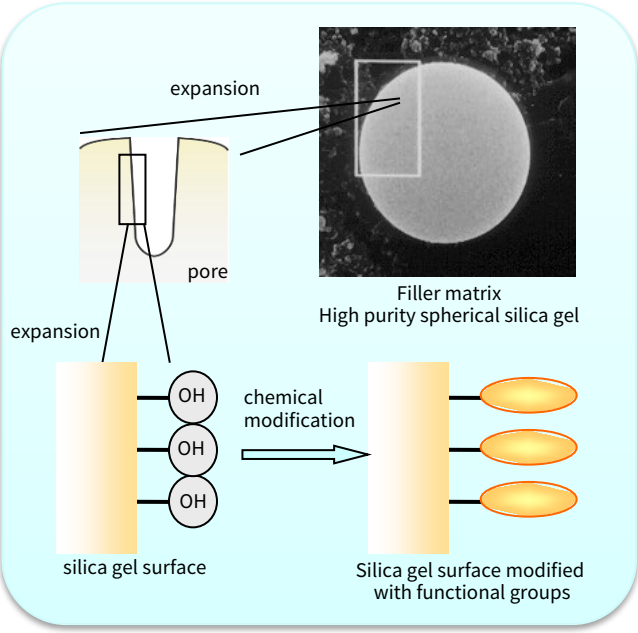
Introduction of InertSustain and Inertsil Series Reversed-Phase Columns

Many manufacturers have released various types of columns for HPLC. In LC Technical Notes No.50 and No.100, in order to respond to the customer's voice that "there are too many types and I don't know which one to choose", we provide reversed-phase HPLC columns that we offer. made a comparison.

Since the previous technical note was published, we have also expanded our column lineup. Therefore, as No.200, we will introduce the comparison data of the reversed-phase column again.

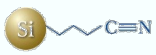
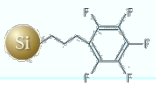
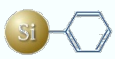
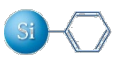
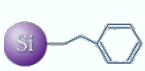
(K. Tanaka)



ODS/C18 columns

Column type	functional group	Features
InertSustain C18	Si—C18H37	This is the first choice reversed-phase column developed by pursuing inertness and chemical stability using our original synthesis technology.
InertSustain AQ-C18	Si—C18H37	This column is recommended for reversed-phase analysis of hydrophilic (highly polar) compounds under eluent conditions close to 100% water.
InertSustainSwift C18	Si—C18H37	This column is suitable for high-speed analysis, designed to elute compounds faster than general ODS columns.
InertSustain AX-C18	Si—C18H37, NR2	This is a mixed-mode column chemically modified with C18 and tertiary amino groups. It is useful when you want to increase the retention of acidic highly polar compounds.
Inertsil ODS-HL	Si—C18H37	This column has a higher retention capacity for hydrophobic compounds because it contains more carbon than a typical ODS column.
Inertsil ODS-4	Si—C18H37	Overall, the elution is a little faster than InertSustain C18, and the planar recognition ability is slightly higher.
Inertsil ODS-3	Si—C18H37	Since its release in 1994, it has been highly evaluated for its retention strength and stable quality, and is still widely used around the world.
Inertsil ODS-2	Si—C18H37	A long-selling column that uses high-purity silica gel as the HPLC packing material for the first time. He is a contributor who made the world know the goodness of Japanese fillers
Inertsil ODS-SP	Si—C18H37	This column controls the amount of octadecyl (ODS, C18) groups introduced to speed up the elution time of highly hydrophobic compounds.
Inertsil ODS-EP	Si—PG—C18H37 (PG：極性基)	This is an embedded column with a polar group introduced at the base of the octadecyl group. A separation pattern different from that of ordinary ODS columns can be obtained.
Inertsil ODS-P	Si—C18H37	Column modified with octadecyl groups at high density. It is particularly useful for separating components with similar structures due to its high stereoscopic ability.
Inertsil WP300 C18	Si 300—C18H37	Because of its large pores, this column can sharply elute large molecules.
MonoClad C18-HS	—C18H37	This is a silica monolith column for HPLC that uses a columnar silica rod with a double pore structure of through pores and mesopores as a separation carrier.

Other reversed-phase columns

Column type	functional group	Features
InertSustain C8		First choice column for C8 columns. It also has excellent inertness, durability, and lot-to-lot reproducibility.
InertSustainSwift C8		Designed to elute compounds quickly, this C8 column is suitable for high-speed and high-sensitivity analysis.
Inertsil C8-4		It is also a C8 column with excellent inertness. Elution is faster than InertSustain C8, and it shows high stereoscopic recognition ability.
Inertsil C8-3		As a C8 column, it is designed to have stronger retention, and a separation pattern slightly different from that of InertSustain C8 can be obtained.
Inertsil WP300 C8		Due to its large pores, it is ideal for rapid analysis of macromolecular compounds such as proteins and peptides.
Inertsil C4		This is a column with butyl group introduced, which has the weakest hydrophobic interaction among Inertsil's alkyl group-bonded columns.
Inertsil WP300 C4		This column is ideal for reversed-phase analysis of highly lipid-soluble proteins and peptides, with its unique embedding treatment to suppress adsorption.
InertSustain Cyano		It is known as a column that has interaction by π bond like Ph column and shows more characteristic behavior.
InertSustain PFP		Various interactions such as hydrophobic interaction, dipole-dipole interaction, and π-electron interaction work to exhibit unique separation behavior.
InertSustain Phenylhexyl		This is an alkylphenyl group bonding type column. It is useful when you want to slightly change the separation pattern on the ODS column.
InertSustain Phenyl		This column contains phenyl groups. Since π electron interaction works, it is used when you want to greatly change the separation pattern.
Inertsil Ph-3		Although the π-electron interaction also works, since the stereorecognition ability is different from that of InertSustain Phenyl, a different separation pattern can be obtained.
Inertsil Ph		Unlike other phenyl columns, this column has an ethyl group (phenethyl group) introduced between the phenyl group and the packing material.

1. Pattern comparison on ODS column

The specifications and comparison results of our ODS columns are shown below. From the next page onwards, the entire chromatogram is shown on the right, and the 4-minute zoom is shown on the left.

column name	chemical bonding group	E.C.	carbon loading	pore size	surface area
InertSustain C18	Octadecyl group	Yes	14%	100 Å	350 m^2/g
InertSustain AQ-C18	Octadecyl group	Yes	13%	100 Å	350 m^2/g
InertSustainSwift C18	Octadecyl group	Yes	9%	200 Å	200 m^2/g
InertSustain AX-C18	Octadecyl + Tertiary amino	Yes	8%	200 Å	200 m^2/g
Inertsil ODS-HL	Octadecyl group	Yes	23%	100 Å	450 m^2/g
Inertsil ODS-4	Octadecyl group	Yes	11%	100 Å	450 m^2/g
Inertsil ODS-3	Octadecyl group	Yes	15%	100 Å	450 m^2/g
Inertsil ODS-2	Octadecyl group	Yes	18.5%	150 Å	320 m^2/g
Inerstil ODS-SP	Octadecyl group	Yes	8.5%	100 Å	450 m^2/g
Inertsil ODS-EP	Octadecyl group	No	9%	100 Å	450 m^2/g
Inertsil ODS-P	Octadecyl group	No	29%	100 Å	450 m^2/g
Inertsil WP300 C18	Octadecyl group	Yes	9%	300 Å	150 m^2/g
MonoClad C18-HS	Octadecyl group	Yes	14%	180 Å *	200 m^2/g

* Since MonoClad C18-HS is based on silica monolith, the mesopore diameter corresponding to the pore diameter of the packed particles is listed.

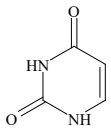
HPLC Conditions

Column : Reversed phase column
(5 µm, 250 × 4.6 mm I.D.)*
Eluent : A) CH_3OH B) H_2O A/B= 80/20, v/v
(InertSustain Cyano only A/B= 60/40, v/v)
Flow rate : 1.0 mL/min*
Col. Temp. : 40 °C
Detection : UV 254 nm
Injection Vol. : 5 µL*

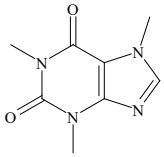
* For MonoClad C18-HS, the flow rate was set at 0.4 mL/min and the injection volume was set at 2 µL, because the measurement was performed using a 3 mm inner diameter column.

Conditions for comparing reversed-phase column selectivity and hydrophobic interaction are shown on the left. The mobile phase used was a methanol-water system, and all columns were of the same size and had the same particle size.

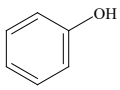
Ingredients and structural formulas used for evaluation



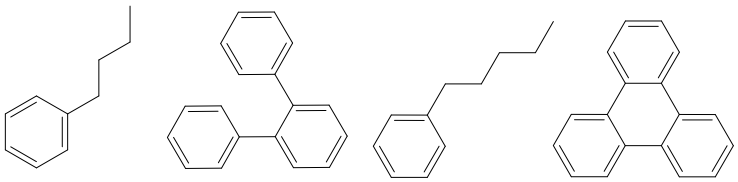
1. Uracil



2. Caffeine



3. Phenol


4. Butylbenzene5. *o*-Terphenyl 6. Amylbenzene 7. Triphenylene

The structural formulas of the components used for evaluation are shown on the left. Differences in the separation of basic and acidic substances, alkylbenzenes and polycyclic aromatic compounds reveal various factors affecting the separation.

The more silanol, which is a weakly acidic functional group on the surface of the silica gel used as a packing material, the later caffeine (2) elutes than phenol (3)*.

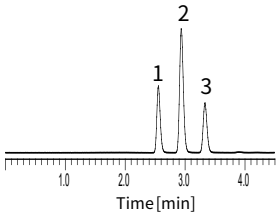
Amylbenzene (6) elutes later than butylbenzene (4) in columns with stronger hydrophobicity.

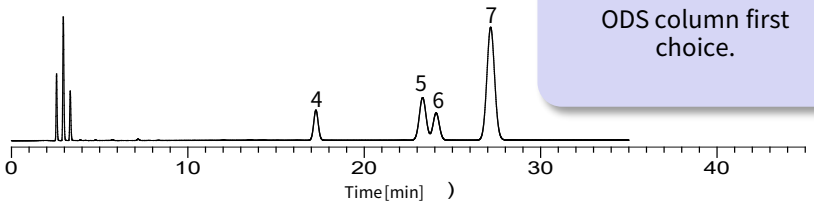
Triphenylene (7) elutes later than o-terphenyl (5) in columns with higher planar recognition ability.

*References
K. Kimata, K. Iwaguchi, S. Onishi, K. Jinno, R. Eksteen, K. Hosoya, M. Araki, N.Tanaka, J. Chromatogr. Sci. 1989, 27, 721-728.

1. Uracil 2. Caffeine 3. Phenol 4. Butylbenzene 5. *o*-Terphenyl 6. Amylbenzene 7. Triphenylene

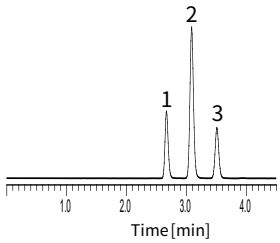
InertSustain C18

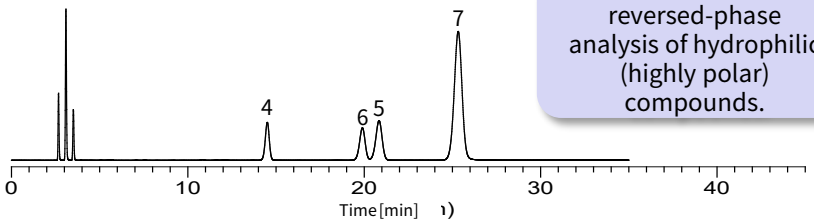




ODS column first choice.

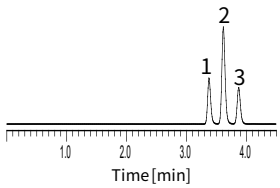
InertSustain AQ-C18

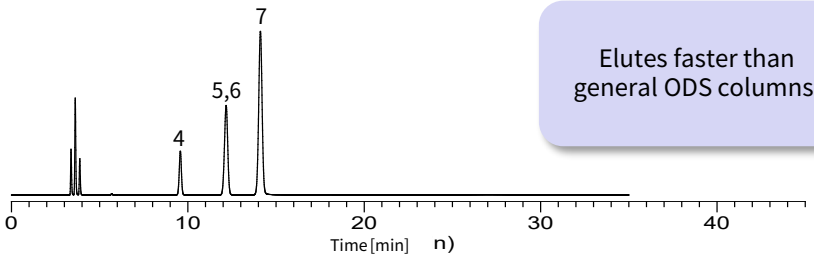




Recommended for reversed-phase analysis of hydrophilic (highly polar) compounds.

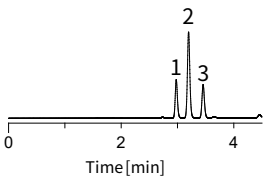
InertSustainSwift C18

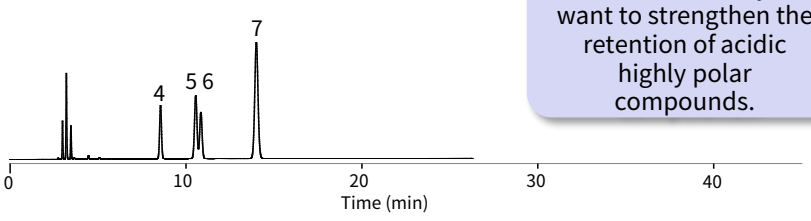




Elutes faster than general ODS columns.

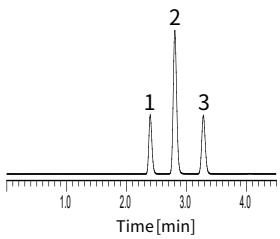
InertSustain AX-C18

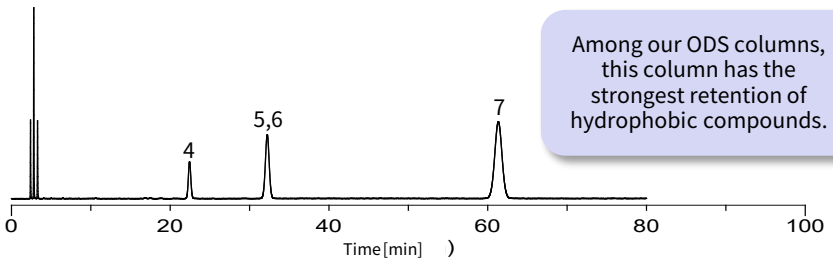




It is useful when you want to strengthen the retention of acidic highly polar compounds.

Inertsil ODS-HL

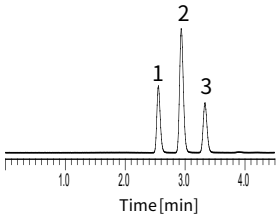


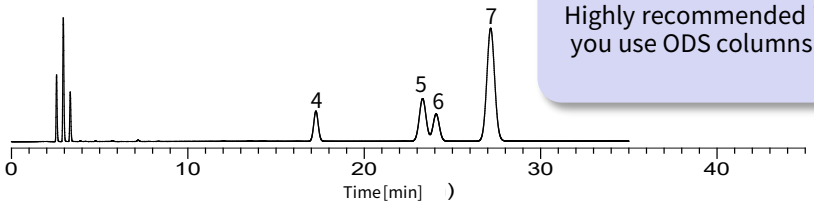


Among our ODS columns, this column has the strongest retention of hydrophobic compounds.

1. Uracil 2. Caffeine 3. Phenol 4. Butylbenzene 5. *o*-Terphenyl 6. Amylbenzene 7. Triphenylene

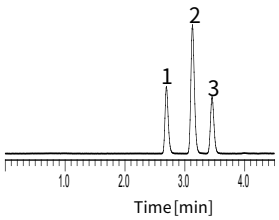
InertSustain C18

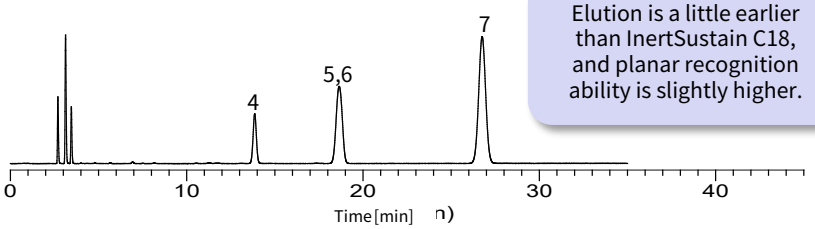




Highly recommended if you use ODS columns!

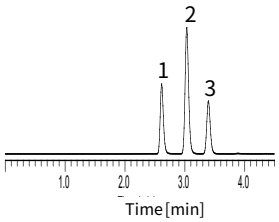
Inertsil ODS-4

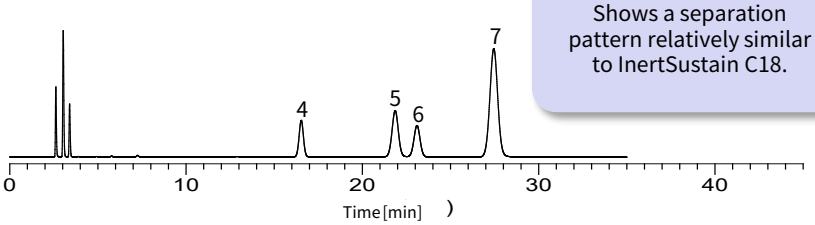




Elution is a little earlier than InertSustain C18, and planar recognition ability is slightly higher.

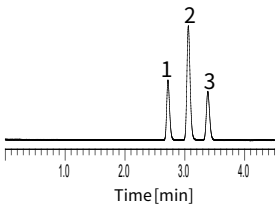
Inertsil ODS-3

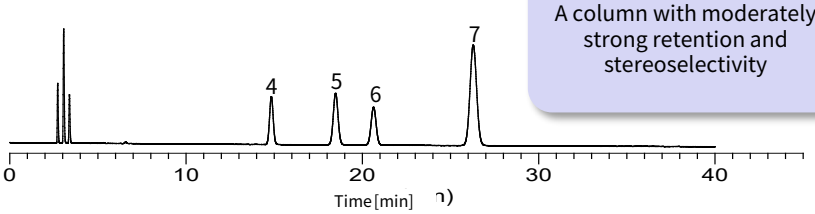




Shows a separation pattern relatively similar to InertSustain C18.

Inertsil ODS-2

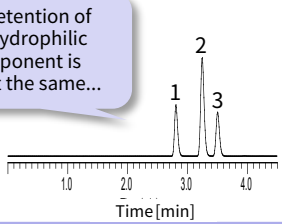


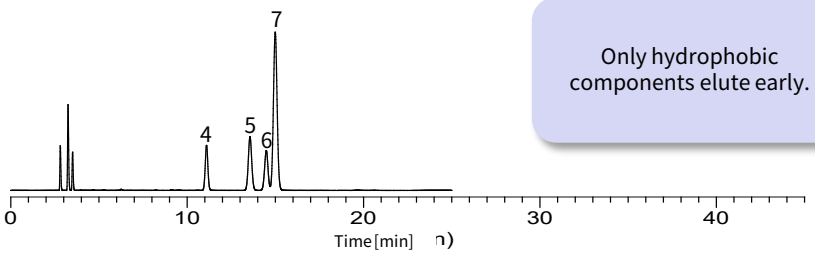


A column with moderately strong retention and stereoselectivity

Inertsil ODS-SP

The retention of the hydrophilic component is almost the same...

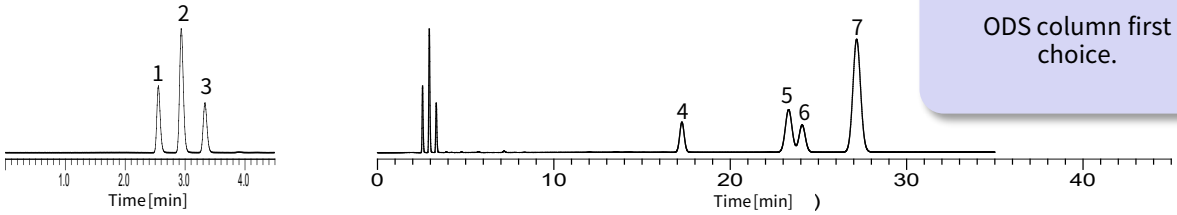




Only hydrophobic components elute early.

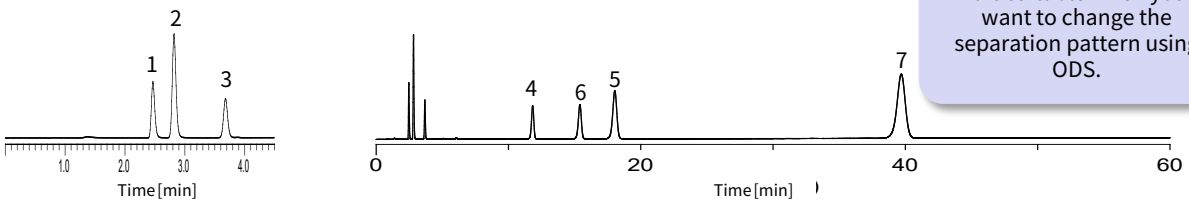
1. Uracil 2. Caffeine 3. Phenol 4. Butylbenzene 5. *o*-Terphenyl 6. Amylbenzene 7. Triphenylene

InertSustain C18



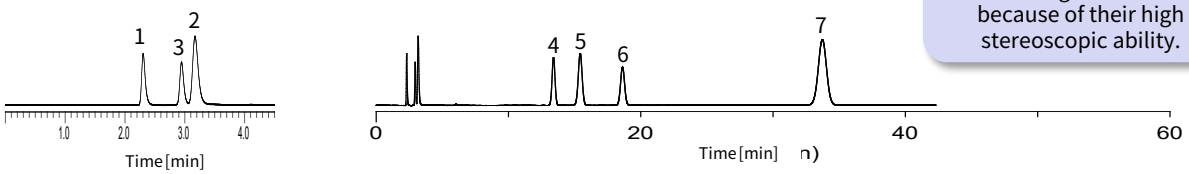
ODS column first choice.

Inertsil ODS-EP



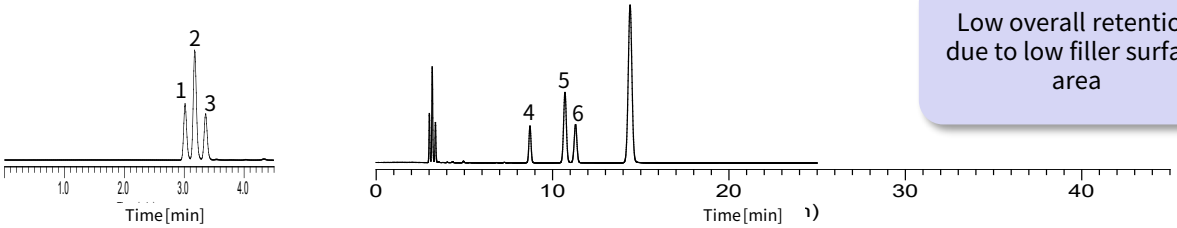
It is suitable when you want to change the separation pattern using ODS.

Inertsil ODS-P



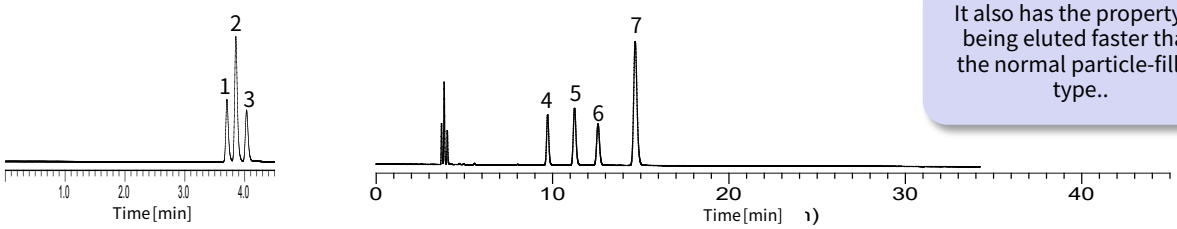
The difference in retention time between 5 and 7 is larger than others because of their high stereoscopic ability.

Inertsil WP300 C18



Low overall retention due to low filler surface area

MonoClad C18-HS



It also has the property of being eluted faster than the normal particle-filled type..

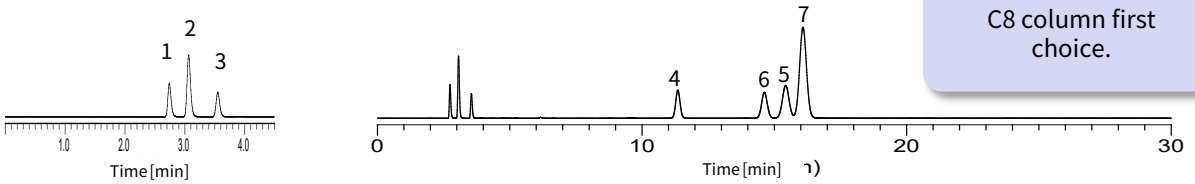
2. Pattern comparison on C8 column

The specifications and comparison results of our C8 columns are shown below. The measurement conditions are the same as in ①.

column name	chemical bonding group	E.C.	carbon loading	pore size	surface area
InertSustain C8	octyl group	Yes	8%	100 Å	350 m^2/g
InertSustainSwift C8	octyl group	Yes	6%	200 Å	200 m^2/g
Inertsil C8-4	octyl group	Yes	5%	100 Å	450 m^2/g
Inertsil C8-3	octyl group	Yes	9%	100 Å	450 m^2/g
Inertsil WP300 C8	octyl group	Yes	4%	300 Å	150 m^2/g

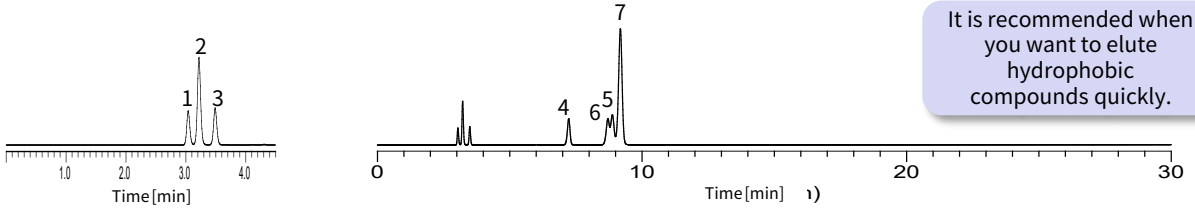
1. Uracil 2. Caffeine 3. Phenol 4. Butylbenzene 5. *o*-Terphenyl 6. Amylbenzene 7. Triphenylene

InertSustain C8



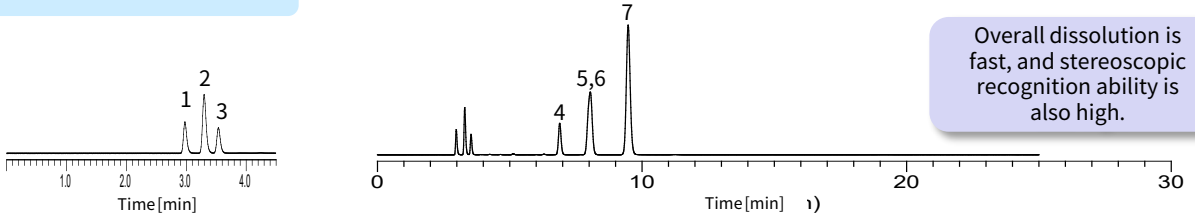
C8 column first choice.

InertSustainSwift C8



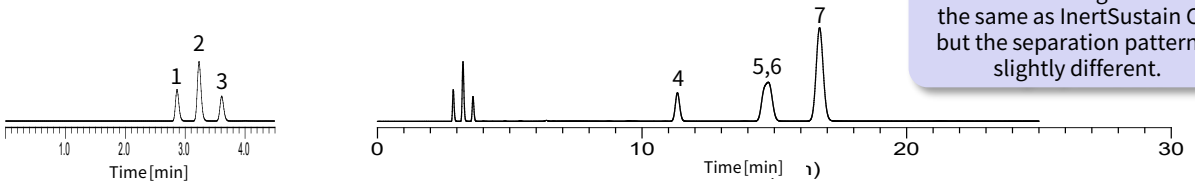
It is recommended when you want to elute hydrophobic compounds quickly.

Inertsil C8-4



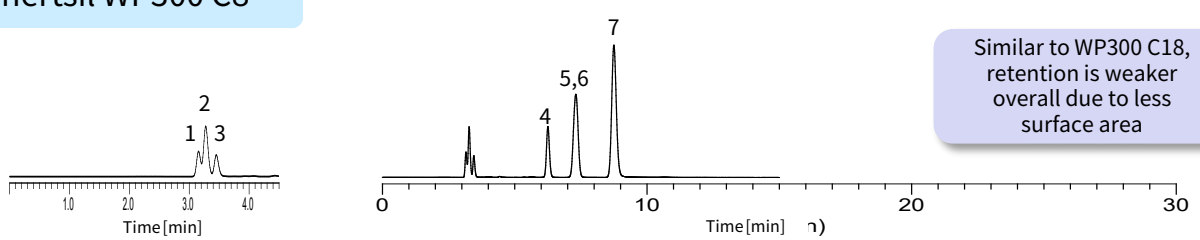
Overall dissolution is fast, and stereoscopic recognition ability is also high.

Inertsil C8-3



Retention strength is about the same as InertSustain C8, but the separation pattern is slightly different.

Inertsil WP300 C8



Similar to WP300 C18, retention is weaker overall due to less surface area

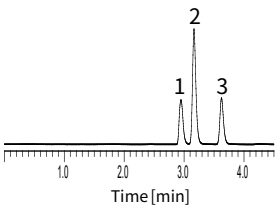
3. Pattern comparison on C4/cyano/phenyl column

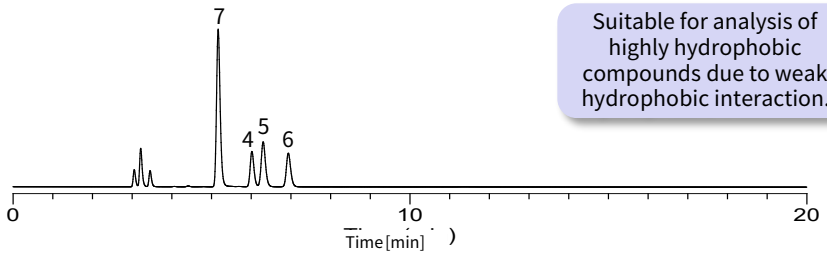
Similar to ① and ②, we show the specifications and comparison results of our C4/cyano/phenyl column. The measurement conditions are the same as ① and ②.

column name	chemical bonding group	E.C.	carbon loading	pore size	surface area
Inertsil C4	butyl group	Yes	7.5%	150 Å	320 m^2/g
Inertsil WP300 C4	butyl group	No	3%	300 Å	150 m^2/g
InertSustain Cyano	cyanopropyl group	Yes	8%	100 Å	350 m^2/g
InertSustain PFP	Pentafluorophenylpropyl group	Yes	10%	100 Å	350 m^2/g
InertSustain Phenylhexyl	phenylhexyl group	Yes	9%	100 Å	350 m^2/g
InertSustain Phenyl	phenyl group	No	10%	100 Å	350 m^2/g
Inertsil Ph-3	phenyl group	No	9.5%	100 Å	450 m^2/g
Inertsil Ph	phenethyl group	Yes	10%	150 Å	320 m^2/g

1. Uracil 2. Caffeine 3. Phenol 4. Butylbenzene 5. *o*-Terphenyl 6. Amylbenzene 7. Triphenylene

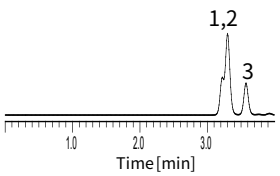
Inertsil C4

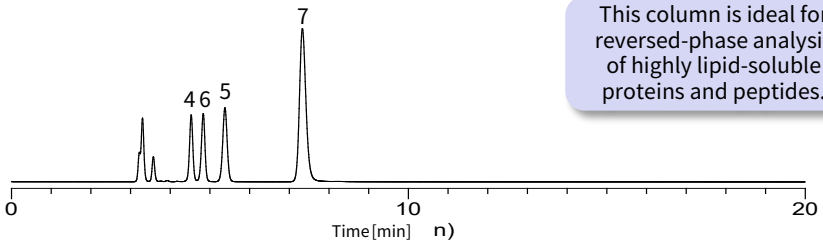




Suitable for analysis of highly hydrophobic compounds due to weak hydrophobic interaction.

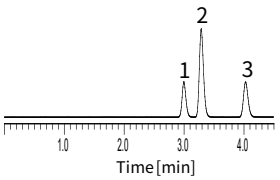
Inertsil WP300 C4

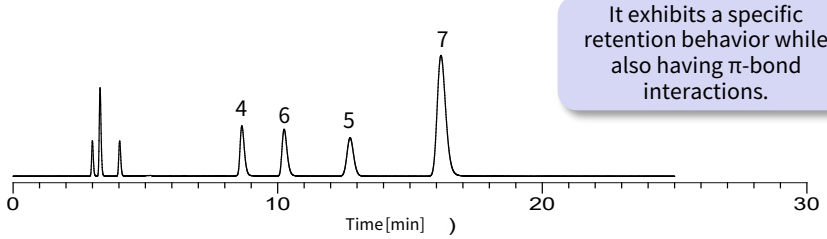




This column is ideal for reversed-phase analysis of highly lipid-soluble proteins and peptides.

InertSustain Cyano

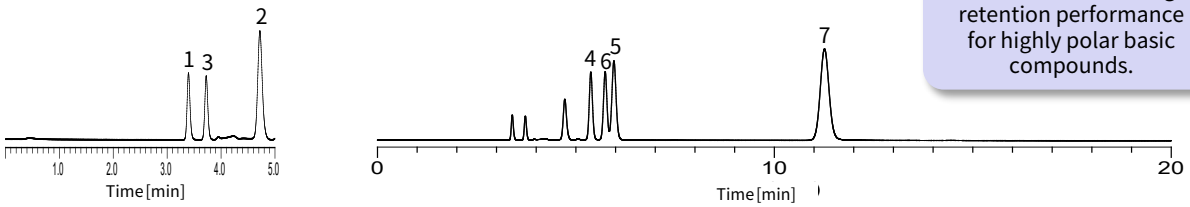




It exhibits a specific retention behavior while also having π-bond interactions.

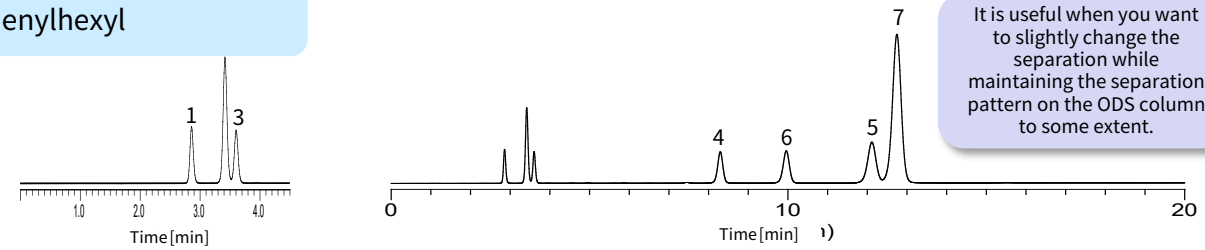
1. Uracil 2. Caffeine 3. Phenol 4. Butylbenzene 5. *o*-Terphenyl 6. Amylbenzene 7. Triphenylene

InertSustain PFP



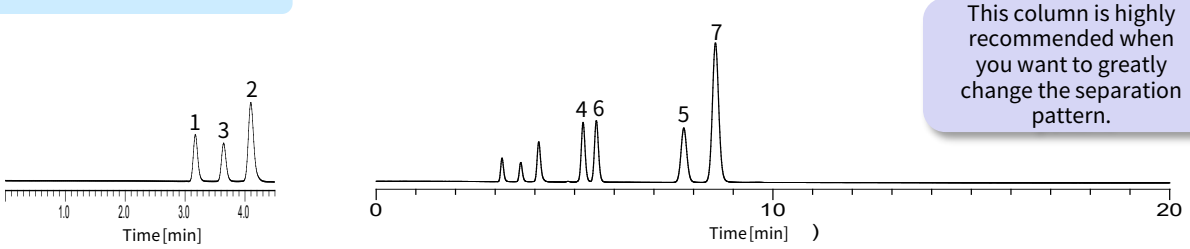
Demonstrates strong retention performance for highly polar basic compounds.

InertSustain Phenylhexyl



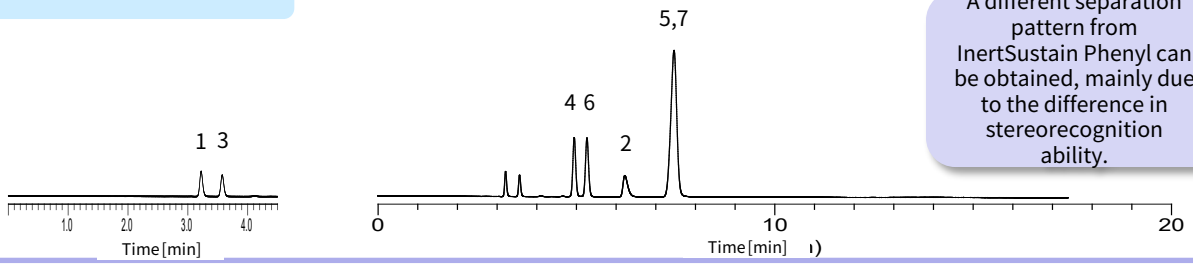
It is useful when you want to slightly change the separation while maintaining the separation pattern on the ODS column to some extent.

InertSustain Phenyl



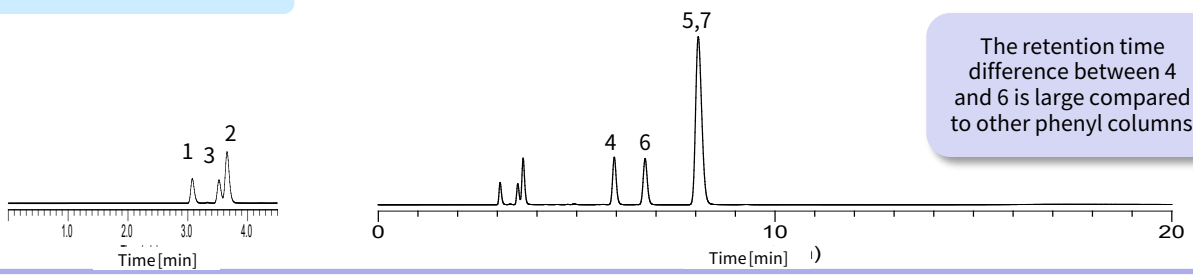
This column is highly recommended when you want to greatly change the separation pattern.

Inertsil Ph-3



A different separation pattern from InertSustain Phenyl can be obtained, mainly due to the difference in stereorecognition ability.

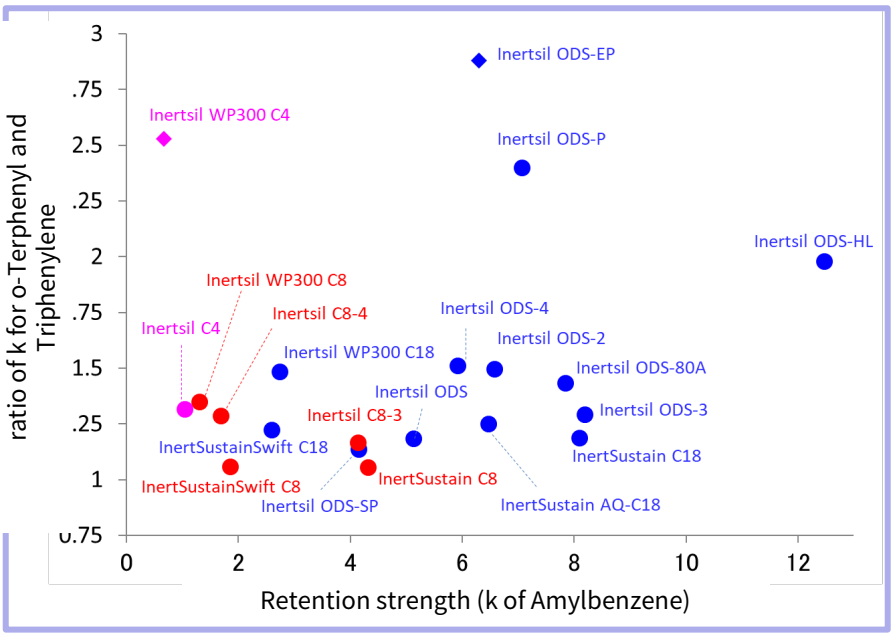
Inertsil Ph

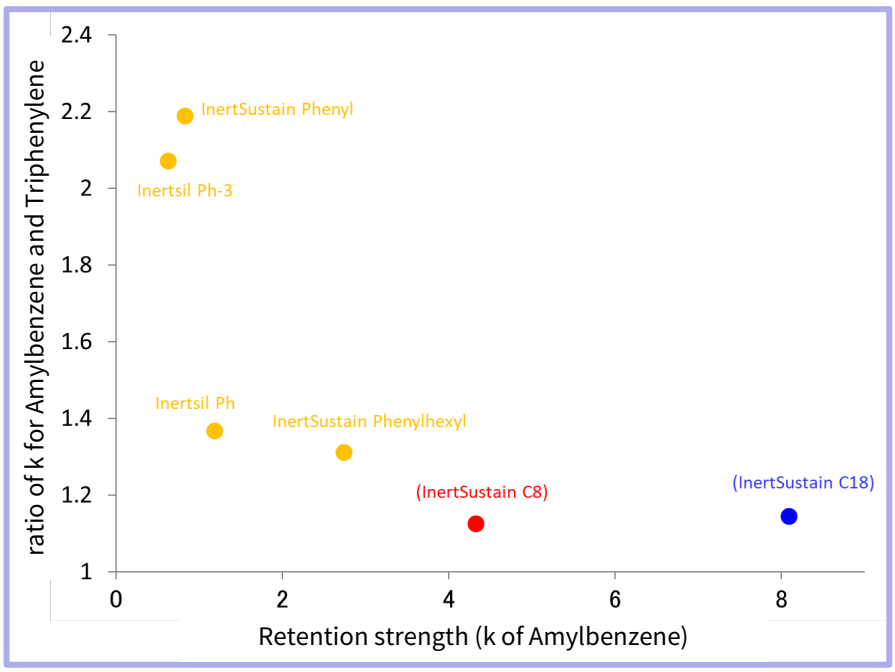


The retention time difference between 4 and 6 is large compared to other phenyl columns.

InertSustain , Inertsil series distribution model

The figure below shows the stereoselectivity and the strength of the π-electron interaction with respect to the retention strength of the reversed-phase column. “Retention strength” is the retention coefficient of Amylbenzene, “Stereoselectivity” is the retention ratio of o-Terphenyl and Triphenylene, and “Strength of π-electron interaction” is the retention ratio of Amylbenzene and Triphenylene.





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