

Attributes of Advantage™ FluroPhase Columns :

- Enhanced Selectivity for Structural Isomers
- Increased Retention for Polar Compounds
- Increased Retention and Selectivity for Halogenated Compounds
- Low Bleed
- pH Stable, 2-9

| Phase | Chemistry | Particle Size | Pore Size |
|----------------|-------------------------|---------------|-----------|
| FluroPhase PFP | Pentafluorophenyl | 3µm, 5µm | 120Å |
| FluroPhase RP | Perfluorinated alkyl C6 | 3µm, 5µm | 120Å |

Fluorinated packings show increased retention and extra selectivity for compounds that have fluorine and chlorine substituents. They exhibit shape selectivity for closely related compounds, especially positional isomers on aromatic rings and other rigid systems.

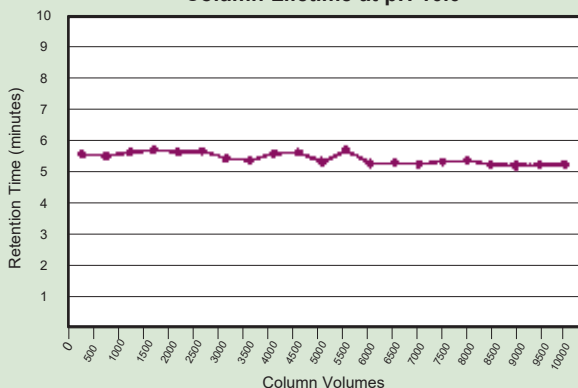
Our Fluorinated packings show excellent results on non-halogenated compounds such as Lipids, Surfactants, Taxanes, Catechins and many other polar compounds with carboxyl or nitro groups.

Halogenated analytes are generally retained longer on the FluroPhase RP phase when compared to C4 and C8 non-fluorinated alkyl phases. This makes FluroPhase RP useful for separating mixtures containing both non-halogenated and halogenated analytes because of the increased retention for the halogenated components. It has also been shown that polyfluorinated solutes are better retained on FluroPhase RP.

The Advantage™ FluroPhase PFP is a fluorinated phenyl ring. The types of applications include separation of natural products, halogenated compounds, aromatics, conjugated compounds and trace impurities in complex matrices.

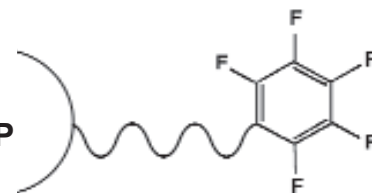
Figures 1 and 2 show how improved resolution can be obtained using Advantage™ FluroPhase RP and Advantage™ PFP when compared to analysis of the same compounds using a typical reverse phase column.

Column Lifetime at pH 10.0



After being exposed to pH 10 mobile phase for 10,000 column volumes, retention time remained unchanged for Napthalene.

Advantage™ FluroPhase PFP



Advantage™ FluroPhase RP

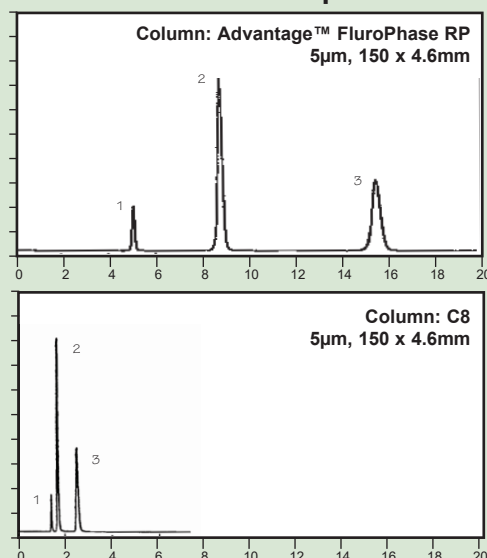


Increased Retention of Polar Compounds

Figure 1

- 1) Procainamide HCl
- 2) Acetylprocainamide
- 3) Propylprocainamide

Mobile Phase:
85/15 20mM
Acetate Buffer
pH 4.0/Acetonitrile
Flow Rate: 1.0 mL/min.
Detector: UV at 254nm

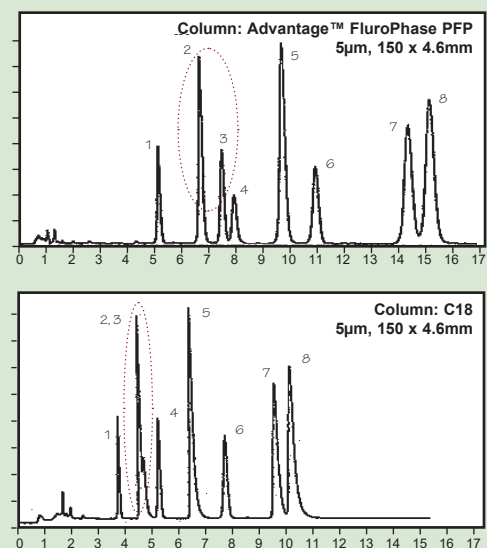


Enhanced Selectivity for Closely Related Compounds

Figure 2

- 1) Simazine
- 2) Simetryn
- 3) Ametryn
- 4) Atrazine
- 5) Propazine
- 6) Prometryn
- 7) Terbutryn
- 8) Prometon

Mobile Phase:
50/50 10mM
Acetate Buffer
pH 4.0/Acetonitrile
Flow Rate: 1.2 mL/min.
Detector: UV at 256nm



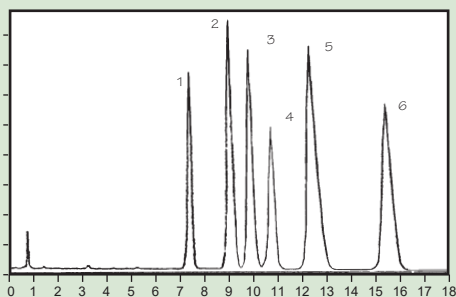
*The circles around peaks 2 & 3 above illustrate the difference in selectivity between these two columns

Figure 3

Isomeric Difluorophenols

Complete & Rapid
Resolution of all
Six Isomers of
Difluorophenol:

- 1) 2,6-Difluorophenol
- 2) 2,4-Difluorophenol
- 3) 2,5-Difluorophenol
- 4) 2,3-Difluorophenol
- 5) 3,4-Difluorophenol
- 6) 3,5-Difluorophenol



Mobile Phase: 75/25 Water/Acetonitrile

Buffer: 25mM Acetate Buffer, pH 4.3

Flow Rate: 1.2 mL/min.

Detector: UV at 256nm

Column: Advantage™ FluroPhase RP
5µm, 150 x 4.6mm

Enhanced Selectivity for Closely Related Compounds and Structural Isomers

Advantage™ FluroPhase PFP is an excellent solution for the difficult analysis of structural isomers, especially those associated with rigid ring systems.

Positional isomers on a ring structure are often difficult if not impossible to separate on an alkyl stationary phase. As the substituents move around a ring structure, as in the isomers of difluorophenol (**Figure 3**), the hydrophobicity of the molecule remains nearly constant. Because the primary interaction between an analyte and an alkyl stationary phase is primarily hydrophobic the selectivity is based only on differences in the hydrophobicity. Often when a separation can not be achieved on an alkyl phase, a phenyl phase may be used for pi-pi interactions.

As **Figure 4** illustrates, although the phenyl phase offers different selectivity than a C18 phase for the isomers of dinitronaphthalene, neither phase offers complete resolution of all 4 compounds under the conditions tested. The rigid nature of the fluorine substituted FluroPhase PFP coupled with pi-pi and dipole-dipole interactions may help explain the improved selectivity observed for this phase.

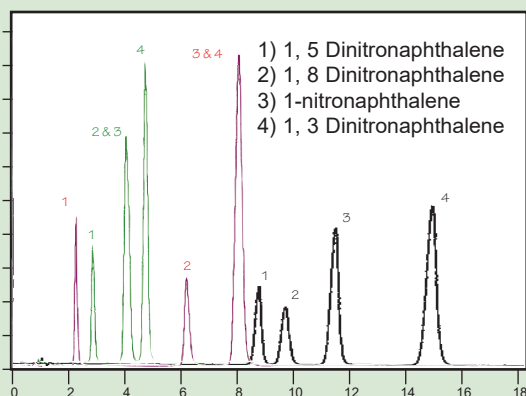
Employing different organic modifiers in the mobile phase can control the pi-pi interactions or aromatic selectivity. Methanol will maximize these interactions, while acetonitrile will minimize these interactions. This can be a powerful tool for improving selectivity between closely eluting conjugated and non-conjugated compounds as the retention of a specific compound can be selectively changed.

TECH TIP

Maximum selectivity of closely related compounds is often achieved with Methanol as organic modifier.

Figure 4

FluroPhase PFP Complete Resolution of Positional Isomers



Mobile Phase: 45/55 Water/Methanol

Flow Rate: 1.0 mL/min.

Columns:
Red: C18 Column
Green: Phenyl Column
Black: Advantage™ FluroPhase PFP
5µm, 150 x 4.6mm

TECH TIP

Try higher pH for better retention, different selectivity of polar basic compounds while improving peak shape and quantitation.

The Advantage™ FluroPhase columns are also highly shape selective for non-halogenated compounds as illustrated in the separation of dinitronaphthalene isomers in Figure 4. The rigid nature of the fluorine substituted bonded phase may explain why the perfluorinated phases offer enhanced shape selectivity for isomers.

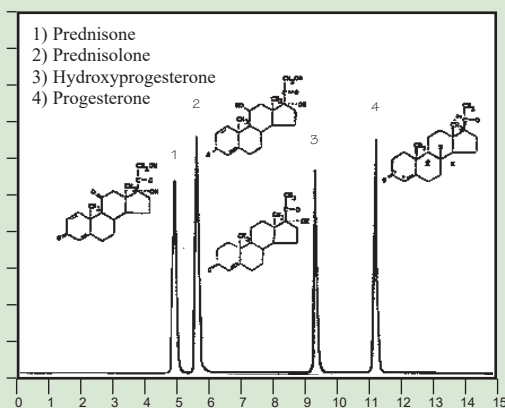
The superior structural recognition offered by Advantage™ FluroPhase makes it ideal for the difficult separation of epimers found in natural products, API impurity identification and purification, steroids, and antibiotics. API impurity identification is often complicated by the fact that impurities are often present in trace levels making quantitation of poorly resolved peaks difficult as the minor peaks are often "lost" under the major components.

Steroids

Mobile Phase:
Water: Acetonitrile

Gradient:
A: H₂O
B: Acetonitrile

| Time | % B |
|------|-----|
| 0 | 40% |
| 6 | 80% |
| 15 | 80% |



Flow Rate: 1.0mL/min.

Detection: UV @ 254nm

Column: FluroPhase PFP
5µm, 250 x 4.6 mm

We recommend Advantage™ FluroPhase Columns for the following applications:

- Bulk pharmaceutical characterization
- Pharmaceutical API impurity identification and purification
- Steroids
- Antibiotics
- Natural products
- Explosives
- Catecholamines
- Halogenated compounds

Increased Retention for Polar Compounds

Retention of polar compounds is often difficult to achieve on ODS phases where the primary solute-phase interaction is hydrophobic. However the strong interaction between the polar groups of the analyte and the dipole properties of the fluorine-carbon bond offers increased retention for polar compounds.

The separation of aminophenols in **Figure 5** clearly illustrates the increased retention behavior of polar compounds on FluroPhase RP. The log P value is the octanol/water partition coefficient. The lower the log P value, the more polar the compound and less it will be retained on C18 or other hydrophobic surfaces. At less than 0.1, the log P values of ortho and meta isomers of phenylene diamine would suggest very little retention on a hydrophobic alkyl phase, however, due to the polar fluorine-carbon bond these compounds are well retained and separated on the Advantage™ FluroPhase RP column.

The polar nature of Advantage™ FluroPhase columns makes them ideal for use in HILIC mode, where retention increases with increasing organic concentration. This is another useful tool for alternative retention and selectivity, especially for LC-MS applications, where sensitivity can be increased with higher organic concentrations.

Increased Retention and Selectivity for Halogenated Compounds

Advantage™ FluroPhase RP and PFP exhibit improved selectivity and retention patterns for halogenated compounds when compared to their non-fluorinated counterparts such as C8 and Phenyl. As illustrated in **Figures 6 & 7** halogenated compounds are more retained than their non-halogenated analogs.

In addition fluorinated phases are highly selective for halogenated compounds. This effect is most appreciable for fluorinated compounds due to specific fluorine-fluorine interactions.

Figure 6

Ftorafur and Impurities

Mobile Phase:
90:10 Water: Acetonitrile
Buffer: 20mM Potassium
Phosphate pH 7.0
Flow Rate: 1.0mL/min.
Detection: UV @ 254nm

Column:
FluroPhase PFP

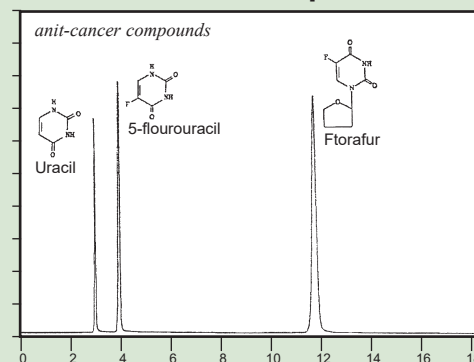
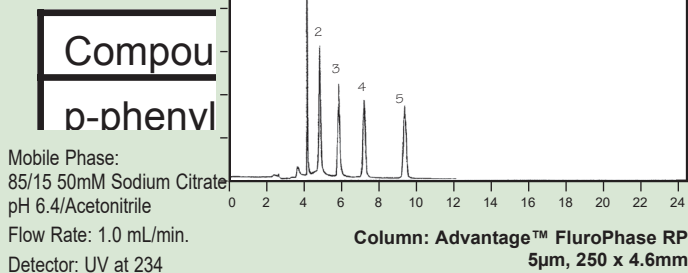


Figure 5

Increased Retention for Polar Compounds: Separation of Amino Phenols

- 1) p-phenylene diamine
- 2) p-aminophenol
- 3) m-phenylene diamine
- 4) m-aminophenol
- 5) Resorcinol



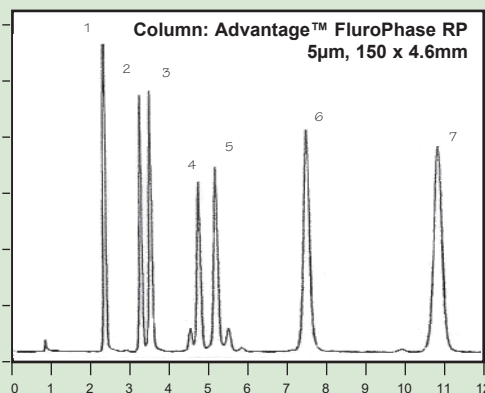
TECH TIP

HILIC mode for alternative selectivity:
Retention for polar compounds increases with increasing organic, so start with a gradient, 10% Aqueous to 90% Aqueous.

Figure 7

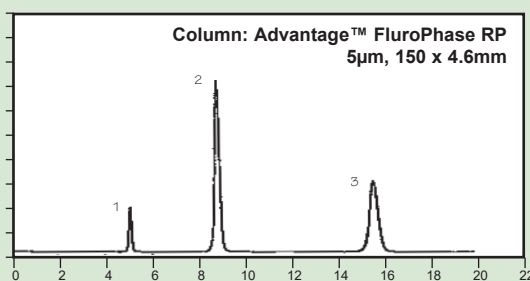
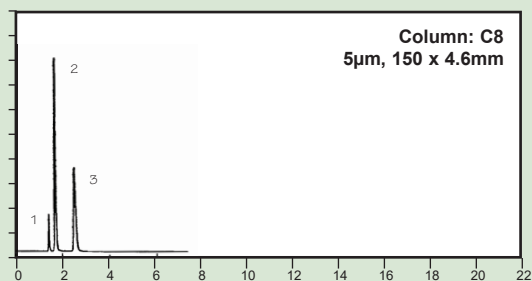
Phenoxyacid Herbicides

Mobile Phase:
65/35 Water/
Acetonitrile
Buffer: 25mM
Phosphate
Buffer, pH 3.0
Flow Rate: 1.0 mL/min.
Detector: UV at 256nm



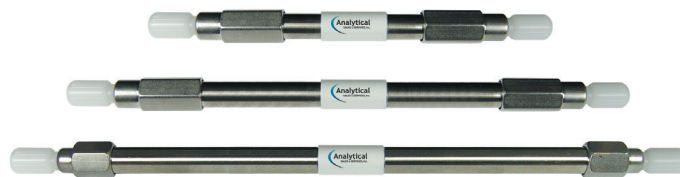
- 1) Phenoxyacetic Acid
- 2) o-chlorophenoxyacetic acid
- 3) p-chlorophenoxyacetic acid
- 4) 2,3-dichlorophenoxyacetic acid
- 5) 2,3-dichlorophenoxyacetic acid
- 6) 2,4,5-trichlorophenoxy acetic acid
- 7) 2,4,5 -trichlorophenoxypropionic

Increased Retention of Polar Compounds



- 1) Procainamide HCl
- 2) Acetylprocainamide
- 3) Propylprocainamide

Mobile Phase:
85/15 20mM
Acetate Buffer
pH 4.0/Acetonitrile
Flow Rate: 1.0 mL/min.
Detector: UV at 254nm



Advantage™ FluroPhase PFP Columns

Standard-bore (4.6mm)

| Cat. No. | Particle Size | Column Size |
|----------|---------------|---------------|
| 8030546 | 3µm | 50mm x 4.6mm |
| 8031046 | 3µm | 100mm x 4.6mm |
| 8031546 | 3µm | 150mm x 4.6mm |
| 8050546 | 5µm | 50mm x 4.6mm |
| 8051046 | 5µm | 100mm x 4.6mm |
| 8051546 | 5µm | 150mm x 4.6mm |
| 8052546 | 5µm | 250mm x 4.6mm |

Small-bore (3.2mm)

| Cat. No. | Particle Size | Column Size |
|----------|---------------|---------------|
| 8030532 | 3µm | 50mm x 3.2mm |
| 8031032 | 3µm | 100mm x 3.2mm |
| 8031532 | 3µm | 150mm x 3.2mm |
| 8050532 | 5µm | 50mm x 3.2mm |
| 8051032 | 5µm | 100mm x 3.2mm |
| 8051532 | 5µm | 150mm x 3.2mm |
| 8052532 | 5µm | 250mm x 3.2mm |

Small-bore (2.1mm)

| Cat. No. | Particle Size | Column Size |
|----------|---------------|---------------|
| 8030521 | 3µm | 50mm x 2.1mm |
| 8031521 | 3µm | 150mm x 2.1mm |
| 8050521 | 5µm | 50mm x 2.1mm |
| 8051021 | 5µm | 100mm x 2.1mm |
| 8051521 | 5µm | 150mm x 2.1mm |
| 8052521 | 5µm | 250mm x 2.1mm |

Advantage™ FluroPhase RP Columns

Standard-bore (4.6mm)

| Cat. No. | Particle Size | Column Size |
|----------|---------------|---------------|
| 8830546 | 3µm | 50mm x 4.6mm |
| 8831046 | 3µm | 100mm x 4.6mm |
| 8831546 | 3µm | 150mm x 4.6mm |
| 8850546 | 5µm | 50mm x 4.6mm |
| 8851046 | 5µm | 100mm x 4.6mm |
| 8851546 | 5µm | 150mm x 4.6mm |
| 8852546 | 5µm | 250mm x 4.6mm |

Small-bore (3.2mm)

| Cat. No. | Particle Size | Column Size |
|----------|---------------|---------------|
| 8830532 | 3µm | 50mm x 3.2mm |
| 8831032 | 3µm | 100mm x 3.2mm |
| 8831532 | 3µm | 150mm x 3.2mm |
| 8850532 | 5µm | 50mm x 3.2mm |
| 8851032 | 5µm | 100mm x 3.2mm |
| 8851532 | 5µm | 150mm x 3.2mm |
| 8852532 | 5µm | 250mm x 3.2mm |

Small-bore (2.1mm)

| Cat. No. | Particle Size | Column Size |
|----------|---------------|---------------|
| 8830521 | 3µm | 50mm x 2.1mm |
| 8831021 | 3µm | 100mm x 2.1mm |
| 8831521 | 3µm | 150mm x 2.1mm |
| 8850521 | 5µm | 50mm x 2.1mm |
| 8851021 | 5µm | 100mm x 2.1mm |
| 8851521 | 5µm | 150mm x 2.1mm |
| 8852521 | 5µm | 250mm x 2.1mm |



Protect your Advantage Analytical Column!

A guard column can increase the life of your analytical column up to five-fold! Use a guard column with the same packing as your column -- it will act as a chemical filter, removing strongly retained materials in your sample that might otherwise contaminate your analytical column. It is more economical to replace a guard cartridge than to buy a new analytical column!

ADVANTAGE™ STAINLESS STEEL GUARD CARTRIDGE HOLDER & FluroPhase RP and PFP Filter Cartridges

- 1cm packed bed with virtually no loss of performance
- Connects with 1/16" tubing and male fitting
- Universal 3.2mm I.D. to protect analytical or small bore columns

| Cat. No. | Description |
|----------|--|
| ADV-CC | Advantage™ Kel-F® Column Coupler, 0.01" ID thru hole |

For pricing, see analytical-sales.com