

Core-shell Technology

CAPCELL CORE



Core-shell Column of Osaka Soda

CAPCELL CORE Series



Structure of Core-shell Type Packing Material

The core-shell type packing material has a non-porous solid core in the porous layer. Solutes injected by the sampler are separated by the porous layer on the packing material surface; the construction of this layer characterizes the packing material. In other words, the capability of this separation field appears as the result of separation. The base material used in CAPCELL CORE is a packing material of 2.7 μm particle size with a 0.5 μm porous layer covering a 1.7 μm solid core (Fig. 1).

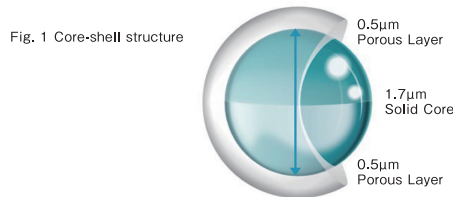


Fig. 1 Core-shell structure

Basic Properties of Core-Shell Type Packing Material (1)

Since the diffusion field for the injected sample is smaller in the core-shell packing material than the fully porous packing material, a chromatogram with a narrower peak width and higher peak intensity is obtained (Fig. 2).

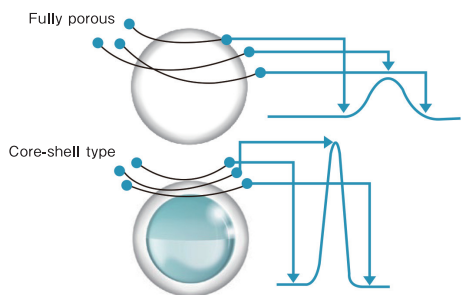


Fig. 2 Diffusion of sample due to the structural difference in packing material and chromatogram obtained

Basic Properties of Core-Shell Type Packing Material (2)

We can understand from the van Deemter curve (Fig. 3) that the height of the theoretical plate decreases (number of theoretical plates increase) as the particle size decreases.

While the number of theoretical plates increases, the disadvantage of packing materials used at present has been that the smaller the particle size, the higher the column pressure. CAPCELL CORE is a packing material that provides separation equivalent to sub-2 μm while keeping the column pressure in control thanks to its core-shell structure (Fig. 4).

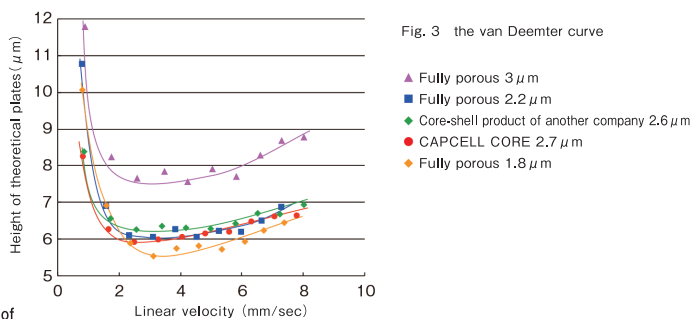


Fig. 3 the van Deemter curve

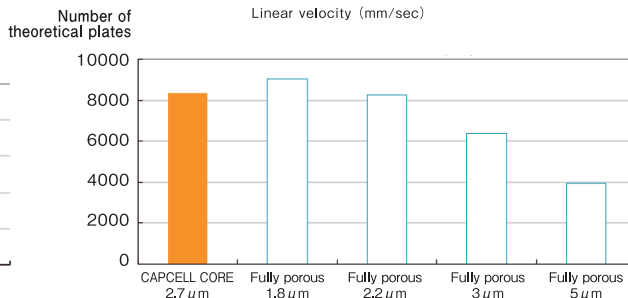
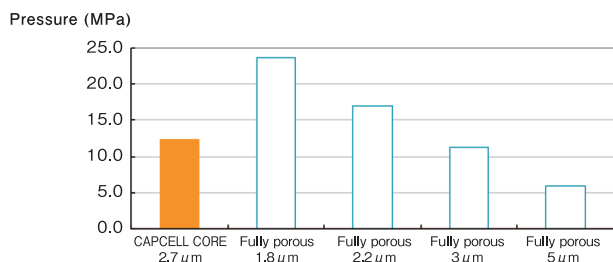


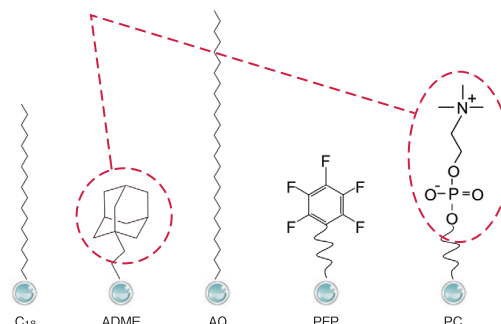
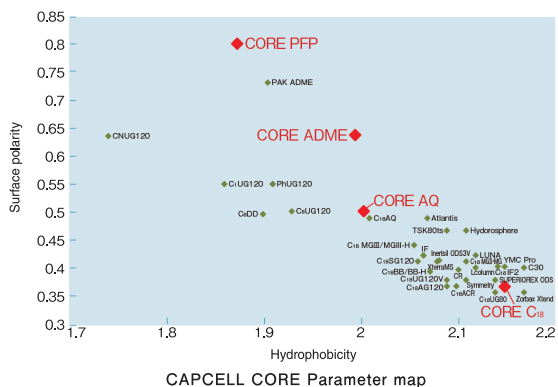
Fig. 4 Comparison of pressure and number of theoretical plates for a fully porous column

CAPCELL CORE Lineup

"CAPCELL CORE" series of Osaka Soda has a unique lineup of products, including the C18 type "CAPCELL CORE C18", a highly versatile column over a wide pH range, as well as the ADME (Adamantyl) and PC (Phosphorylcholine) groups, which are the functional groups commonly used for "CAPCELL PAK" series, and the C27 (Heptacosyl) and PFP (Pentafluorophenyl) groups, which are the original functional groups of the core-shell series.

| Functional group | Product name | USP class No. | Particle Size (μm) | Pore Size (\AA) | Surface Area (m^2/g) | % of Carbon | Density ($\mu\text{mol}/\text{m}^2$) | pH range | Pressure resistance (MPa) | End-fitting Style |
|-------------------------------|-------------------|---------------|---------------------------------|----------------------------|--|-------------|--|----------|---------------------------|-----------------------|
| C18 (octadecyl groups) | CAPCELL CORE C18 | L1 | 2.7 | 90 | 150 | 7 | 2.9 | 1.5 - 10 | 60 | Parker type (UP type) |
| | CAPCELL CORE MP | | 2.7 | 160 | 90 | 5 | 2.6 | 2 - 10 | 60 | Parker type (UP type) |
| ADME (Adamantyl group) | CAPCELL CORE ADME | - | 2.7 | 90 | 150 | 5.5 | 2.5 | 2 - 9 | 60 | Parker type (UP type) |
| C27 (heptacosyl group) | CAPCELL CORE AQ | - | 2.7 | 160 | 90 | 4 | 1.4 | 2 - 10 | 60 | Parker type (UP type) |
| PFP (pentafluorophenyl group) | CAPCELL CORE PFP | L43 | 2.7 | 90 | 150 | 5 | 3.1 | 2 - 8 | 60 | Parker type (UP type) |
| PC (phosphorylcholine group) | CAPCELL CORE PC | - | 2.7 | 90 | 150 | - | 0.94 | 3 - 7.5 | 60 | Parker type (UP type) |

Even functional groups "ADME" and "PC" used in CAPCELL PAK



CAPCELL CORE functional group lineup

CAPCELL CORE C18 / MP

1st Choice C18 of Core-Shell Type

Highly versatile 1st Choice C18 column of core-shell type.
Pore diameter can be selected from 2 types according to the molecular weight of the target compound.

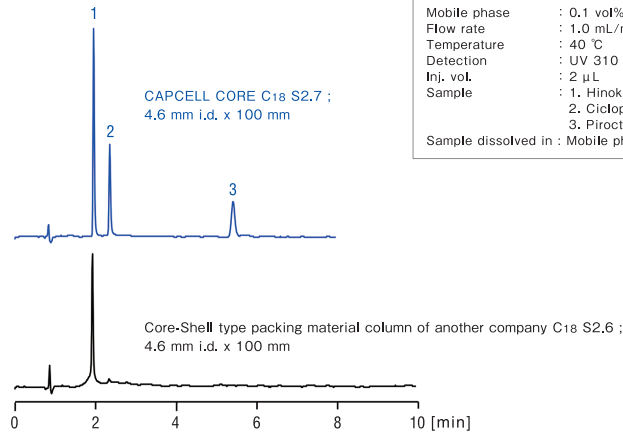
Reduces the Adsorption of Chelating Compounds

The elution behavior of chelating compounds Hinokitiol, Ciclopirox ethanolamine, and Piroctone olamine was compared.

These chelating compounds elute with good peak shapes in the CAPCELL CORE C18 column.

On the other hand, the peak intensity of Hinokitiol was also small, and elution of the other two chelating compounds was not observed in another company's column with core-shell packing material.

The CAPCELL CORE C18 column is also useful for the analysis of chelating compounds.



| HPLC Conditions | |
|------------------------------------|---|
| Mobile phase | : 0.1 vol% H ₃ PO ₄ , H ₂ O / CH ₃ CN = 50 / 50 |
| Flow rate | : 1.0 mL/min |
| Temperature | : 40 °C |
| Detection | : UV 310 nm |
| Inj. vol. | : 2 µL |
| Sample | : 1. Hinokitiol 50 µg/mL 2. Ciclopirox olamine 50 µg/mL 3. Piroctone olamine 50 µg/mL |
| Sample dissolved in : Mobile phase | |

Simultaneous Analysis of Flavonoids

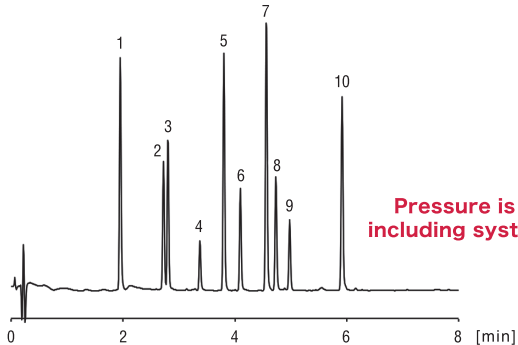
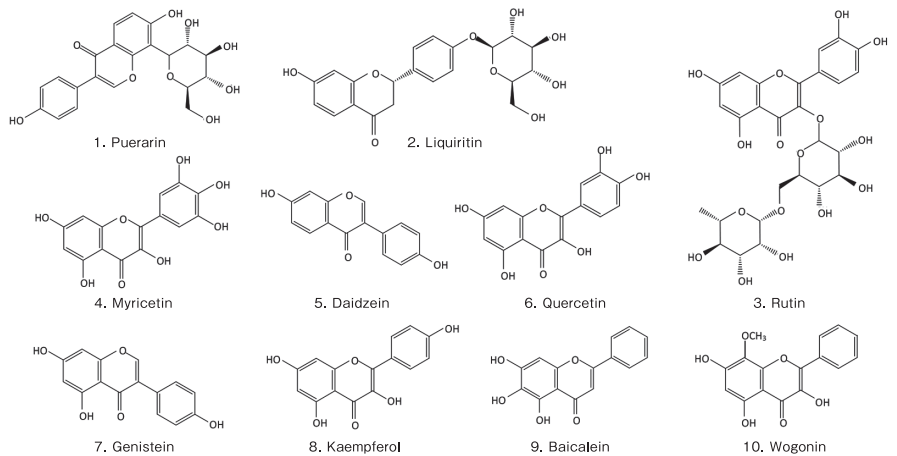
The following is an analysis example of ten flavonoids using the CAPCELL CORE C18 column.

Flavonoids having a similar structure tend to require a longer analysis time as sufficient separation must be obtained.

Here, the flow rate is 600 µL/min, three times the standard flow rate.

Ten flavonoids, including some with coordination properties, could be analyzed in about 6 minutes with good peak shapes.

Pressure is also maintained at about 20 MPa.



| HPLC Conditions | |
|-----------------|---|
| Column | : CAPCELL CORE C18 S2.7; 2.1 mm i.d. x 50 mm |
| Mobile phase | : A) 0.1 vol% HCOOH, H ₂ O B) 0.1 vol% HCOOH, CH ₃ CN B 5 % (0 min) -> 40 % (8 min) -> 5 % (8.1 min) -> 5 % (10 min) Gradient |
| Flow rate | : 600 µL/min |
| Temperature | : 40 °C |
| Detection | : UV 254 nm |
| Inj. vol. | : 1 µL |

Middle pore (MP) Type Useful for High Molecular Weight Compounds

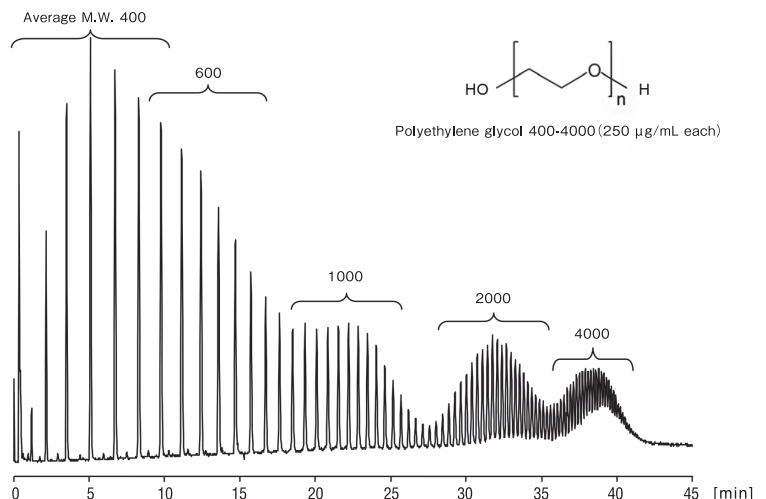
Polyethylene glycol

Polyethylene glycol (PEG) is used in many industrial applications, including cosmetics.

Analysis example of an equal weight mixture of average molecular weight from 400 to 4000 using NQAD as the detector is shown.

Chromatograms faithfully showing the weight distribution that cannot be obtained with mass spectrometry were obtained.

| HPLC Conditions | |
|---------------------|---|
| Column | : CAPCELL CORE MP S2.7 ; 2.1 mm i.d. x 50 mm |
| Mobile phase | : A) H ₂ O, B) CH ₃ CN B 5 % (0 min) -> 40 % (45 min) -> 5 % (45.1 min) Gradient |
| Flow rate | : 400 µL/min |
| Temperature | : 50 °C |
| Detector | : NQAD (Evaporation 35 °C, Nebulizer 30 °C, Filter 2.5 sec) |
| Inj. vol. | : 2 µL |
| Sample dissolved in | : Each standard was dissolved in 20 % CH ₃ CN at 10 mg/mL. All the solutions were mixed together, and diluted with 20 % CH ₃ CN, so that concentration of each type was 250 µg/mL. |



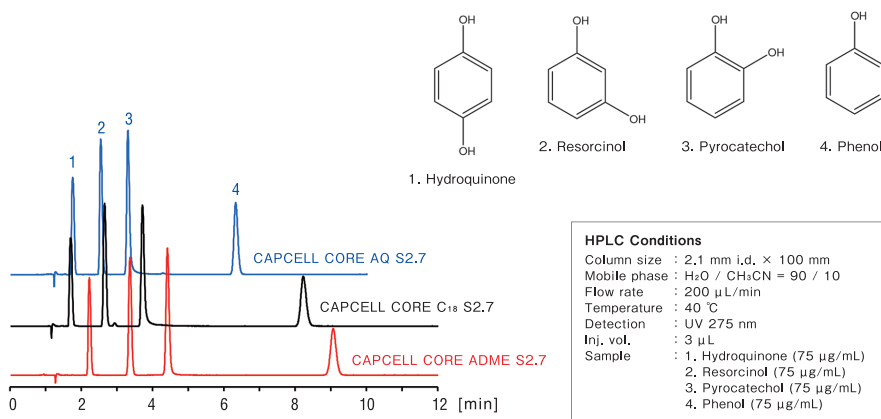
CAPCELL CORE ADME

Proprietary functional groups with unique selectivity that are ideal for highly polar compounds

A core-shell column in which Osaka Soda's original functional group, the adamantyl group, has been introduced. This group is also used commonly in the CAPCELL PAK series
 Similar to the CAPCELL PAK ADME-HR column, unique selectivity and high retention for highly polar compounds can be achieved with the cage-shaped functional groups.

High Surface Polarity

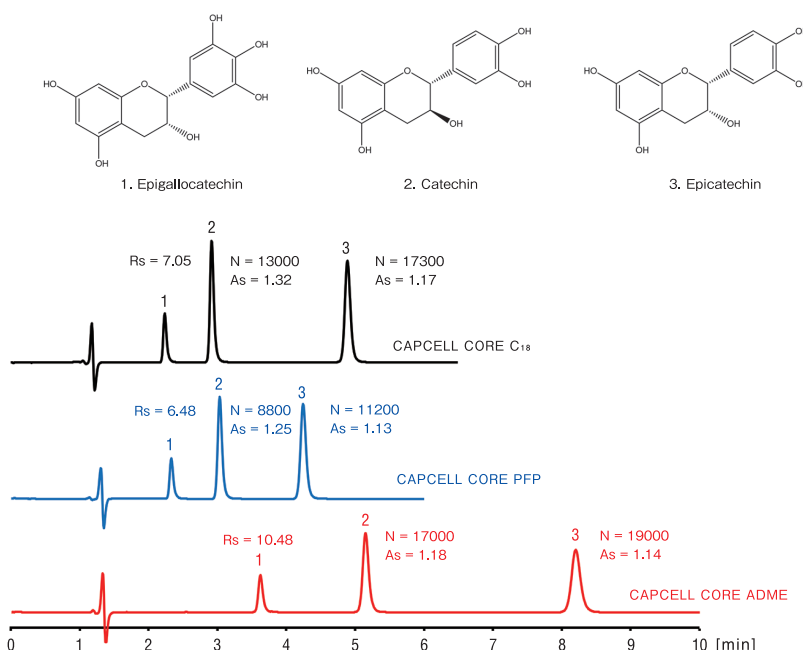
The figure shows data comparing the retention of highly polar compounds in the CAPCELL CORE C18, CAPCELL CORE AQ and CAPCELL CORE ADME columns.
 We can understand from the figure that the retention of the CAPCELL CORE ADME column is higher for highly polar compounds with hydroxyl groups.
 Although CAPCELL CORE ADME and CAPCELL CORE AQ columns show comparable hydrophobicity, we can observe that high surface polarity, which is a feature of the cage-shaped ADME group, works predominantly.



Comparison of Catechin Retention

The retention of the CAPCELL CORE C18, CAPCELL CORE PFP and CAPCELL CORE ADME columns were compared using catechins as samples.
 The CAPCELL CORE ADME column showed higher retention than the CAPCELL CORE PFP column with a higher surface polarity parameter.

| HPLC Conditions | |
|-----------------|---|
| Column size | : 2.1 mm i.d. × 100 mm |
| Mobile phase | : 0.1 vol% HCOOH, H ₂ O / CH ₃ CN = 90 / 10 |
| Flow rate | : 200 μL/min |
| Temperature | : 40 °C |
| Detection | : UV 280 nm |
| Inj. vol. | : 1 μL |
| Sample | : 1. Epigallocatechin 2. Catechin 3. Epicatechin |



Acetaminophen and its Metabolites

- Elution behavior in acidic and neutral mobile phases -

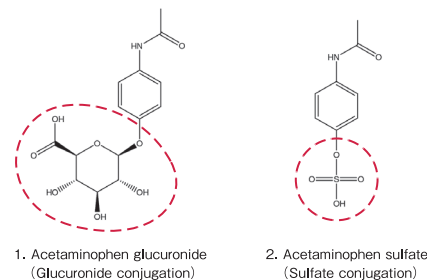
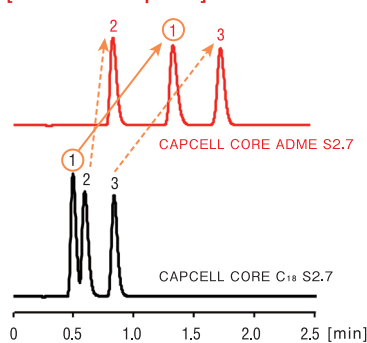
Data comparing the elution behavior of the CAPCELL CORE ADME and CAPCELL CORE C18 columns using samples of each compound in the metabolic pathway of acetaminophen is shown in the figure.

We can understand that the retention of the CAPCELL CORE ADME column is high in acidic and mobile phases.
 In addition, since the glucuronic acid conjugate suppresses the dissociation of the carboxyl group under acidic conditions and turns into a carboxyl group in the molecular state, the retention increases due to the high surface polarity of the CAPCELL CORE ADME column.

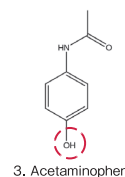
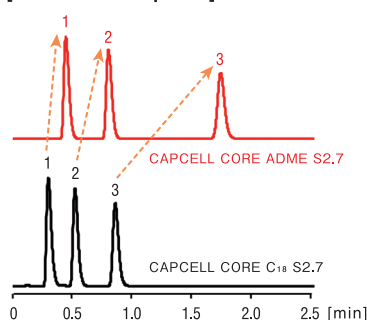
As a result, this column exhibits an elution pattern different from the CAPCELL CORE C18 column.

Since ADME columns with modified adamantyl groups can retain and separate highly polar compounds such as metabolites compared to widely used C18 columns, they are expected to separate the peaks of impurities that elute near the void volume.

[Acidic mobile phase]



[Neutral mobile phase]



| HPLC Conditions | |
|---------------------|--|
| Column | : CAPCELL CORE ADME S2.7 ; 2.1 mm i.d. × 50 mm CAPCELL CORE C18 S2.7 ; 2.1 mm i.d. × 50 mm |
| Mobile phase | : Acidic ; 0.1 vol% HCOOH / CH ₃ OH = 95 / 5 Neutral ; 10 mmol/L HCOONH ₄ / CH ₃ OH = 95 / 5 |
| Flow rate | : 500 μL/min |
| Temperature | : 40 °C |
| Detection | : UV 254 nm |
| Inj. vol. | : 2 μL |
| Sample dissolved in | : H ₂ O / CH ₃ OH = 95 / 5 (25 μg/mL each) |

CAPCELL CORE AQ (C27)

Highly polar core-shell columns for use with 100% aqueous mobile phase

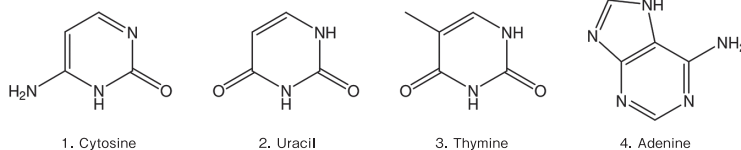
The CAPCELL CORE AQ column is a highly polar core-shell column with an optimal balance of the C27 (heptacosyl) group.

Try this core-shell column to analyze highly polar compounds under 100% aqueous mobile phase conditions and for compounds that are difficult to separate using the C18 column.

Can achieve good reproducibility with 100% aqueous mobile phase

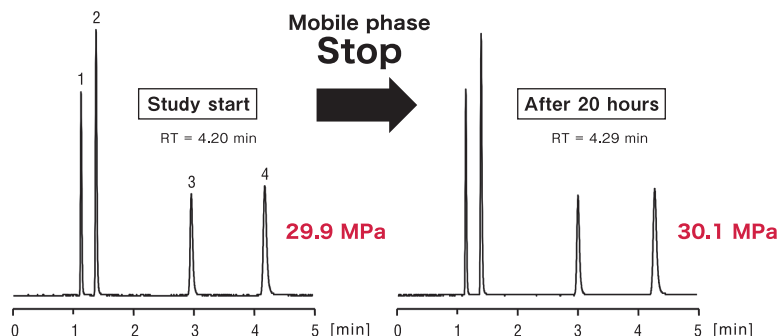
The retention reproducibility (stability) in a 100% aqueous mobile phase has been confirmed using nucleic acid bases as the sample. Good retention reproducibility has been obtained even with analysis after the flow is stopped.

The CAPCELL CORE AQ column can be used with stability even in a 100% aqueous mobile phase since the amount of functional groups introduced is optimally controlled.



HPLC Conditions

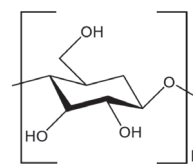
Column : CAPCELL CORE AQ S2.7 ; 2.1 mm i.d. × 150 mm
Mobile phase : 10 mmol/L HCOONH₄
Flow rate : 400 μL/min
Temperature : 40 °C
Detection : UV 254 nm
Inj. vol. : 1 μL (50 ppm each)



Cyclodextrin

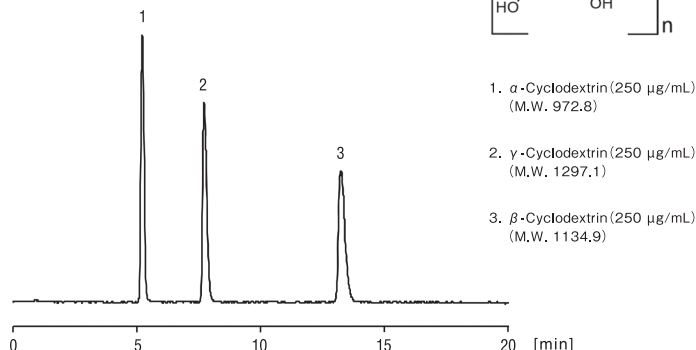
An example of analysis of 3 types of cyclodextrins (α , β and γ bodies) using the CAPCELL CORE AQ column is shown in the figure. Although separation of α and γ bodies was difficult with the CAPCELL CORE C18 column, it was achieved with the CAPCELL CORE AQ column.

Since a long alkyl chain (heptacosyl group) is introduced in the CAPCELL CORE AQ column, it may be useful for compounds that are difficult to separate with an ODS (C18) column.



HPLC Conditions

Column : CAPCELL CORE AQ S2.7 ; 2.1 mm i.d. × 100 mm
Mobile phase : 10 mmol/L HCOONH₄ / CH₃CN = 98 / 2
Flow rate : 300 μL/min
Temperature : 40 °C
Detector : NQAD (Evaporation 35°C, Nebulizer 30°C)
Inj. vol. : 1 μL
Sample dissolved in : Mobile phase



Fatty Acids

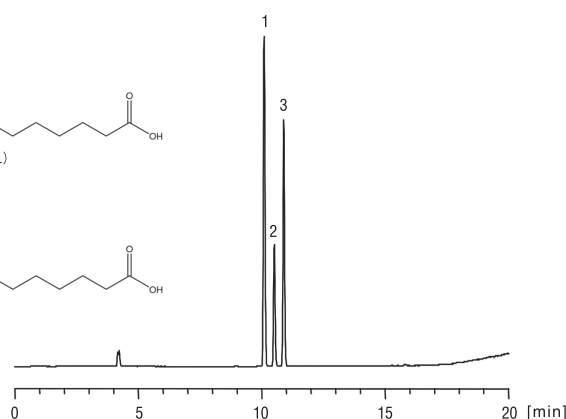
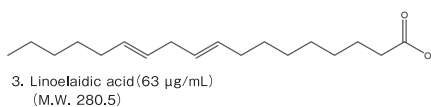
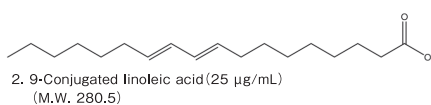
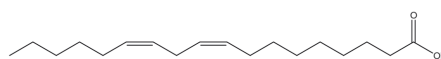
The following is an example of analyzing three fatty acids (linoleic acid, 9-conjugated linoleic acid, and linoelaidic acid) with similar structures.

Adequate retention and separation were obtained with the CAPCELL CORE AQ column.

The use of NQAD as the detector allows for high sensitivity detection.

HPLC Conditions

Column : CAPCELL CORE AQ S2.7 ; 2.1 mm i.d. × 100 mm
Mobile phase : A) 0.1 vol% HCOOH B) 0.1 vol% HCOOH, CH₃CN
B 60 % (0 min) -> 80 % (10 min) -> 99 % (16 min) -> 99 % (18 min) -> 60 % (19 min) Gradient
Flow rate : 300 μL/min
Temperature : 40 °C
Detector : NQAD (Evaporation 35 °C, Nebulizer 30 °C, Filter 2.5 sec)
Inj. vol. : 2 μL
Sample dissolved in : CH₃CN



CAPCELL CORE PFP

Core-shell column effective for isomer compounds

The CAPCELL CORE PFP column in which the PFP (pentafluorophenyl) group is introduced shows selectivity different from the C18 column due to the hydrogen bonding properties of fluorine, dipole-dipole interaction and π - π interaction by π electrons of the benzene ring. The CAPCELL CORE ADME column is a core-shell column similar to the CAPCELL CORE AQ column that should be tried when selectivity has to be changed from C18 columns.

Cortisol and Cortisone

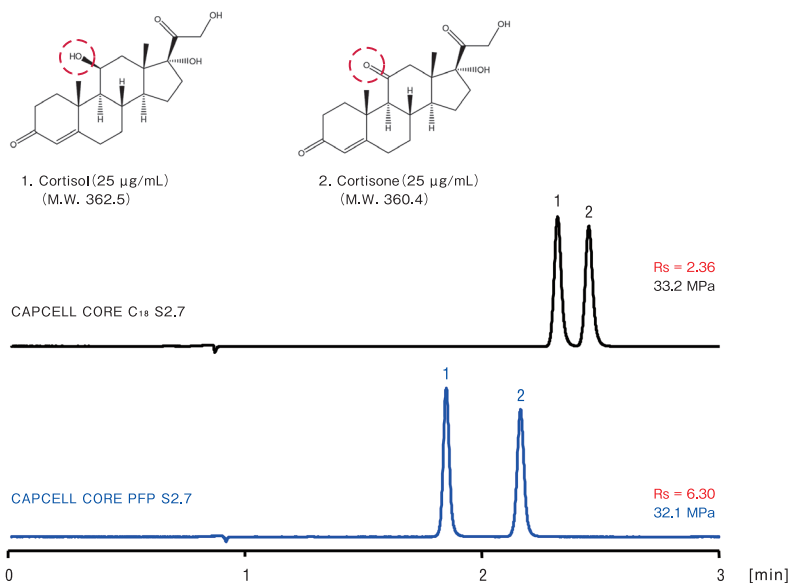
The degree of separation has been improved in the CAPCELL CORE PFP column even though the retention of this column is smaller than the CAPCELL CORE C18 column.

The separation of cortisol and cortisone shows that the CAPCELL CORE PFP column has a better ability to recognize the difference between hydroxyl and carbonyl groups.

The improvement in the degree of separation with the CAPCELL CORE PFP column also indicated the potential for further shortening analysis time by increasing the organic solvent concentration in the mobile phase.

HPLC Conditions

Column : CAPCELL CORE C18 S2.7 ; 2.1 mm i.d. × 150 mm
CAPCELL CORE PFP S2.7 ; 2.1 mm i.d. × 150 mm
Mobile phase : H₂O / CH₃CN = 70 / 30
Flow rate : 400 μ L/min
Temperature : 40 °C
Detection : UV 245 nm
Inj. vol. : 1 μ L (25 ppm each)



Corticosteroid Hormones

An example of analyzing five corticosteroid hormones is shown below.

The five components of corticosteroid hormones are well separated.

Prednisolone with two double bonds in ring A is retained more than cortisol in CAPCELL CORE PFP (prednisolone elutes first in CAPCELL CORE C18).

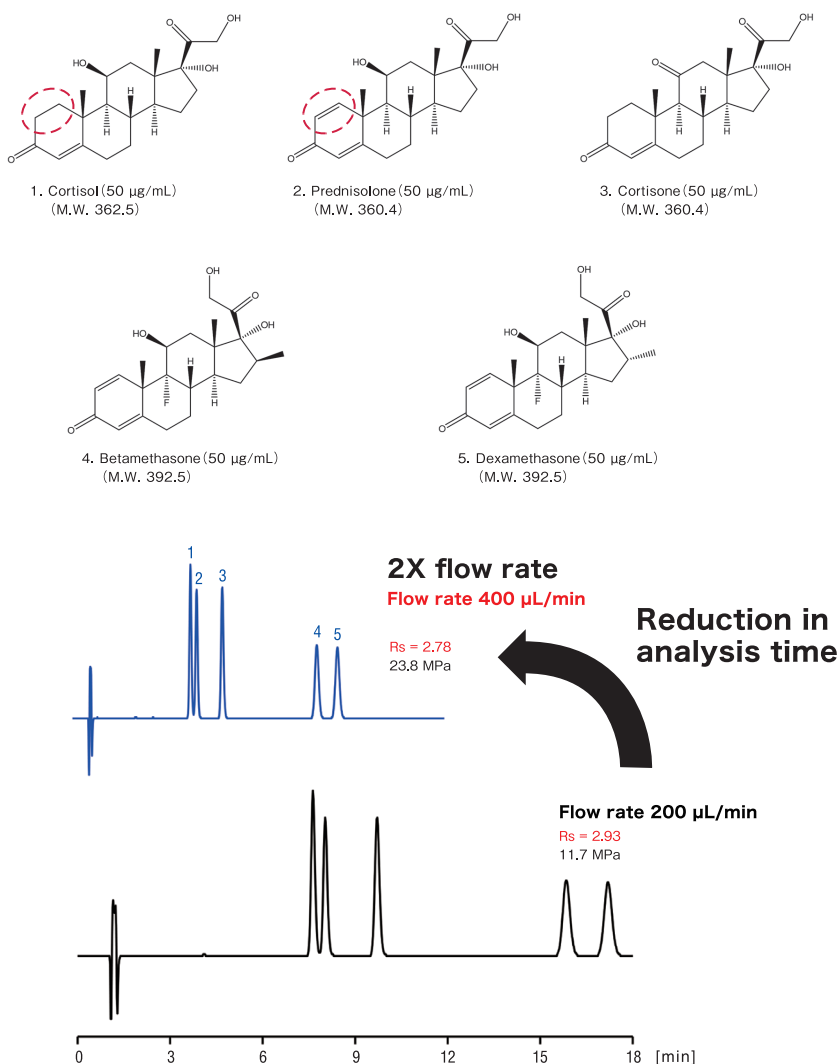
This is presumably due to increased retention because of the π - π interaction between the double bond in ring A and PFP (pentafluorophenyl) group.

The speed could be increased while maintaining the separation by doubling the flow rate (from 200 μ L/min to 400 μ L/min) to analyze corticosteroid hormones introduced here.

This reduced the analysis time by approximately half.

HPLC Conditions

Column : CAPCELL CORE PFP S2.7 ; 2.1 mm i.d. × 100 mm
Mobile phase : H₂O / CH₃CN = 80 / 20
Flow rate : 200 μ L/min, 400 μ L/min
Temperature : 40 °C
Detection : UV 240 nm
Inj. vol. : 1 μ L



CAPCELL CORE PC

Core-shell columns in HILIC mode with enhanced hydrophilicity

Similar to PC HILIC, a HILIC column with fully porous silica gel, this is a core-shell column in HILIC mode that has been introduced with the PC (Phosphorylcholine) group, which is the hydrophilic component of lecithin.

Comparison of Separation Behavior with PC HILIC

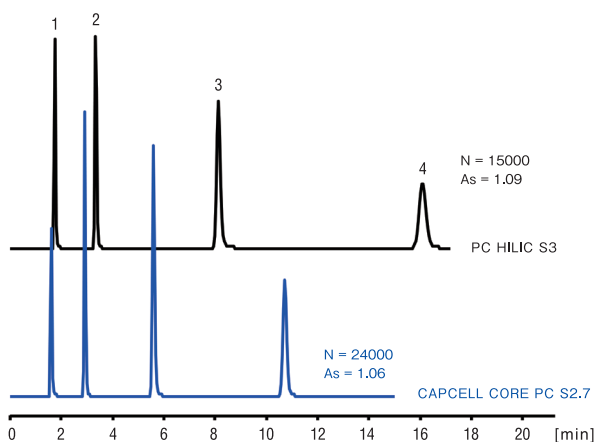
PC (phosphorylcholine) group, which is the same functional group as the fully porous silica gel column PC HILIC is introduced in the CAPCELL CORE PC column.

The elution behavior for four types: naphthalene, thymine, adenine and cytosine, are compared here.

We confirmed the same elution behavior and obtained a higher number of theoretical plates, a feature of core-shell columns, with the CAPCELL CORE PC column.

Although the retention time is also short in proportion to the specific surface area, this column can also be used for short-duration analysis by utilizing these features.

Depending on the purpose, PC HILIC with a large specific surface area can be used when retention is required, while the CAPCELL CORE PC can be used for short duration analysis.



HPLC Conditions

Column : PC HILIC S3 ; 2.0 mm i.d. × 150 mm
CAPCELL CORE PC S2.7 ; 2.1 mm i.d. × 150 mm
Mobile phase : 5 mmol/L HCOONH₄ / CH₃CN = 5 / 95
Flow rate : 200 μL/min
Temperature : 40 °C
Detection : UV 254 nm
Inj. vol. : 2 μL
Sample : 1. Naphthalene 2. Thymine 3. Adenine 4. Cytosine

Nucleic Acid Base

Data comparing the elution behavior of the CAPCELL CORE C18, CAPCELL CORE PC and CAPCELL CORE AQ columns for 5 types of nucleic acid base is shown.

CAPCELL CORE C18 is not capable of retaining a highly polar nucleic acid base.

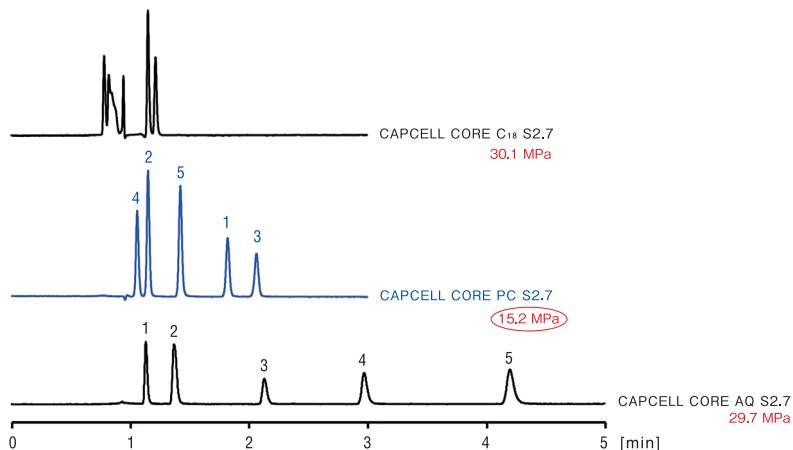
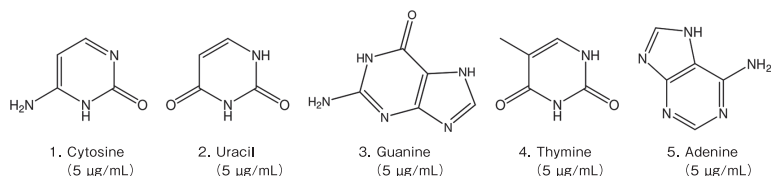
The high surface polarity works effectively in the CAPCELL CORE AQ column, and better retention is obtained than the CAPCELL CORE C18 column.

We can observe that the column is useful even for nucleic acid analysis.

Since the degree of separation is sufficient, further reduction in the analysis time can be expected by increasing the flow rate, but the pressure will also increase.

Let's take a look at the CAPCELL CORE PC column.

The pressure is lower, and the separation of the five nucleic acid base components is achieved in a shorter duration compared to the CAPCELL CORE AQ column.



HPLC Conditions

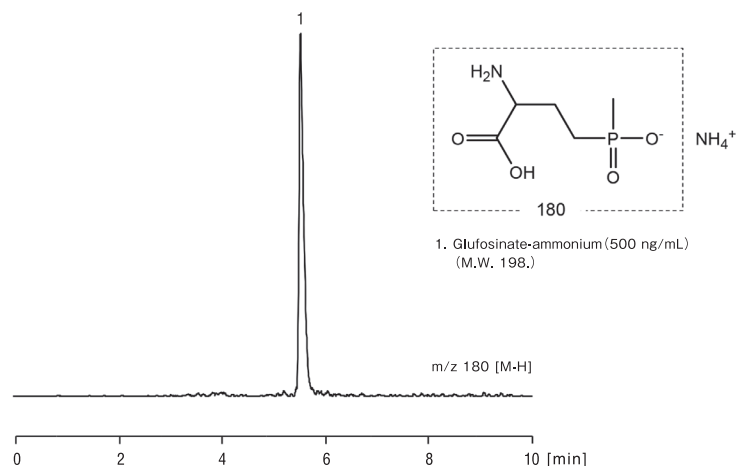
Mobile phase
CAPCELL CORE C18 : 10 mmol/L HCOONH₄ / CH₃CN = 95 / 5
CAPCELL CORE PC : 10 mmol/L HCOONH₄ / CH₃CN = 15 / 85
CAPCELL CORE AQ : 10 mmol/L HCOONH₄
Flow rate : 400 μL/min
Temperature : 40 °C
Detection : UV 254 nm
Inj. vol. : 1 μL

Glufosinate Ammonium

Glufosinate ammonium is an amino acid herbicide that is highly polar and difficult to retain in reverse phase columns. Derivatization is commonly used for high-sensitivity analysis, but an example of direct analysis by LC-MS using the CAPCELL CORE PC column without derivatization is shown here.

HPLC Conditions

Column : CAPCELL CORE PC S2.7 ; 2.1 mm i.d. × 150 mm
Mobile phase : A) 100 mmol/L HCOONH₄, B) CH₃CN
B 90 % (0 min) → 50 % (3 min) → 50 % (7 min) → 90 % (7.1 min) Gradient
Flow rate : 300 μL/min
Temperature : 40 °C
Detection : MS
Ionization : ESI Negative
Inj. vol. : 5 μL
Sample dissolved in : 50 vol% CH₃CN



CAPCELL CORE series Product Lineup

CAPCELL CORE C18

| Product number | Type | Particle Size(μm) | Inner diameter(mm) | Length(mm) |
|----------------|------|-------------------|--------------------|------------|
| 51097 | C18 | 2.7 | 1.0 | 50 |
| 51099 | C18 | 2.7 | 1.0 | 100 |
| 51100 | C18 | 2.7 | 1.0 | 150 |
| 51101 | C18 | 2.7 | 2.1 | 20 |
| 51102 | C18 | 2.7 | 2.1 | 35 |
| 51103 | C18 | 2.7 | 2.1 | 50 |
| 51104 | C18 | 2.7 | 2.1 | 75 |
| 51105 | C18 | 2.7 | 2.1 | 100 |
| 51106 | C18 | 2.7 | 2.1 | 150 |
| 51107 | C18 | 2.7 | 3.0 | 20 |
| 51108 | C18 | 2.7 | 3.0 | 35 |
| 51109 | C18 | 2.7 | 3.0 | 50 |
| 51110 | C18 | 2.7 | 3.0 | 75 |
| 51111 | C18 | 2.7 | 3.0 | 100 |
| 51112 | C18 | 2.7 | 3.0 | 150 |
| 51113 | C18 | 2.7 | 4.6 | 20 |
| 51118 | C18 | 2.7 | 4.6 | 30 |
| 51114 | C18 | 2.7 | 4.6 | 50 |
| 51115 | C18 | 2.7 | 4.6 | 75 |
| 51116 | C18 | 2.7 | 4.6 | 100 |
| 51117 | C18 | 2.7 | 4.6 | 150 |

CAPCELL CORE MP

| Product number | Type | Particle Size(μm) | Inner diameter(mm) | Length(mm) |
|----------------|----------|-------------------|--------------------|------------|
| 51212 | MP (C18) | 2.7 | 2.1 | 35 |
| 51213 | MP (C18) | 2.7 | 2.1 | 50 |
| 51214 | MP (C18) | 2.7 | 2.1 | 75 |
| 51215 | MP (C18) | 2.7 | 2.1 | 100 |
| 51216 | MP (C18) | 2.7 | 2.1 | 150 |
| 51221 | MP (C18) | 2.7 | 3.0 | 100 |
| 51222 | MP (C18) | 2.7 | 3.0 | 150 |
| 51224 | MP (C18) | 2.7 | 4.6 | 50 |
| 51225 | MP (C18) | 2.7 | 4.6 | 75 |
| 51226 | MP (C18) | 2.7 | 4.6 | 100 |
| 51227 | MP (C18) | 2.7 | 4.6 | 150 |

CAPCELL CORE ADME

| Product number | Type | Particle Size(μm) | Inner diameter(mm) | Length(mm) |
|----------------|------|-------------------|--------------------|------------|
| 51197 | ADME | 2.7 | 1.0 | 50 |
| 51198 | ADME | 2.7 | 1.0 | 75 |
| 51199 | ADME | 2.7 | 1.0 | 100 |
| 51200 | ADME | 2.7 | 1.0 | 150 |
| 51182 | ADME | 2.7 | 2.1 | 35 |
| 51183 | ADME | 2.7 | 2.1 | 50 |
| 51184 | ADME | 2.7 | 2.1 | 75 |
| 51185 | ADME | 2.7 | 2.1 | 100 |
| 51186 | ADME | 2.7 | 2.1 | 150 |
| 51188 | ADME | 2.7 | 3.0 | 50 |
| 51189 | ADME | 2.7 | 3.0 | 75 |
| 51190 | ADME | 2.7 | 3.0 | 100 |
| 51191 | ADME | 2.7 | 3.0 | 150 |
| 51193 | ADME | 2.7 | 4.6 | 50 |
| 51194 | ADME | 2.7 | 4.6 | 75 |
| 51195 | ADME | 2.7 | 4.6 | 100 |

CAPCELL CORE AQ

| Product number | Type | Particle Size(μm) | Inner diameter(mm) | Length(mm) |
|----------------|----------|-------------------|--------------------|------------|
| 51161 | AQ (C27) | 2.7 | 2.1 | 20 |
| 51162 | AQ (C27) | 2.7 | 2.1 | 35 |
| 51163 | AQ (C27) | 2.7 | 2.1 | 50 |
| 51164 | AQ (C27) | 2.7 | 2.1 | 75 |
| 51165 | AQ (C27) | 2.7 | 2.1 | 100 |
| 51166 | AQ (C27) | 2.7 | 2.1 | 150 |
| 51171 | AQ (C27) | 2.7 | 3.0 | 100 |
| 51172 | AQ (C27) | 2.7 | 3.0 | 150 |
| 51174 | AQ (C27) | 2.7 | 4.6 | 50 |
| 51175 | AQ (C27) | 2.7 | 4.6 | 75 |
| 51176 | AQ (C27) | 2.7 | 4.6 | 100 |
| 51177 | AQ (C27) | 2.7 | 4.6 | 150 |

CAPCELL CORE PFP

| Product number | Type | Particle Size(μm) | Inner diameter(mm) | Length(mm) |
|----------------|------|-------------------|--------------------|------------|
| 51141 | PFP | 2.7 | 2.1 | 20 |
| 51142 | PFP | 2.7 | 2.1 | 35 |
| 51143 | PFP | 2.7 | 2.1 | 50 |
| 51144 | PFP | 2.7 | 2.1 | 75 |
| 51145 | PFP | 2.7 | 2.1 | 100 |
| 51146 | PFP | 2.7 | 2.1 | 150 |
| 51154 | PFP | 2.7 | 4.6 | 50 |
| 51155 | PFP | 2.7 | 4.6 | 75 |
| 51156 | PFP | 2.7 | 4.6 | 100 |
| 51157 | PFP | 2.7 | 4.6 | 150 |

CAPCELL CORE PC

| Product number | Type | Particle Size(μm) | Inner diameter(mm) | Length(mm) |
|----------------|------|-------------------|--------------------|------------|
| 51121 | PC | 2.7 | 2.1 | 20 |
| 51122 | PC | 2.7 | 2.1 | 35 |
| 51123 | PC | 2.7 | 2.1 | 50 |
| 51124 | PC | 2.7 | 2.1 | 75 |
| 51125 | PC | 2.7 | 2.1 | 100 |
| 51126 | PC | 2.7 | 2.1 | 150 |
| 51129 | PC | 2.7 | 3.0 | 50 |
| 51130 | PC | 2.7 | 3.0 | 75 |
| 51131 | PC | 2.7 | 3.0 | 100 |
| 51132 | PC | 2.7 | 3.0 | 150 |
| 51134 | PC | 2.7 | 4.6 | 50 |
| 51135 | PC | 2.7 | 4.6 | 75 |
| 51136 | PC | 2.7 | 4.6 | 100 |
| 51137 | PC | 2.7 | 4.6 | 150 |

Guard cartridge column for CAPCELL CORE series (pressure resistance 60 MPa)

| Product number | Product name | Particle Size(μm) | Inner diameter(mm) | Length(mm) |
|----------------|--|-------------------|--------------------|------------|
| 3640 | EXP® DIRECT CONNECT HOLDER | - | - | 5 |
| 3643 | EXP® GUARD CARTRIDGE CAPCELL CORE C18 | 2.7 | 2.1 | 5 |
| 3644 | EXP® GUARD CARTRIDGE CAPCELL CORE C18 | 2.7 | 4.6 | 5 |
| 3649 | EXP® GUARD CARTRIDGE CAPCELL CORE MP | 2.7 | 2.1 | 5 |
| 3648 | EXP® GUARD CARTRIDGE CAPCELL CORE ADME | 2.7 | 2.1 | 5 |
| 3645 | EXP® GUARD CARTRIDGE CAPCELL CORE AQ | 2.7 | 2.1 | 5 |
| 3647 | EXP® GUARD CARTRIDGE CAPCELL CORE PFP | 2.7 | 2.1 | 5 |
| 3646 | EXP® GUARD CARTRIDGE CAPCELL CORE PC | 2.7 | 2.1 | 5 |

* Purchase both holder (product number 3640) and cartridge.

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* Check our website or the "HPLC Column Price List" for the latest prices.



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