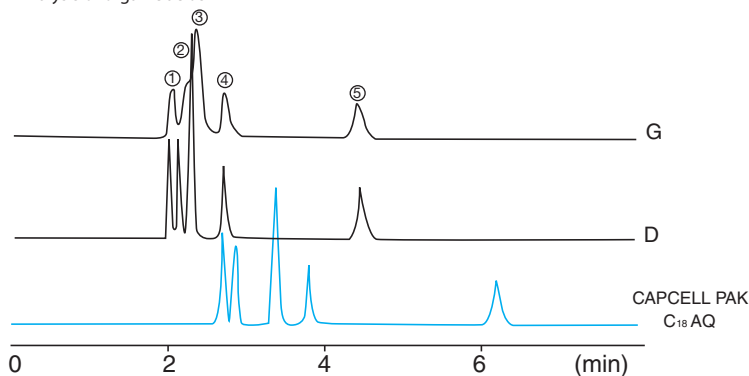
characteristics

| Column | Specific surface area of silica support (m ² /g) | Carbon content (C%) |
|--------------------------------|---|---------------------|
| CAPCELL PAK C ₁₈ AQ | 300 | 11 |
| CAPCELL PAK C ₁₈ MG | 260 | 15 |
| CAPCELL PAK C ₁₈ UG | 300 | 15 |

Excellent retention of polar compounds

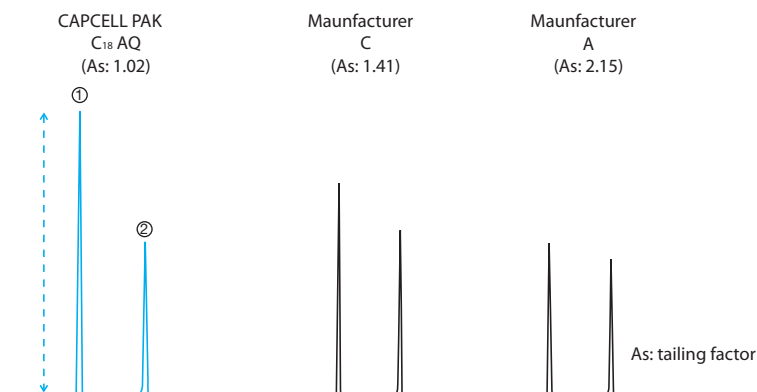
Column : 4.6mm i.d. x 150 mm
 Mobile Phase : 0.1vol% H₃PO₄
 CH₃CN / H₂O = 2/ 98
 Flow Rate : 1.0 mL/min
 Temperature : 40°C
 Detection : UV 210 nm
 Samples : 1) Lactic acid 2) Acetic acid
 3) Citric acid 4) Succinic acid
 5) Propionic acid

Analysis of organic acids



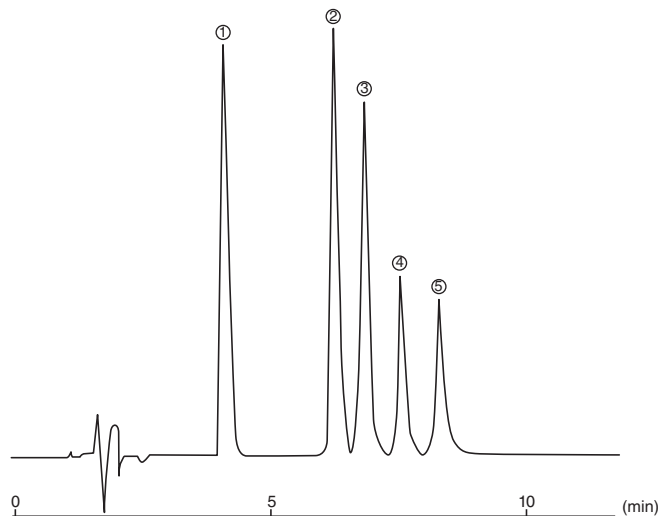
The peak shape of basic compounds represented by pyridine is almost symmetrical without tailing.

Column : 4.6mm i.d. x 150 mm
 Mobile Phase : CH₃CN / H₂O = 30 / 70
 Flow Rate : 1.0 mL/min
 Temperature : 40°C
 Detection : UV 254 nm
 Samples : 1) Pyridine
 2) Phenol



Good peak shape of basic compounds under slightly acidic conditions.

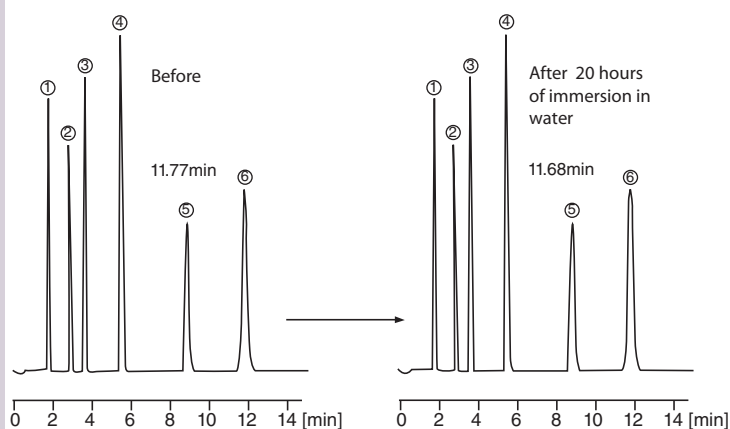
Analysis of tricyclic antidepressants



| | | |
|--------------|--|------------------|
| Column | : 4.6mm i.d. x 150 mm | |
| Mobile phase | : 0.1vol% HCOOH, CH ₃ CN /H ₂ O = 25 / 75 | |
| Flow Rate | : 1.0 mL/min | |
| Temperature | : 40°C | |
| Detection | : UV 210 nm | |
| Samples | 1) Doxepine | 4) Nortriptyline |
| | 2) Desipramine | 5) Amitriptyline |
| | 3) Imipramine | |

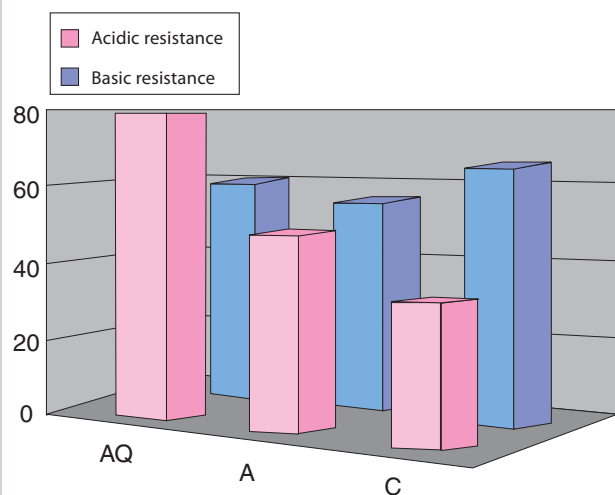
Compatible with a mobile phase of 100% water

Analysis of nucleic acid base

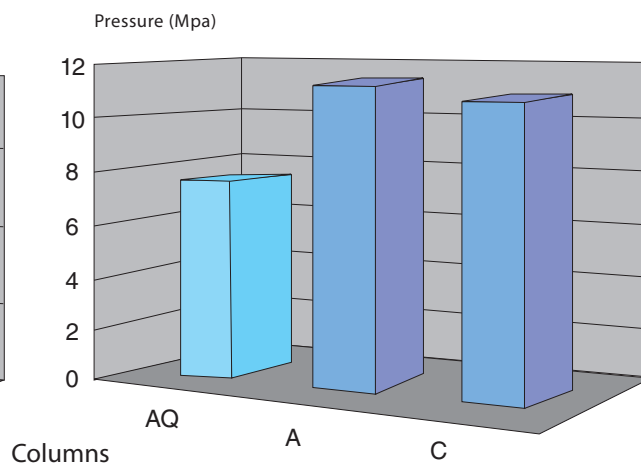


| | | |
|--------------|--|------------|
| Column | : 4.6 mm i.d. x 150 mm | |
| Mobile phase | : 20 mmol/L KH ₂ PO ₄ , 20 mmol/L K ₂ HPO ₄ | |
| Flow rate | : 1.0 mL/min | |
| Temperature | : 40°C | |
| Detection | : UV 254 nm | |
| Samples | 1) Sodium nitrite | 4) Guanine |
| | 2) Cytosine | 5) Thymine |
| | 3) Uracil | 6) Adenine |

Superior resistance to acidic and Basic conditions



Excellent durability due to low column pressure



CAPCELL PAK CR

28



CR...Strong Cation Exchange & Reversed Phase

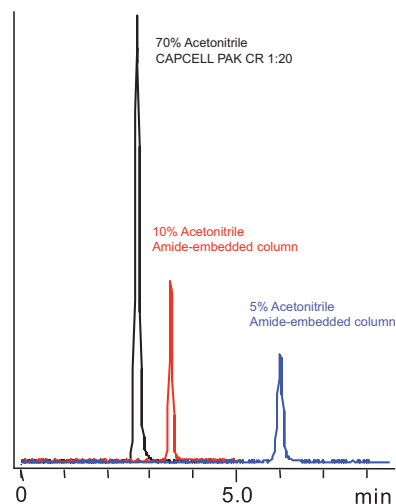
As a method to improve the sensitivity of basic drugs and their metabolites in LC-MS, Shiseido has developed a unique stationary phase.

The new product, "CAPCELL PAK CR," is a single column in which SCX and C₁₈ are mixed inside. The CR column is available with different mixing ratios that were not possible to obtain by connecting two columns; SCX:C₁₈ = 1:50, 1:20 and 1:4. Simply choose the optimum column that best suits your separation.

They are intended to elute basic compounds possessing a certain level of hydrophobicity under a mobile phase with a higher organic content than that for C₁₈ phases, for obtaining a higher sensitivity in LC-MS, or simply to obtain an altered separation selectivity.

Sensitivity increase in LC-MS

When a very hydrophilic and basic compound is to be analyzed in LC-MS, the choice of mobile phase may not be straightforward. An acidity and a large organic content are preferred to obtain a good ionization efficiency (sensitivity), while an organic content is limited in order to keep an adequate retention on reversed phase. CAPCELL PAK CR makes it possible to use a large organic content in a mobile phase for hydrophilic compounds, such as procaine, while only a very small organic content is allowed even for an amide-embedded column, a column considered suitable for such polar compounds.

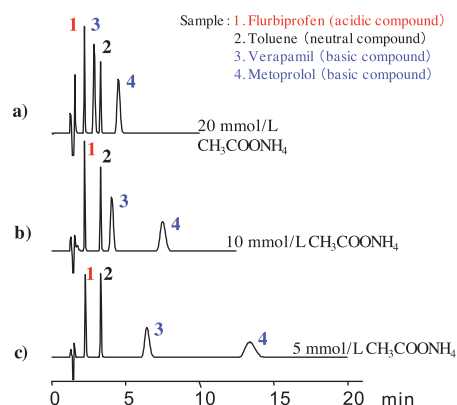


Conditions

| | |
|--------------|---|
| Column | : Black : CAPCELL PAK CR 1 : 20 2.0 mm i.d. x 150 mm Red and blue : Amide-embedded column 2.1 mm i.d. x 150 mm |
| Mobile phase | : A) 10 mmol/L HCOONH ₄ (adjusted at pH3 with HCOOH) B) CH ₃ CN A / B : Black 30 / 70, Red 90 / 10, Blue 95 / 5 |
| Flow rate | : 200 μL/min |
| Temp. | : 40 °C |
| Detection | : MS, ESI, Positive mode |
| Inj. vol. | : 2 μL |
| Sample | : Procaine |

Simultaneous analysis of acidic/neutral/basic materials

CAPCELL PAK CR allows the analysis of not only basic compounds but the simultaneous analysis of neutral and acidic compounds. By varying the salt concentration in the mobile phase, it is also possible to independently adjust the retention of the basic compound.

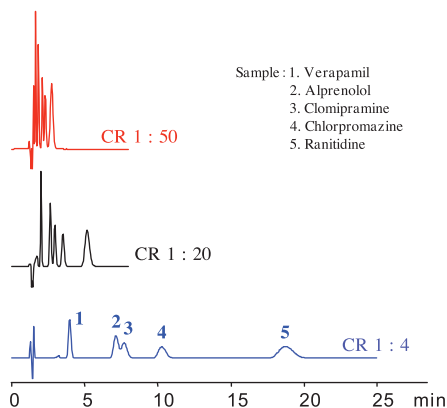


Conditions

| | |
|--------------|---|
| Column | : CAPCELL PAK CR 1 : 4 |
| Column size | : 2.0 mm i.d. x 150 mm |
| Mobile phase | : a) 20 mmol/L CH ₃ COONH ₄ (adjusted at pH4.0 with CH ₃ COOH) / CH ₃ CN = 30 / 70 b) 10 mmol/L CH ₃ COONH ₄ (adjusted at pH4.0 with CH ₃ COOH) / CH ₃ CN = 30 / 70 c) 5 mmol/L CH ₃ COONH ₄ (adjusted at pH4.0 with CH ₃ COOH) / CH ₃ CN = 30 / 70 |
| Flow rate | : 200 μL/min |
| Temp. | : 40 °C |
| Detection | : UV 220 nm |
| Inj. vol. | : 1 μL |

Choice of three different ratios

Reducing run time and improving the separation profile are possible with the same mobile phase condition by choosing a different mixing ratios available in CAPCELL PAK CR.



Conditions

| | |
|--------------|--|
| Column | : Red : CAPCELL PAK CR 1 : 50 Black : CAPCELL PAK CR 1 : 20 Blue : CAPCELL PAK CR 1 : 4 |
| Column size | : 2.0 mm i.d. x 150 mm |
| Mobile phase | : 10 mmol/L HCOONH ₄ (adjusted at pH 3.0 with HCOOH) / CH ₃ CN = 30 / 70 |
| Flow rate | : 200 μL/min |
| Temp. | : 40 °C |
| Detection | : UV 220 nm |
| Inj. vol. | : 2 μL |
| Sample | : Basic compounds 5 types |

CAPCELL PAK CR -Atlas-

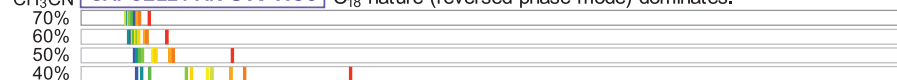
CAPCELL PAK C₁₈, CAPCELL PAK SCX, and three types of CAPCELL PAK CR columns were compared in the separations of ten typical basic compounds. The figures below show structure, pKa value, and change in retention time and selectivity under different mobile phases, for each compound. While CR 1:50 and CR 1:20 generally show selectivity close to those of C₁₈, CR 1:4 has selectivity totally different from those of C₁₈ and SCX. It is advised to utilize the results for method developments of other basic compounds.

A. Ohkubo et al. *J.Chromatogr. A* 779 (1997) 113-122.

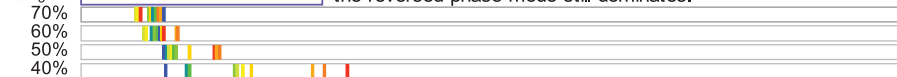
CH₃CN **C₁₈** The C₁₈ phase retains compounds based on the hydrophobicity of the alkyl groups.



CH₃CN **CAPCELL PAK CR 1:50** Slight cation-exchange effect is added, but the C₁₈ nature (reversed-phase mode) dominates.



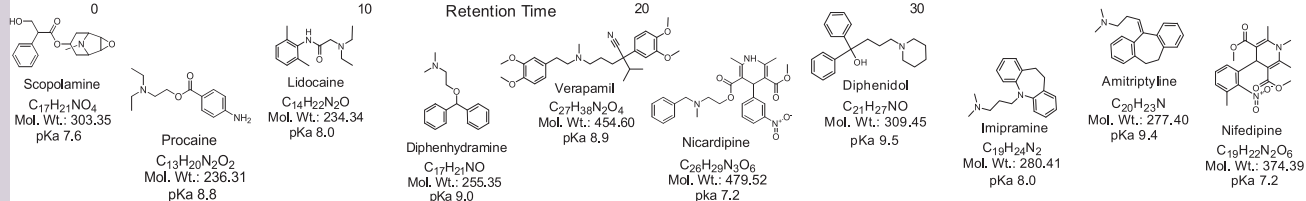
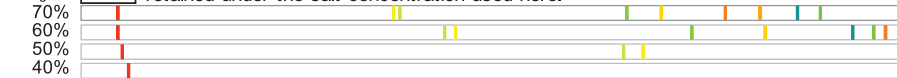
CH₃CN **CAPCELL PAK CR 1:20** Cation-exchange effect is further added, but the reversed-phase mode still dominates.



CH₃CN **CAPCELL PAK CR 1:4** The phase has a selectivity totally different from those of C₁₈ and SCX.

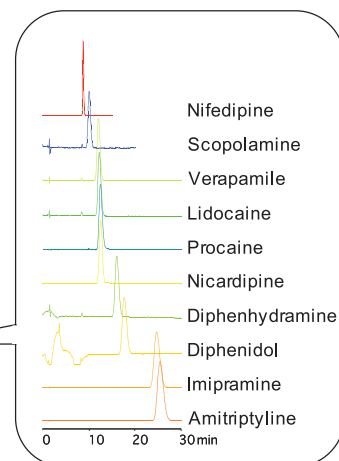


CH₃CN **SCX** Cation-exchange effect dominates. Cationic compounds are strongly retained under the salt concentration used here.



HPLC Conditions

| | |
|---------------------|---|
| Column size | : 2.0 mm i.d. x 150 mm |
| Mobile phase | : 10 mmol/L HCOONH ₄ (pH3, HCOOH) / CH ₃ CN |
| Flow rate | : 200 ml/min |
| Temp. | : 40 °C |
| Inj. vol. | : 2mL |
| Sample dissolved in | : CH ₃ OH |



CAPCELL PAK C₈ DD (Double Durability)

CAPCELL PAK C₈ DD, Different performances from those of conventional C₈ phases

Alkyl groups attached to silica-based packing material are cleaved when used in an acidic mobile phase for a long period of time. When used in a basic mobile phase, the silica support dissolves thus destroying the column. Durability of reversed phases has a tendency to decrease as the length of the alkyl group decreases. CAPCELL PAK C₈ DD (Double Durability) is a column with unparalleled acidic and basic resistance. The high surface polarity and smaller hydrophobicity, compared to C₁₈ columns, make this product the best choice for short-time analysis of mixtures with diverse hydrophobicities.

Excellent durability (pH range : 1.5 – 10)

Excellent Acidic resistance

Acidic resistance depends on the concentration of the organic content in a mobile phase. It is known that the higher the concentration of the organic content is, the more difficult it is to cleave the Si-C bond. The test method here uses a mobile phase of pH 1 with no organic solvent, thus representing an extremely harsh acidic condition.

*Acidic resistance test conditions

| | |
|--------------|---|
| Mobile phase | : (A) 2 vol% TFA, H ₂ O, pH1 (B) 2 vol% TFA, CH ₃ CN B 65% (20min)>0% (60min) >98% (5min)>65% (5min) |
| Flow rate | : 1.0 mL/min |
| Temperature | : 60 °C |
| Detection | : UV 254 nm |
| Sample | : Uracil, amylbenzene |

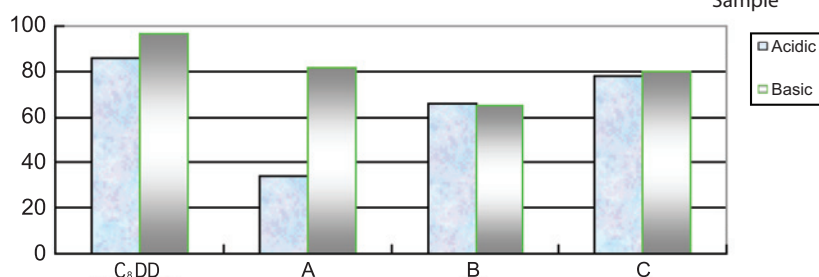
Excellent Basic resistance

Silica is not hydrolysed under acidic conditions, but unstable under neutral to basic conditions. The test method uses a mobile phase of pH 10 which represents an extremely harsh basic condition.

*Basic resistance test conditions

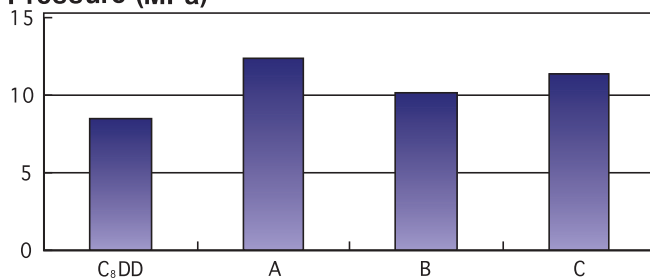
| | |
|--------------|---|
| Column | : 4.6mm i.d. x150mm |
| Mobile phase | : 4 mmol/L Na ₂ B ₄ O ₇ /CH ₃ CN=90/10, pH 10.0 |
| Flow rate | : 1.0 mL/min |
| Temperature | : 50 °C |
| Detection | : UV 254 nm |
| Sample | : Uracil, amylbenzene |

Durability (%)



Low back pressure

Pressure (MPa)



Conditions

| | |
|--------------|---|
| Column | : 4.6mm i.d. x150mm |
| Mobile phase | : H ₂ O/CH ₃ CN=50/50 |
| Flow rate | : 1.0 mL/min |
| Temperature | : 40°C |



Excellent peak shape of basic compounds

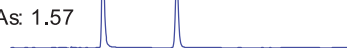
The polymer coating technology used for CAPCELL PAK C₈ DD resulted in showing excellent peak shapes for basic compounds. The figure down on the left is the comparison with other columns in "pyridine/phenol test", an evaluation method commonly used for silanol effects. A good separation was also obtained for five tricyclic antidepressants, highly basic compounds (down, left).

Pyridine/phenol test

As: 1.02



As: 1.57



As: 1.36

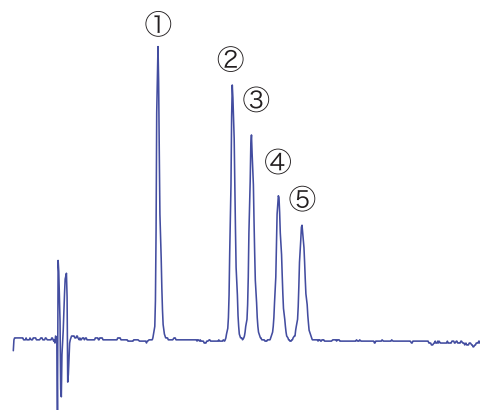


As: 2.61



Condition
 Column : Capcell Pak C₈ DD S5
 4.6 mm i.d. x150mm
 Mobile phase : H₂O/CH₃CN=30/70
 Flow rate : 1.0 mL/min
 Temperature : 40 °C
 Samples : 1) Pyridine 2) Phenol

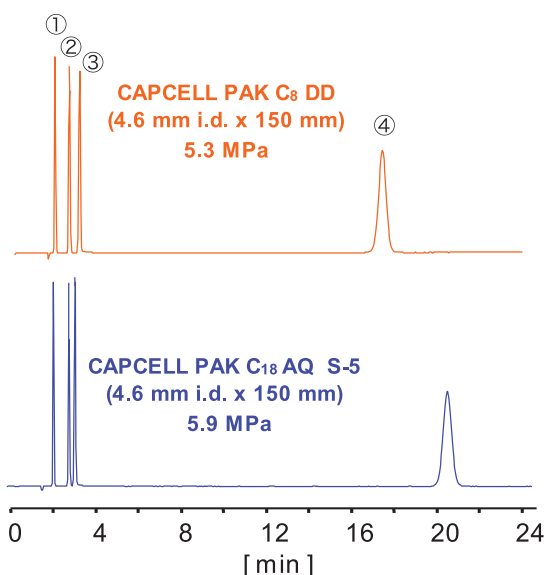
Analysis of tricyclic antidepressants



Column : Capcell Pak C₈ DD S5
 4.6 mm i.d. x150mm
 Mobile phase : 0.1 vol% HCOOH,
 CH₃CN/H₂O=25/75
 Flow rate : 1.0 mL/min
 Temperature : 40 °C
 Detection : UV 254 nm
 Samples : 1) Doxepine 2) Desipramine
 3) Imipramine 4) Nortriptyline
 5) Amitriptyline

Suitable for quickly separating mixtures with diverse hydrophobicity

This is a comparison between CAPCELL PAK C₁₈ AQ, and CAPCELL PAK C₈ DD column. Due to large hydrophobicity corresponding to the long functional group, CAPCELL PAK C₁₈ AQ requires more time to elute ibuprofen that has a relatively high hydrophobicity. On the other hand, C₈ DD column, with its low hydrophobicity, is capable of separating the sample in a much shorter time. In addition, because of the high surface polarity that is equivalent to that of the C₁₈ AQ, highly polar samples are effectively retained.



1, Caffeine
 2, Ethenzamide
 3, Bromovalerylurea
 4, Ibuprofen

Mobile phase : CH₃OH/H₂O = 60/40, 0.1 H₃PO₄
 Flow rate : 1.0mL/min
 Detection : UV 220 nm
 Temperature : 40 °C

CAPCELL PAK MF

CAPCELL PAK MF is a mixed-function phase for direct analysis of drugs contained in serum, plasma or other body fluids.

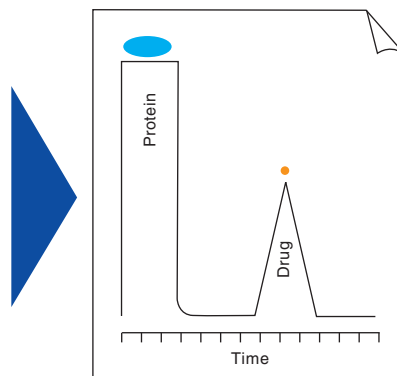
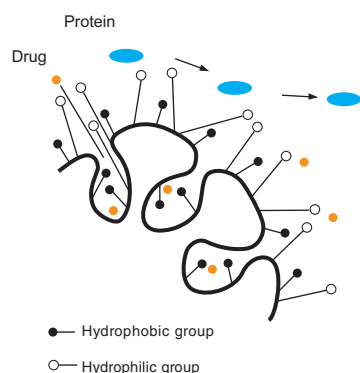
- Direct injection of body fluids
- High recovery of drugs
- Very reproducible
- Higher sensitivity using column switching method
- Available as analytical columns and guard cartridges
- Available in four different functional groups

Using the same polymer coating technology, CAPCELL PAK MF is designed to allow the direct injection of serum or other biological fluids, without tedious and time-consuming pretreatment procedures. This is done by bonding hydrophilic polyoxyethylene groups and hydrophobic groups (phenyl, C₈, C₁₈, SCX) to the polymer coated silica. This allows proteins to pass through the column and elute in the void volume due to restricted access to the surface of the packing, while retaining a drug of interest on the small hydrophobic phase. CAPCELL PAK MF columns have three main functions.

1) Protein removal

2) Sample concentration

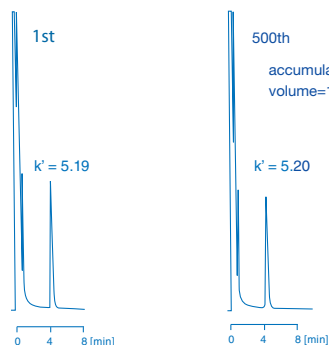
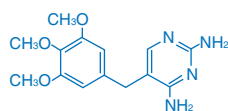
3) Sample analysis



EXCELLENT DURABILITY

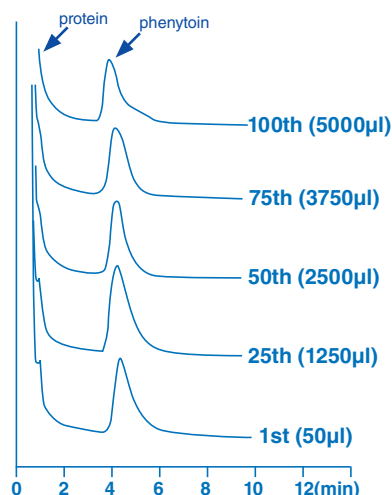
Analytical column

| | |
|--------------|---|
| Column | : CAPCELL PAK MF Ph-1 4.6mm i.d. x 100mm |
| Mobile Phase | : 0.1 mol/L Phosphate buffer / CH ₃ CN = 90 / 10 (pH6.98) |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : Trimethoprim |



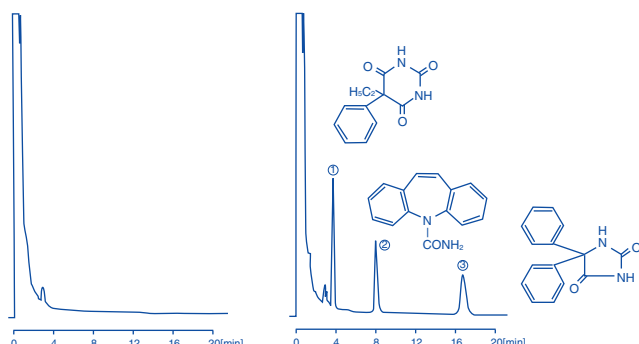
Cartridge column

| | |
|--------------|--|
| Column | : CAPCELL PAK MF Ph-1 Guard Cartridge 4.0mm i.d. x 10mm |
| Mobile Phase | : 100mmol/L Phosphate buffer (pH6.9) / CH ₃ CN = 90 / 10 |
| Flow Rate | : 1.0mL/min |
| Temperature | : 40°C |
| Detection | : UV 254nm |
| Sample | : Phenytoin |



Direct Injection of Serum or Plasma / Single Column System

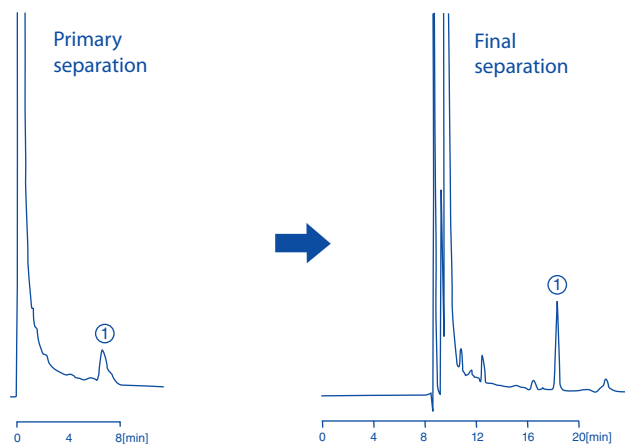
ANTI-EPILEPTIC DRUGS



Column : CAPCELL PAK MF Ph-1
4.6mm i.d. x 100mm
Mobile Phase : 0.1mol/L Phosphate buffer / CH₃CN = 85 / 15 (pH7.09)
Flow Rate : 1.0mL/min
Temperature : 40°C
Detection : UV 254nm
Sample : 1. Phenobarbital (20µg/ml)
2. Carbamazepine (5µg/ml)
3. Phenytoin (40µg/ml)

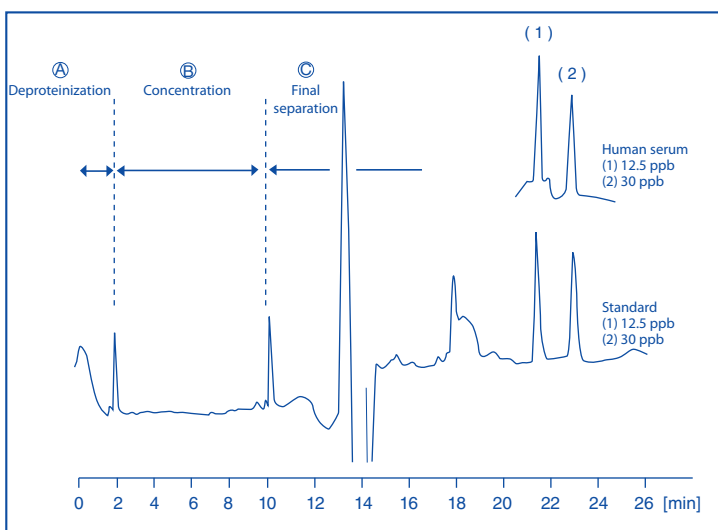
Direct Injection of Serum or Plasma / Dual Column-Switching System

INDOMETHACIN



Column : CAPCELL PAK MF Ph-1
4.6mm i.d. x 50mm
CAPCELL PAK C₁₈ UG120 S5
4.6 mm I.d. x 250 mm
Mobile Phase : A: 100mmol/L Phosphate buffer / CH₃CN = 90 / 10 (pH6.9)
B: 100mmol/L Phosphate buffer / CH₃CN = 50 / 50 (pH2.3, H₃PO₄)
Flow Rate : 1.0mL/min
Temperature : 40°C
Detection : UV 254nm
Sample : 1. Indomethacin

Analysis of Carbamazepine and Phenytoin in Human Serum/Triple Column-Switching System



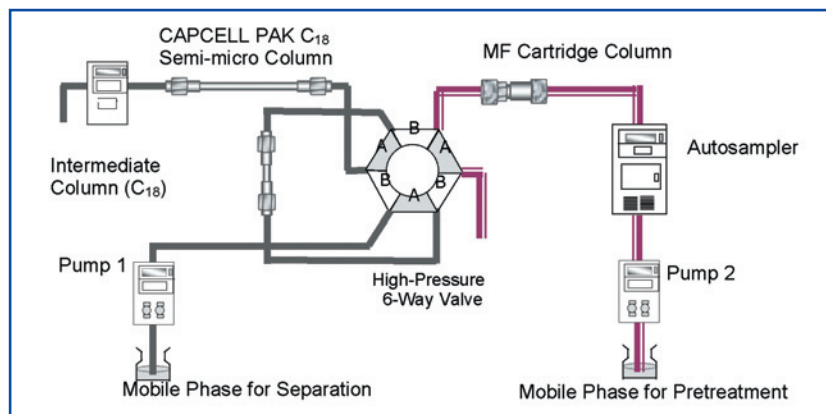
Conditions of Primary separation and Focusing
Column : CAPCELL PAK MF Ph-1 Cartridge
4.0mm i.d. x 10mm
CAPCELL PAK C₁₈ UG120 S5
1.5 mm I.d. x 35 mm
Mobile Phase : 100mmol/L Phosphate buffer (pH7) / CH₃CN = 90 / 10
Flow Rate : 0.5 mL/min - 0.25mL/min
Temperature : 40°C
Detection : UV 254nm

Conditions of Final separation
Column : CAPCELL PAK C₁₈ UG120 S5
1.5 mm i.d. x 250 mm
Mobile Phase : 100mmol/L Phosphate buffer (pH7) / CH₃CN = 70 / 30
Flow Rate : 0.1 mL/min
Temperature : 40°C
Detection : UV 254nm
Sample : 1. Carbamazepine
2. Phenytoin

Trace Analysis of Drugs in Serum and Plasma/ Triple Column-Switching System

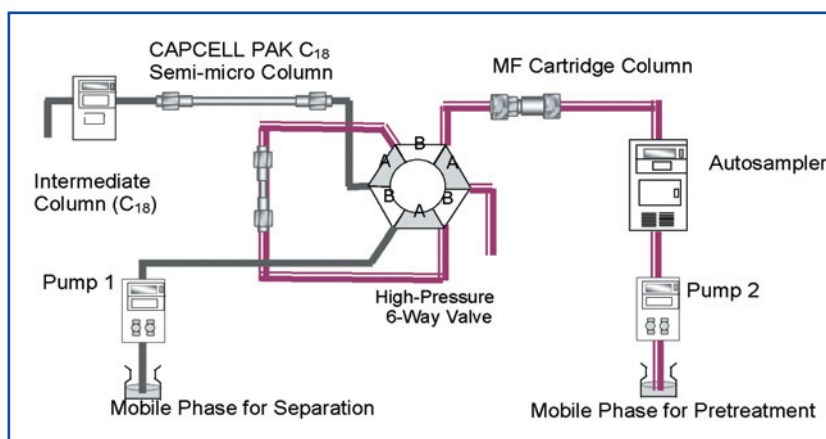
This analytical format consists of a CAPCELL PAK MF cartridge, a small intermediate column and a main analytical column.

DEPROTEINIZATION



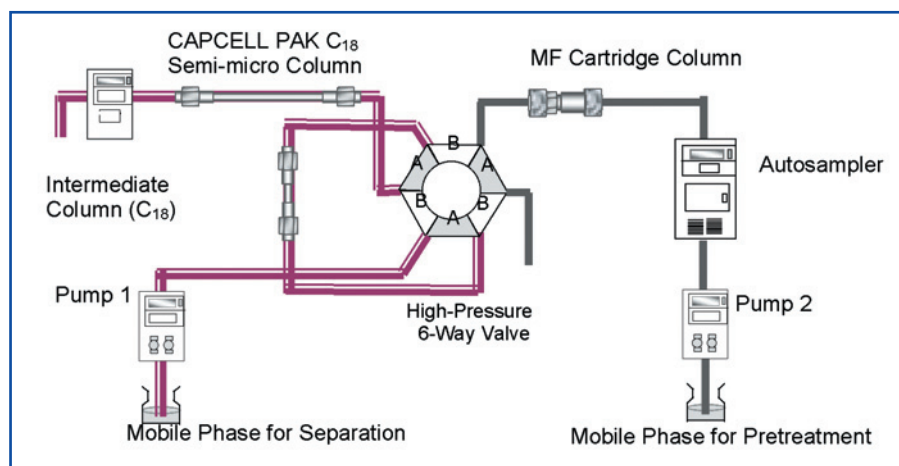
This system using an intermediate column is designed to save run time when a 1.5mm i.d. or smaller column is used. Proteins pass through the MF column, while drugs are retained.

FRACTIONATION AND CONCENTRATING



Drugs are transferred and concentrated in the intermediate column.

FINAL SEPARATION



The concentrated drug is separated in a final semi-micro column, An increased sensitivity without any loss in chromatographic efficiency can be obtained.