ZORBAX Eclipse XDB HPLC Columns

The "Perfect Fit" for Developing Better HPLC Methods

Technical Overview

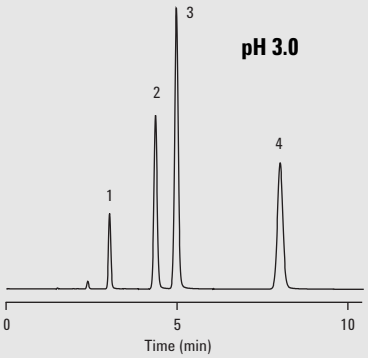
- Excellent peak shape for basic, acidic or neutral compounds
- High performance over a wide pH range
- Rugged, reproducible chromatography from column-to-column and lot-to-lot
- More selectivity options for method development

More and more chromatographers are developing their analytical and LC/MS separations on ZORBAX Eclipse XDB HPLC columns. Why? Because ZORBAX Eclipse XDB columns solve many of their separation challenges. In fact, Agilent Technologies includes a 4.6 x 150 mm, 5 µm ZORBAX Eclipse XDB-C8 column with every Agilent 1100 HPLC instrument it delivers. As Figure 1 shows, ZORBAX Eclipse XDB columns, specifically designed to extend column life and provide excellent peak shape for basic compounds in the pH range of 6 - 9, also deliver outstanding performance at low pH, as well.

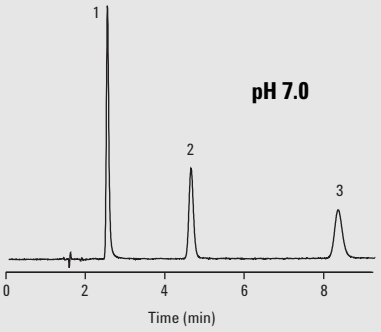
More detailed information about the benefits of the Eclipse column family can be found in this brochure.

Figure 1
Good Peak Shape for Acids, Bases and Neutrals at Low and Intermediate pH

ZORBAX Eclipse XDB-C18, 4.6 x 150 mm, 5 µm
(Agilent Part No. 993967-902)



Mobile Phase:	80% 25 mM Na_2HPO_4, pH 3.0 20% Methanol
Flow Rate:	1.0 mL/min
Temperature:	35°C
Sample:	1. Theobromine 2. Theophylline 3. 1,7-dimethylxanthine 4. Caffeine



Mobile Phase:	70% 25 mM Na_2HPO_4, pH 7.0 30% Methanol
Flow Rate:	1 mL/min
Temperature:	RT
Detection:	UV 254 nm
Sample:	1. Procainamide 2. N-acetylprocainamide 3. N-propionylprocainamide

Agilent Technologies

Eclipse XDB HPLC Column Technology Provides:

Excellent Peak Shape

eXtra Dense Bonding + High Purity Silica = Excellent Peak Shape

eXtra Dense Bonding is key to the exceptional performance of ZORBAX Eclipse XDB columns at intermediate pH (Figure 2). This dense bonding is accomplished by adding an extra-dense monolayer of C18, C8 or Phenyl silane to the ultra-pure, fully-hydroxylated, ZORBAX Rx-silica surface. The packing is then endcapped not once, but twice, using two different and unique endcapping reagents. This combination of extra-dense surface coverage by the bonded phase and double endcapping produces a highly, deactivated stationary phase that virtually eliminates undesirable interactions between polar solutes and the silica surface. As a result, superior peak shape, high efficiency, and long-term chromatographic reproducibility are assured when using Eclipse XDB HPLC columns at both intermediate and low pH.

The exceptional and reproducible performance at low pH that you can expect from the Eclipse XDB is demonstrated in Figure 3. In this example, acetylsalicylic acid, and the base, dextromethorphan, are consistently separated with excellent peak shape at low pH on three different Eclipse XDB-C8 columns from three different lots of packing material.

Figure 2
eXtra Dense Bonding (XDB) and Double Endcapping Improves Peak Shape for Polar Compounds at pH 7

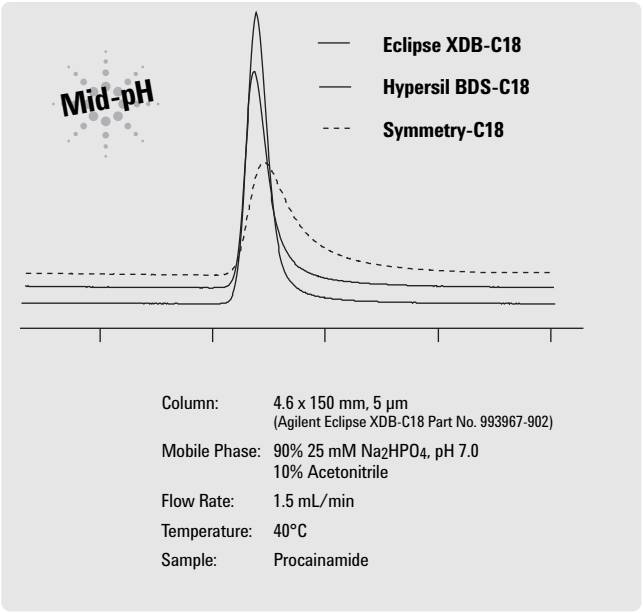
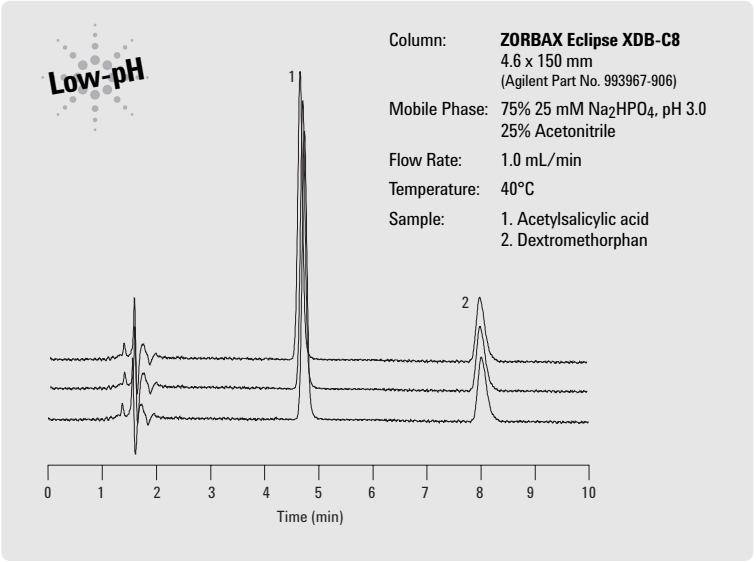


Figure 3
eXtra Dense Bonding (XDB) and Double Endcapping Improves Peak Shape for Polar Compounds at pH 3



Eclipse XDB HPLC Column Technology Provides:

Long Column Life

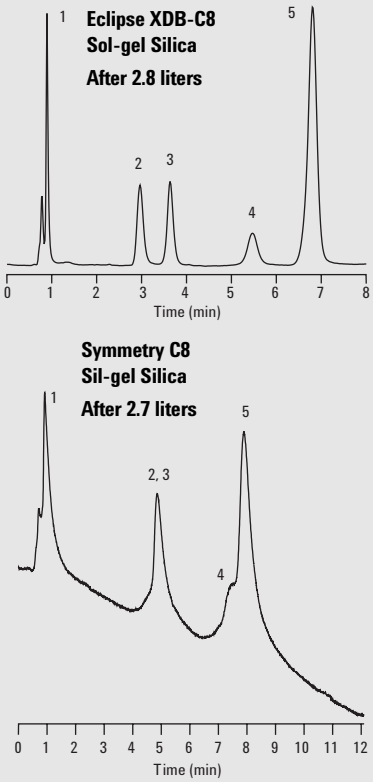
Eclipse XDB columns not only provide excellent peak shape but they are also exceptionally durable. In fact, the spherical ZORBAX Rx-SIL particles are the most durable, porous, 5 and 3.5 µm, silica particles commercially available. They are manufactured using a patented and proprietary process, forming thick, hard-walled silica, commonly referred to in the literature as "sol-gel" silica.

Because of the strength of the ZORBAX particle, all ZORBAX columns are consistently and reliably packed at pressures exceeding 8000 psi. The result is a durable column that can easily tolerate pressures up to 5000 psi in regular use without a loss in efficiency or a reduced lifetime.

Long Column Life at Intermediate pH

This thick, hard-walled "sol-gel" silica resists dissolution at intermediate pH and when densely bonded, the resultant Eclipse XDB column provides excellent column performance and increased column lifetime, even under the stressed intermediate pH conditions described in Figure 4.

Figure 4
Accelerated Column Aging Study Demonstrates the Durability of Eclipse XDB-C8 Over Waters' Symmetry C8



Column: 4.6 x 150 mm

Purge Conditions:

Mobile Phase:
20% Acetonitrile
80% 250 mM phosphate buffer, pH 7

Flow Rate: 1.5 mL/min

Temperature: 60°C

Test Conditions:

Mobile Phase:
60% Acetonitrile
40% 10 mM phosphate buffer, pH 7

Flow Rate: 1.5 mL/min

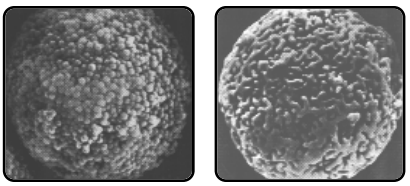
Temperature: 40°C

Sample: Tricyclic Antidepressants
1. Uracil 2. Nortriptyline 3. Doxepin
4. Amitriptyline 5. Trimipramine

Many commercial, base-deactivated, silica-based HPLC columns use manufacturing processes that produce a less robust "sil-gel" silica particle. The walls of these resulting high-surface area materials (typically 300 m^2/g for an 80-100Å pore material) are thinner and less uniform and can easily crush under high pressure conditions. Moreover, in many cases, they fail to withstand the high pressures of high flow rate LC/MS and High-Throughput methods.

The Eclipse XDB thick, hard-walled "sol-gel" is compared to the thin-walled "sil-gel" silica, used to make most of today's base-deactivated products, in electron micrographs shown in Figure 5.

Figure 5
Eclipse XDB is Based on Thick, Hard-Walled, Sol-gel Silica



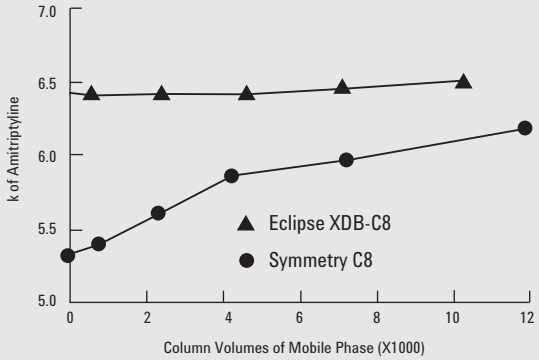
Sol-gel **Sil-gel**

Eclipse XDB columns are made with patented "hard wall" sol-gel silica particles. The thick walls of this silica are more resistant to dissolution than the "thin wall" sil-gel silica that is used to make most base-deactivated columns.

Long Column Life at Low pH

At low pH, Eclipse XDB columns provide better column life than most commercially available reversed-phase HPLC columns. Figure 6 summarizes the results from a low-pH accelerated aging study where loss in column performance is measured by a loss in bonded phase, indirectly measured by the change in retention of amitriptyline. The results show that less than 3% of the Eclipse XDB column performance is lost when exposed to 12,000 mL of a pH 3 mobile phase at 60°C. Under these same conditions more than 14% of column performance is lost on another popular "deactivated" reversed-phase HPLC column.

Figure 6
Accelerated Column Aging Study Demonstrates the Durability of ZORBAX Eclipse XDB-C8 Over Waters' Symmetry



Column: 4.6 x 150 mm

Purge Conditions:

Mobile Phase: 30% Acetonitrile
70% 50 mM NaOAc-HCl, pH 3

Flow Rate: 1.5 mL/min

Temperature: 60°C

Retention Test Conditions:

Mobile Phase: 30% Acetonitrile
70% 50 mM NaOAc-HCl, pH 3

Flow Rate: 1.0 mL/min

Temperature: 60°C

Sample: Amitriptyline

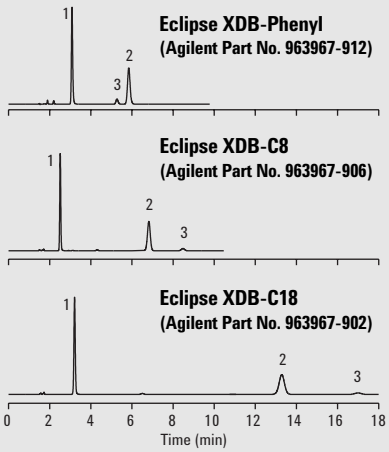
Eclipse XDB HPLC Column Technology Provides:

More Selectivity Options C18, C8 and Phenyl

Eclipse XDB HPLC columns are available as C18, C8 and Phenyl bonded phases. The Eclipse XDB-Phenyl phase complements both the most retentive Eclipse XDB-C18 and the moderately retentive Eclipse XDB-C8. The Eclipse XDB-Phenyl offers unique selectivity as well as reduced retention of non-polar and moderately polar compounds while maintaining retention of polar analytes.

These benefits are illustrated in Figure 7. Sunscreen components are well retained on the Eclipse XDB-C18, although the analysis time is long. Analysis time is reduced with more than acceptable resolution when using the Eclipse XDB-C8 or Eclipse XDB-Phenyl column, where analysis time is shortened by 50 or 61 percent, respectively.

Figure 7
Eclipse XDB-Phenyl Columns Offer Unique Selectivity and Short Analysis Times



Column: **ZORBAX Eclipse XDB**
4.6 x 150 mm, 3.5 µm

Mobile Phase: 85% Methanol
15% Water

Flow Rate: 1.0 mL/min

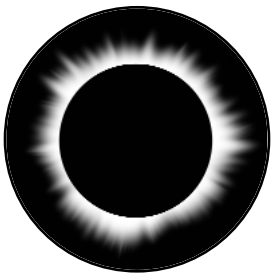
Temperature: 30°C

Detection: UV 310 nm

Sample: 1. Oxybenzone
2. Padimate O
3. Ethylhexyl Salicylate

Eclipse XDB HPLC Column Technology Provides:

Rapid Resolution

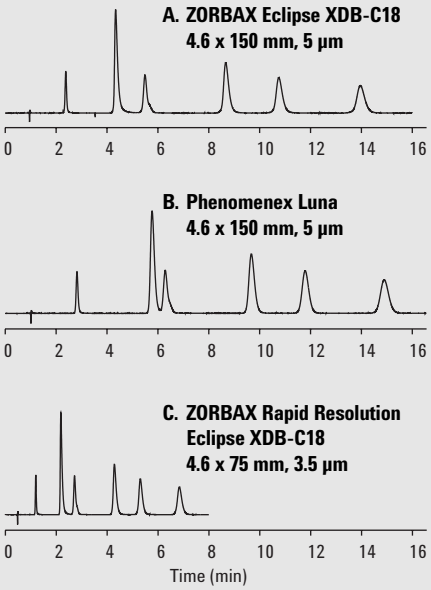


Eclipse XDB columns, available in 5 and 3.5 µm particle size packings, are highly efficient. In Figure 8A, six basic antidepressant compounds are well separated on a 5 µm, 4.6 x 150 mm, Eclipse XDB-C18 column using a methanol-phosphate mobile phase at pH 7. Peaks elute in sharp bands having average peak widths at half-height of 0.19 minutes. When the same sample was run on the Phenomenex Luna column, resolution between nortriptyline and doxepin ($R_{2,3}$) decreased significantly, with average peak widths at half-height being 47% wider, averaging 0.28 minutes for this assay.

For faster analysis, shorter Rapid Resolution Eclipse XDB columns, packed with 3.5 µm particles, provide equally efficient separations with reduced analysis times. This is demonstrated in Figure 8C, where analysis time is decreased by 50% — as retention decreases from 15.6 to 6.8 minutes — while resolution is maintained for this highly basic antidepressant sample.

If you have any questions about this or other applications in this bulletin, call 800-227-9770 select option 4 and ask for HPLC column technical support.

Figure 8
Eclipse XDB Provides High Efficiency and Rapid Resolution



Mobile Phase: 73% Methanol
27% 50 mM Phosphate, pH 7
Flow Rate: 1.5 mL/min.
Temperature: 40°C
Sample: Antidepressants
1. Imipramine
2. Nortriptyline
3. Doxepin
4. Doxylamine succinate
5. Amitriptyline
6. Cloripramine

Developing reliable reversed-phase methods for basic, acidic and neutral compounds just got easier . . .

Order Your ZORBAX Eclipse XDB HPLC Columns today!

ZORBAX Eclipse XDB Column Specifications

Bonded Phase	Pore Size	Surface Area	Temp. Limits	pH Range	Endcapped	Carbon Load
ZORBAX Eclipse XDB-C18	80Å	180 m^2/g	60°C	2.0 - 9.0	Double	10%
ZORBAX Eclipse XDB-C8	80Å	180 m^2/g	60°C	2.0 - 9.0	Double	7.6%
ZORBAX Eclipse XDB-Phenyl	80Å	180 m^2/g	60°C	2.0 - 9.0	Double	7.2%

ZORBAX Eclipse XDB Column Ordering Information

Column Description	Size (mm)	Particle Size (µm)	XDB-C18 USP L1	XDB-C8 USP L7	XDB-Phenyl USP L11
Standard Columns and Bulk Packings					
Semi-Prep	9.4 x 250	5	990967-202	990967-206	
Analytical	4.6 x 250	5	990967-902	990967-906	990967-912
Analytical	4.6 x 150	5	993967-902	993967-906	993967-912
Analytical	4.6 x 50	5	946975-902	946975-906	
Rapid Resolution	4.6 x 150	3.5	963967-902	963967-906	963967-912
Rapid Resolution	4.6 x 100	3.5	961967-902	961967-906	
Rapid Resolution	4.6 x 75	3.5	966967-902	966967-906	966967-912
Rapid Resolution	4.6 x 50	3.5	935967-902	935967-906	935967-912
Solvent Saver	3.0 x 250	5	990967-302	990967-306	990967-312
Solvent Saver	3.0 x 150	5	993967-302	993967-306	993967-312
Solvent Saver Plus	3.0 x 150	3.5	963954-302	963954-306	963954-312
Solvent Saver Plus	3.0 x 100	3.5	961967-302	961967-306	961967-312
Solvent Saver Plus	3.0 x 75	3.5	966954-302		
Narrow Bore	2.1 x 150	5	993700-902	993700-906	993700-912
Narrow Bore	2.1 x 50	5	960967-902	960967-906	960967-912
Narrow Bore RR*	2.1 x 150	3.5	930990-902	930990-906	
Narrow Bore RR	2.1 x 100	3.5	961753-902	961753-906	
Narrow Bore RR	2.1 x 75	3.5	966735-902		
Narrow Bore RR	2.1 x 50	3.5	971700-902	971700-906	
MicroBore RR	1.0 x 150	3.5	963600-902	963600-906	
MicroBore RR	1.0 x 50	3.5	965600-902	965600-906	
MicroBore RR	1.0 x 30	3.5	961600-902	961600-906	
Bulk Packing, 2 grams		5	920966-902		
Guard Cartridges, 4/pk	4.6 x12.5	5	820950-925	820950-926	820950-927
Guard Cartridges, 4/pk	2.1 x12.5	5	821125-926	821125-926	821125-926
Guard Hardware Kit			820777-901	820777-901	820777-901
Agilent Cartridge Columns					
Analytical	4.6 x 250	5	7995118-585	7995108-585	
Analytical	4.6 x 150	5	7995118-595	7995108-595	
Rapid Resolution	4.6 x 75	3.5	7995118-344	7995108-344	
Solvent Saver	3.0 x 75	3.5	7995230-344		
Guard Cartridges, 10/pk	4.0 x 4	5	7995118-504	7995118-504	
Cartridge Holder			5021-1845	5021-1845	
High Throughput Cartridge Columns (requires Hardware Kit 820222-901)					
Rapid Resolution Cartridge	4.6 x 30	3.5	933975-902	933975-906	
Rapid Resolution Cartridge, 3/pk	4.6 x 30	3.5	933975-932	933975-936	
Rapid Resolution Cartridge	4.6 x 15	3.5	931975-902	931975-906	
Rapid Resolution Cartridge, 3/pk	4.6 x 15	3.5	931975-932	931975-936	
Rapid Resolution Cartridge	2.1 x 30	3.5	973700-902	973700-906	
Rapid Resolution Cartridge, 3/pk	2.1 x 30	3.5	973700-932	973700-936	
Rapid Resolution Cartridge	2.1 x 15	3.5	975700-902	975700-906	
Rapid Resolution Cartridge, 3/pk	2.1 x 15	3.5	975700-932	975700-936	
Hardware Kit for High Throughput Columns			820222-901	820222-901	
CombiHT Columns (end fittings required)					
CombiHT	21.2 x 150	5	970150-902	970150-906	
CombiHT	21.2 x 100	5	970100-902	970100-906	
CombiHT	21.2 x 50	5	970050-902	970050-906	
CombiHT End Fittings (2) (required for use)			820400-901	820400-901	
Capillary Glass-lined Columns					
Capillary	0.5 x 250	5	5064-8286		
Capillary	0.5 x 150	5	5064-8287		
Capillary RR	0.5 x 150	3.5	5064-8288		
Capillary RR	0.5 x 35	3.5	5064-8298		
Capillary	0.3 x 250	5	5064-8269		
Capillary	0.3 x 150	5	5064-8291		
Capillary RR	0.3 x 150	3.5	5064-8271		
Guard Cartridges	0.5 x 35	5	5064-8296		
Guard Cartridges	0.3 x 35	5	5064-8297		

*RR: Rapid Resolution 3.5 µm columns.

For more information on these and other columns consult the Agilent web site at **www.agilent.com.**

Configurations not shown are available upon request.

For the latest information on the complete line of Agilent Technologies columns and supplies for analytical instruments, see our online catalog at www.agilent.com/chem on the World Wide Web, or contact your local Agilent sales office. For all other areas contact Agilent or your local authorized distributor.

Information, descriptions and specifications in this publication are subject to change without notice.

Printed in the USA
December 3, 2002
5988-8367EN

Agilent Technologies