



Explaining the Small Particle Advantage

Faster Sample Throughput on a 1.9 μ m Pinnacle™ DB HPLC Column

By Rick Lake, Pharmaceutical Innovations Chemist, Randy Romesberg, HPLC Innovations Chemist, and Becky Wittrig, Ph.D., HPLC Product Marketing Manager

- Faster analyses, uncompromised chromatography using a 1.9 μ m Pinnacle™ DB column.
- Narrow particle size distribution ensures consistent, high efficiencies and longer column lifetimes.
- 100% Restek manufactured—from base silica to final packed column—assures quality and reliability.

Restek is pleased to introduce an exciting new addition to our family of HPLC columns—the 1.9 μ m Pinnacle™ DB small particle column. Intended for use in ultra-high pressure liquid separations, the 1.9 μ m Pinnacle™ DB column combines the benefits of a popular technique with the unmatched quality you expect from Restek. From the manufacturing of the base silica through the packing of the column, Restek performs and tightly controls every step in the manufacturing process, guaranteeing ruggedness and reliability. Here we discuss how and why small particle HPLC columns provide faster separations, and demonstrate the high efficiency, excellent peak symmetry, and rapid analysis times that can be achieved on the 1.9 μ m Pinnacle™ DB column. *Continued on page 4.*

Explaining the Small Particle Advantage *(continued from page 3)*

In HPLC column terminology, particle size refers to the mean diameter of the silica spheres used as the support material to which the stationary phase is bonded. Until recently, the practical particle size limit was around 3 μ m; smaller particles created backpressures above the limit of conventional LC systems. The advent of LC systems capable of handling higher backpressures (>10000psi) now allows chromatographers to realize the benefits of sub-2 μ m particle size columns. Smaller particles give rise to greater column efficiencies and a wider range of usable flow rates, resulting in better resolution and higher sensitivity with a significantly faster overall analysis time. Figure 1 and Table 1 illustrate the excellent peak shape and higher efficiency characteristic of a 1.9 μ m Pinnacle™ DB C18 column, compared to competitive columns.

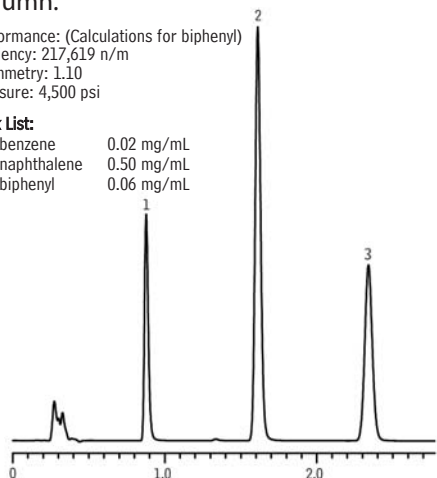
To demonstrate the substantial gain in sample throughput that is possible on a small particle column, we assayed a series of parabens under conditions that give comparable linear velocities on both a C18 column with conventional dimensions and on a 1.9 μ m Pinnacle™ DB C18 column (Figure 2B & C). Similar resolution was achieved in a much shorter analysis time on the 1.9 μ m Pinnacle™ DB C18 column. We also doubled the flow rate on the 1.9 μ m Pinnacle™ DB C18 column: the resolution and peak efficiencies again were comparable, but the analysis time was cut in half (Figure 2A). This illustrates the considerable effect that small particles can have on chromatographic separations; a much wider range of usable flow rates translates into significantly faster analysis times—in this case 10-fold faster, with no loss in chromatographic quality.

Figure 1 Excellent peak symmetry and efficiency on a 1.9 μ m Pinnacle™ DB C18 column.

Performance: (Calculations for biphenyl)
 Efficiency: 217,619 n/m
 Asymmetry: 1.10
 Pressure: 4,500 psi

Peak List:

1. benzene	0.02 mg/mL
2. naphthalene	0.50 mg/mL
3. biphenyl	0.06 mg/mL



Sample: Inj.: 2 μ L, HPLC Reversed Phase Test Mix #1 (cat.# 35005),
 Sample diluent: water:methanol (25:75), Sample temp.: ambient,
 Column: Pinnacle™ DB C18, Cat. #: 9414252, Dimensions: 50 x 2.1mm,
 Particle size: 1.9 μ m, Pore size: 140Å, Mobile phase: water:acetonitrile
 (45:55), Flow: 0.4 mL/min., Temp.: 25°C, Det.: UV @ 254nm LC_EX0427

Table 1 1.9 μ m Pinnacle™ DB C18 column offers the highest efficiency of all columns tested.

Column	Efficiency (n/m)	Pressure (psi)	Asymmetry
1.9 μ m Pinnacle™ DB	217,619	4,500	1.10
Competitor A	177,999	4,400	1.13
Competitor B	188,508	4,300	1.09

Data from the biphenyl peak of a reversed phase test mix.

Figure 2 1.9 μ m Pinnacle™ DB columns offer a wider range of usable flow rates, dramatically increasing sample throughput—with no loss in resolution.

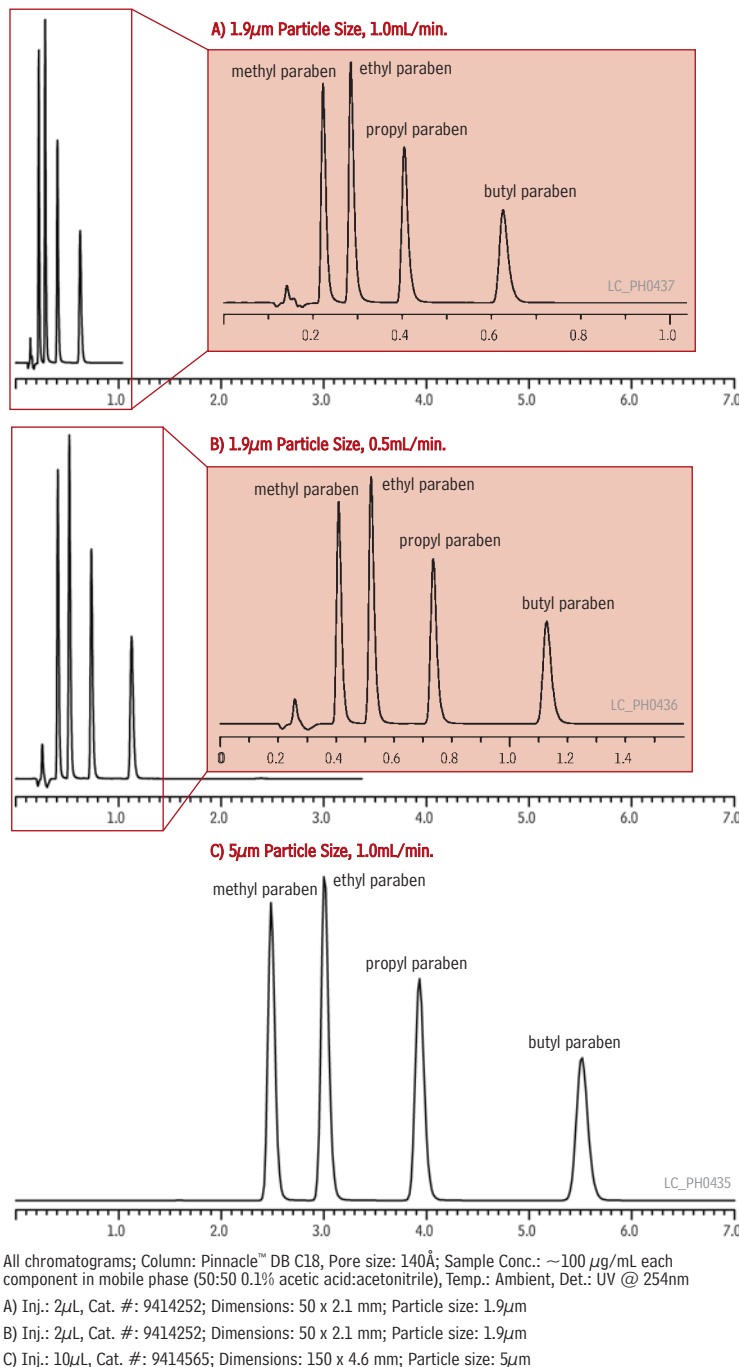
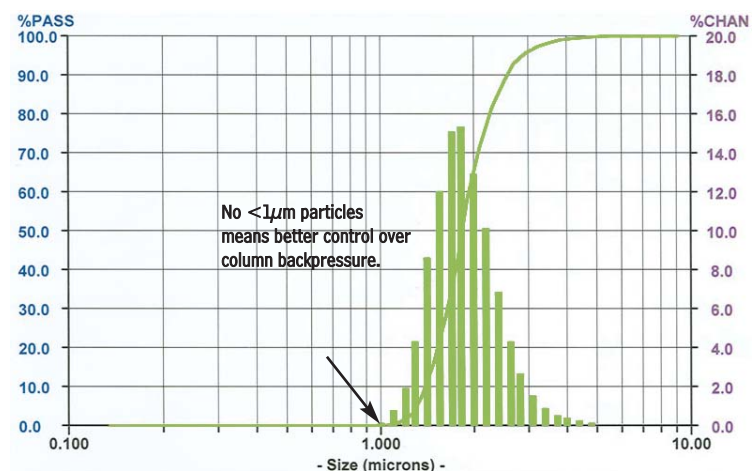


Figure 3 Pinnacle™ DB silica particle size distribution shows an exceptionally tight, symmetrical distribution around 1.9 μ m.



Column	Target Particle Size (μ m)	Actual Mean Particle Size (μ m)	Standard Deviation	Particles present <1 μ m
1.9 μ m Pinnacle™ DB	1.9	1.952	0.437	No
Competitor A	1.7	1.993	0.529	No
Competitor B	1.8	1.832	0.468	Yes

The stated particle size of an HPLC column is actually the mean of the distribution of all particles used in manufacturing the column. In practice, the smaller the particle size distribution, the more uniformly packed the column will be, resulting in higher efficiencies. This distribution is even more critical when manufacturing columns with particle sizes less than 2 μ m. If the distribution contains many larger particles and is not tightly controlled, the efficiency of the column and column-to-column reproducibility will suffer. More importantly, if the column contains particles less than 1 μ m (termed “fines”), clogging of the column frit and excessively high column backpressure can result. 1.9 μ m Pinnacle™ DB columns have a narrow, symmetric particle size distribution; they contain no particles less than 1 μ m in diameter. Figure 3 illustrates this exceptional distribution, which is tighter and more accurate than competitive sub-2 μ m columns.

1.9 μ m Pinnacle™ DB columns offer practical advantages for today's chemist across a wide range of analytes, from acidic to basic. For higher sample throughput, matched with the reliability and ruggedness of a column made entirely by chromatographers for chromatographers, reach for Restek small particle HPLC columns.

1.9 μ m Pinnacle™ DB C18 HPLC Columns

Physical Characteristics:

particle size: 1.9 μ m	endcap: yes
pore size: 140Å	pH range: 2.5 - 10
carbon load: 11%	temperature limit: 80°C

1.9 μ m Column, 2.1mm	cat. #
30mm	9414232
50mm	9414252
100mm	9414212

More Small Particles

For more information on the theory behind small particles, please refer to the complete article, “Explaining the Small Particle Advantage,” at www.restek.com/pharmaceutical



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