

ZORBAX Eclipse XDB HPLC Columns

The First Choice 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

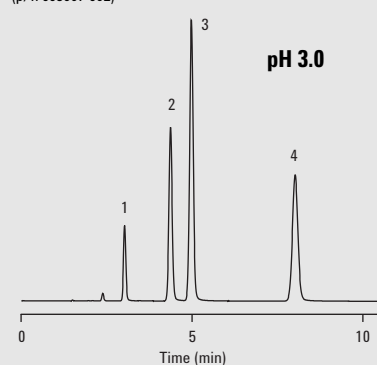
More and more chromatographers are developing their analytical and LC/MS separations on ZORBAX Eclipse XDB HPLC columns. Why? Because ZORBAX Eclipse XDB columns solve many of their separation challenges. In fact, Agilent Technologies includes a 4.6 × 150 mm, 5 μm ZORBAX Eclipse XDB column with every 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.

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

ZORBAX Eclipse XDB-C18

4.6 × 150 mm, 5 μm

(p/n 993967-902)

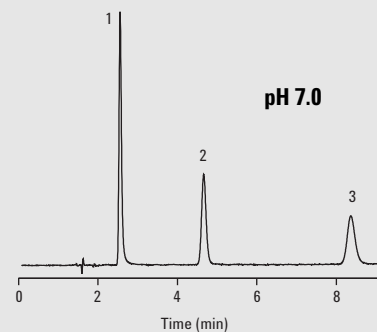


Mobile phase: 80% 25 mM Na₂HPO₄, pH 3.0
20% Methanol

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 Na₂HPO₄, 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



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



Agilent Technologies

Eclipse XDB HPLC Column Technology Provides: Excellent Peak Shape



eXtra Dense Bonding + High Purity Silica = Excellent Peak Shape

eXtra Dense Bonding (XDB) 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, phenyl, or CN-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
XDB and Double Endcapping Improves Peak Shape for Polar Compounds at pH 7.

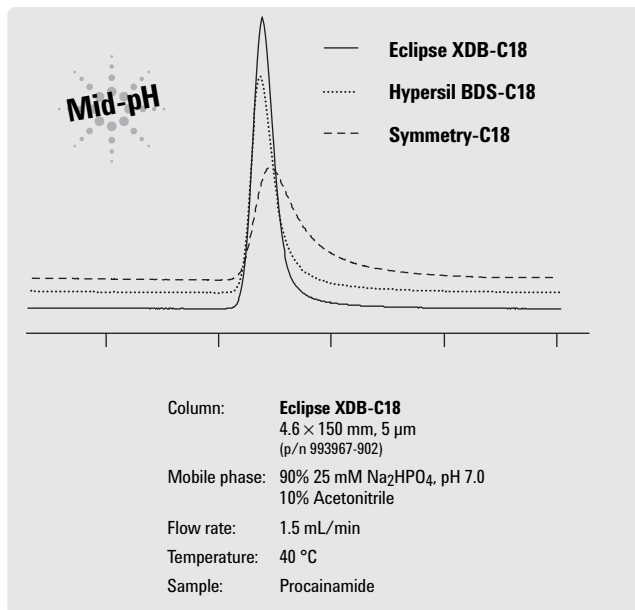
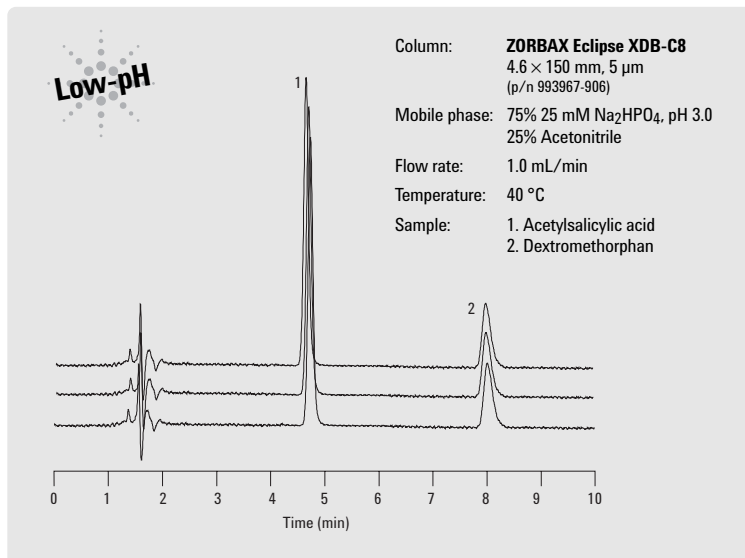


Figure 3
XDB and Double Endcapping Improves Peak Shape for Polar Compounds at pH 3.



Eclipse XDB HPLC Column Technology Provides: Long Column Life



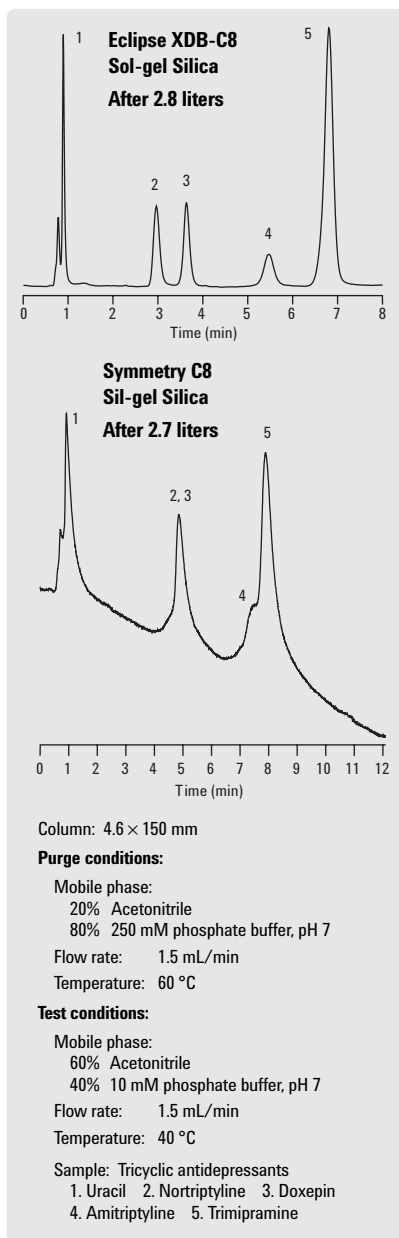
Eclipse XDB columns not only provide excellent peak shape but they are also exceptionally durable. In fact, the spherical ZORBAX Rx-SIL particles are the most durable, porous, 5, 3.5, and 1.8- μm silica particles commercially available. They are manufactured using a patented and proprietary process, 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/500 bar. The result is a durable column that can easily tolerate pressures up to 6000 psi/400 bar 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. When densely bonded, the resultant Eclipse XDB column provides excellent column performance and increased column lifetime, even when stressed at intermediate pH conditions as described in Figure 4.

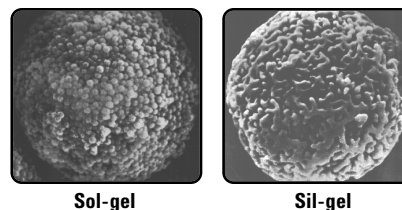
Figure 4
Accelerated Column Aging Study
Demonstrates the Durability of Eclipse
XDB-C8 Over Waters’ Symmetry C8.



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 80–100 \AA 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 fast 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.



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.

Long Column Life with All Bonded Phases

C18 and C8 columns are known for their long lifetimes. Shorter chain bonded phases, such as CN can be less stable. Figure 7 demonstrates Eclipse XDB-CN has superior stability at mid pH when compared to other CN bonded phases. The densely bonded and double-end-capped CN provides increased column lifetime when compared to other end-capped CN columns under mid pH conditions. This is shown by the consistent retention of the analyte caffeine at pH 7, while all of the competitive columns show dramatic losses in retention, and therefore loss in bonded phase, at pH 7.

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

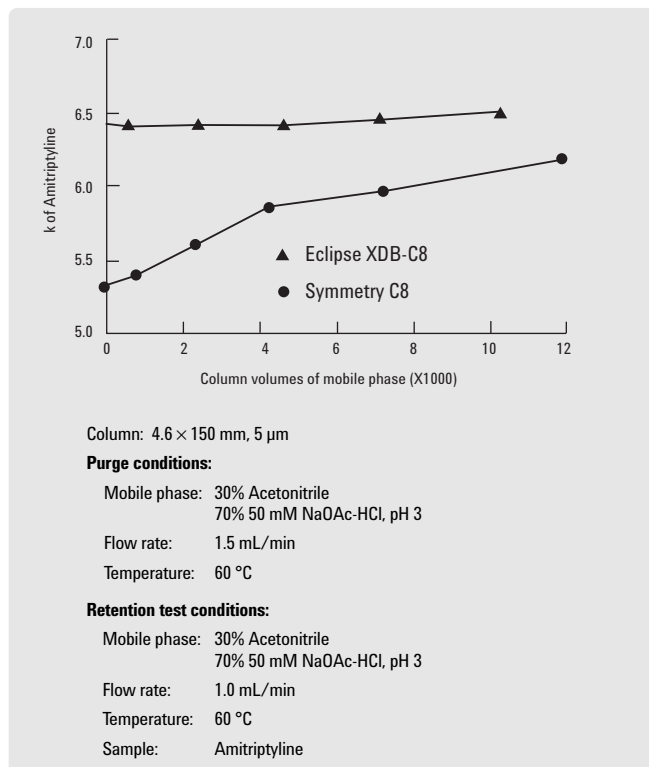
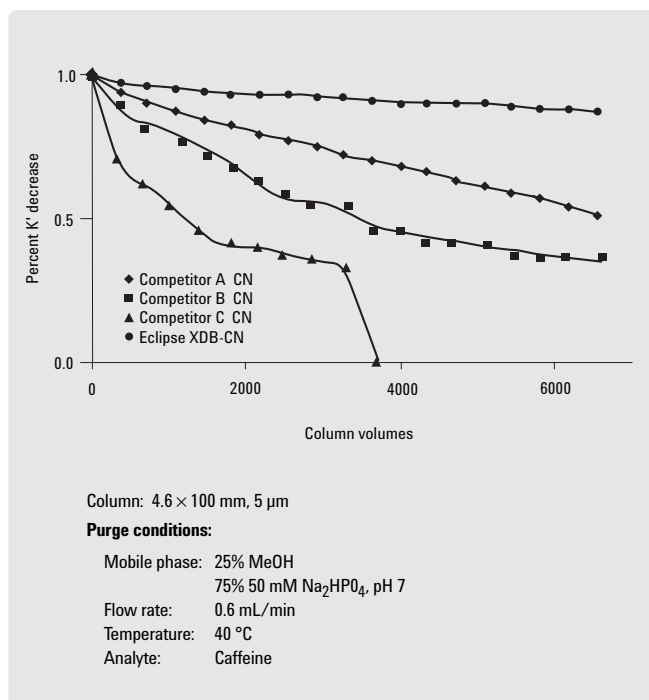


Figure 7
Superior Column Lifetime at pH 7 with Eclipse XDB-CN.



Eclipse XDB HPLC Column Technology Provides: More Selectivity Options C18, C8, Phenyl and CN

Eclipse XDB HPLC columns are available as C18, C8, Phenyl and CN bonded phases. The Eclipse XDB-Phenyl and CN phases complement 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. The Eclipse XDB-CN also provides the same benefits while maintaining retention of polar analytes.

These benefits are illustrated in Figures 8 and 9. In Figure 8, 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%, respectively.

In Figure 9 urea pesticides are well retained and resolved on Eclipse XDB-C18. The analysis time is reduced dramatically, by nearly 90%, on Eclipse XDB-CN. This is achieved by maintaining retention and resolution of the polar analytes and reducing retention of the most non-polar analyte, Pencycuron. When the mobile phase used on the Eclipse XDB-C18 is strengthened to reduce retention, the overall analysis time is reduced, comparable to the Eclipse XDB-CN. At the same time resolution is reduced with increasing solvent strength on the Eclipse XDB-C18 where it is maintained on the Eclipse XDB-CN under the same conditions.

Figure 8
Eclipse XDB-Phenyl Columns Offer Unique Selectivity and Short Analysis Times.

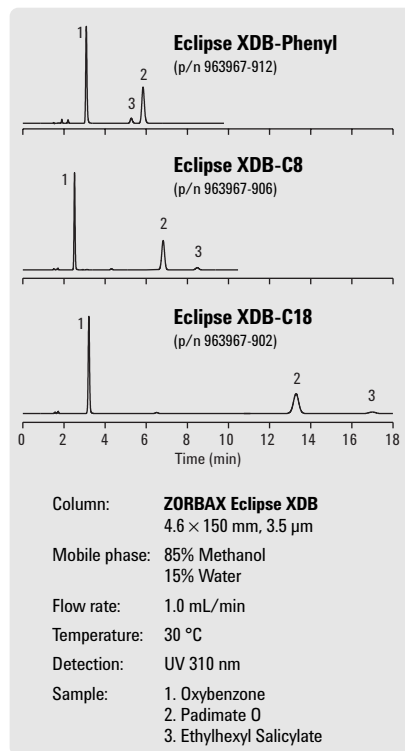
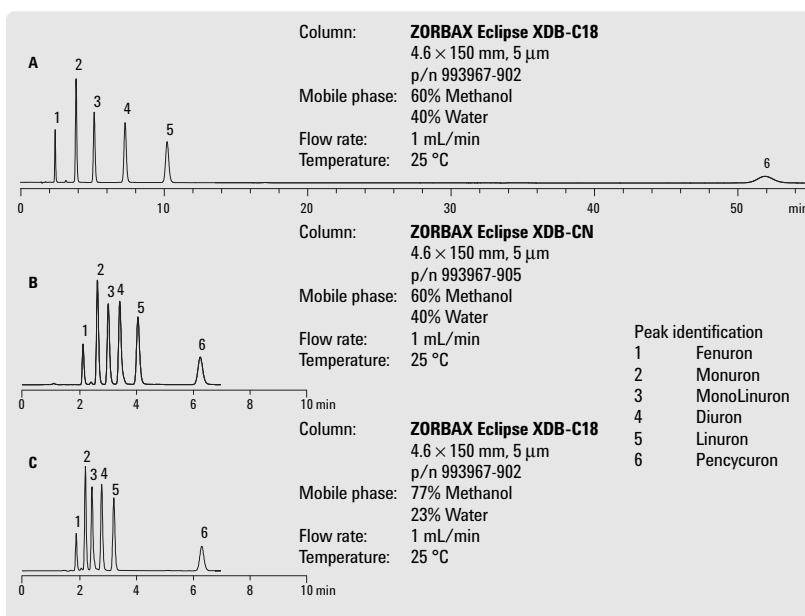


Figure 9
Comparison of Eclipse XDB-CN versus XDB-C18 for the Analysis of Urea Pesticides.



Eclipse XDB HPLC Column Technology Provides: Method Compatibility

Eclipse XDB columns, are available in C18, C8, Phenyl and CN bonded phases, and are excellent choices for pharmacopoeia or other regulated methods. Figure 10 shows the Eclipse XDB-C8 and Eclipse XDB-CN columns used in USP (United States Pharmacopoeia) methods for Norethindrone and Mestranol. The Eclipse XDB-C8 is used for the assay method requiring an L7 column while the Eclipse XDB-CN is used for the dissolution method requiring an L10 column. In each method the Eclipse XDB column is an ideal choice for meeting the method requirements.

A second example of method compatibility is shown in Figure 11. In this example the Eclipse XDB-CN column is used as the USP L10 column required in the method for purity determination of warfarin. The method specifies that the resolution between warfarin and warfarin related compound A should not be less than 3 and that the relative retention times should be 1.0 and about 1.2 for warfarin and its related compound. Figure 11 shows that these requirements are easily met. Therefore Eclipse XDB columns can be used equally well for new method development and as alternatives in published methods.

Figure 10
HPLC Separation of Norethindrone and Mestranol, Using Progesterone as an Internal Standard, on an Eclipse XDB-CN (L10-USP) Column vs. an Eclipse XDB-C8 (L7-USP) Column.

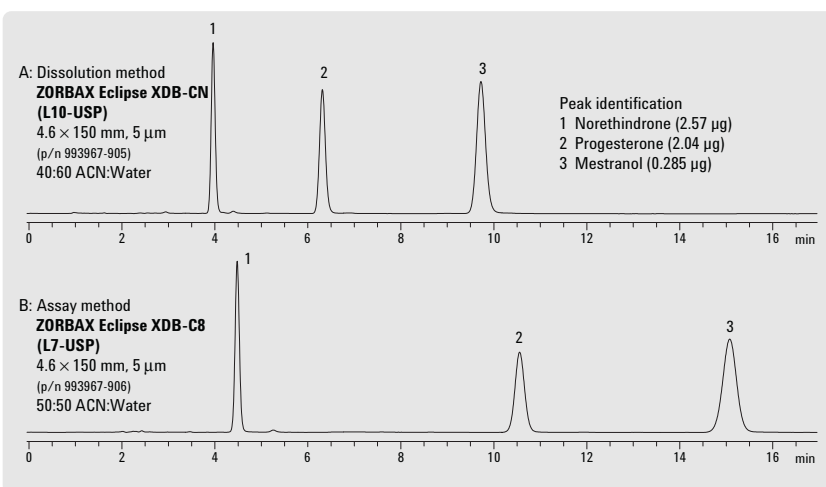
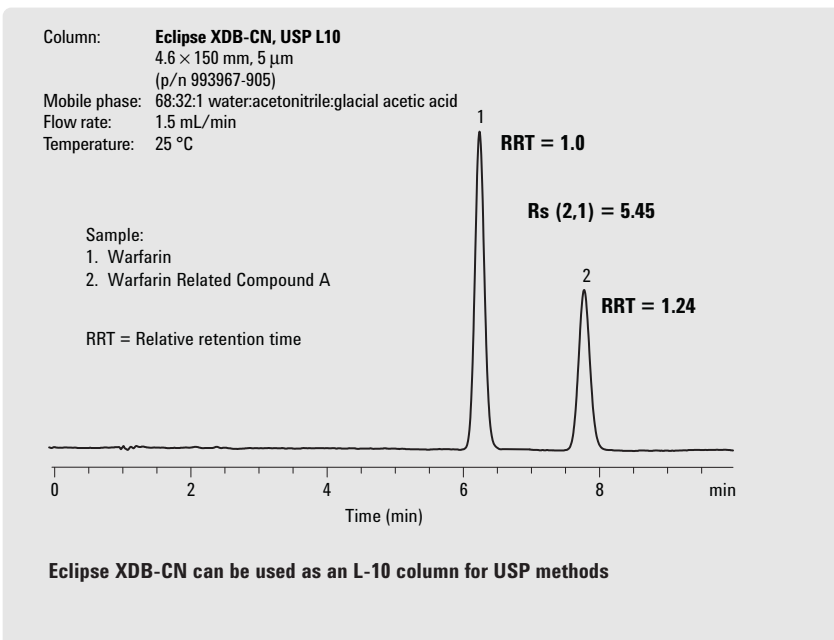
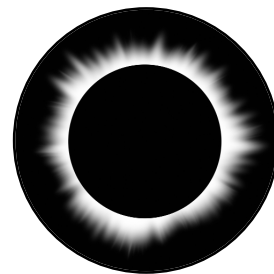


Figure 11
Separation of Warfarin and Warfarin Related Compound A Standards (USP Method).



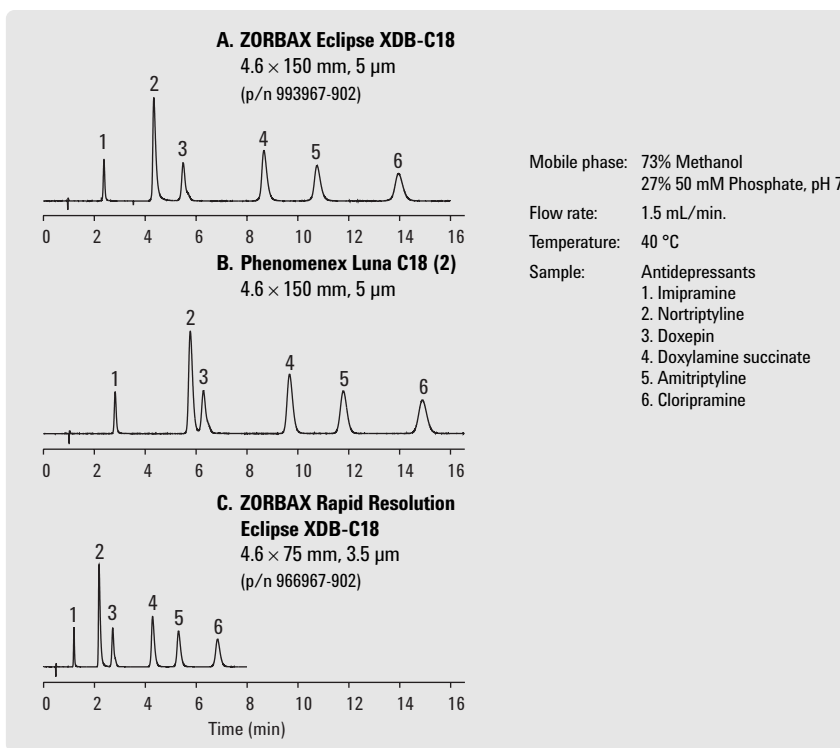
Eclipse XDB HPLC Column Technology Provides: Rapid Resolution



Eclipse XDB columns, available in 1.8, 3.5, and 5- μ m particle size packings, are highly efficient. In Figure 12A, six basic antidepressant compounds are well separated on a 5 μ m, 4.6 \times 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 C18 (2) 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- μ m particles, provide equally efficient separations with reduced analysis times. This is demonstrated in Figure 12C, where analysis time is decreased by 50%— while resolution is maintained for this highly basic antidepressant sample.

Figure 12
Eclipse XDB Provides High Efficiency and Rapid Resolution.



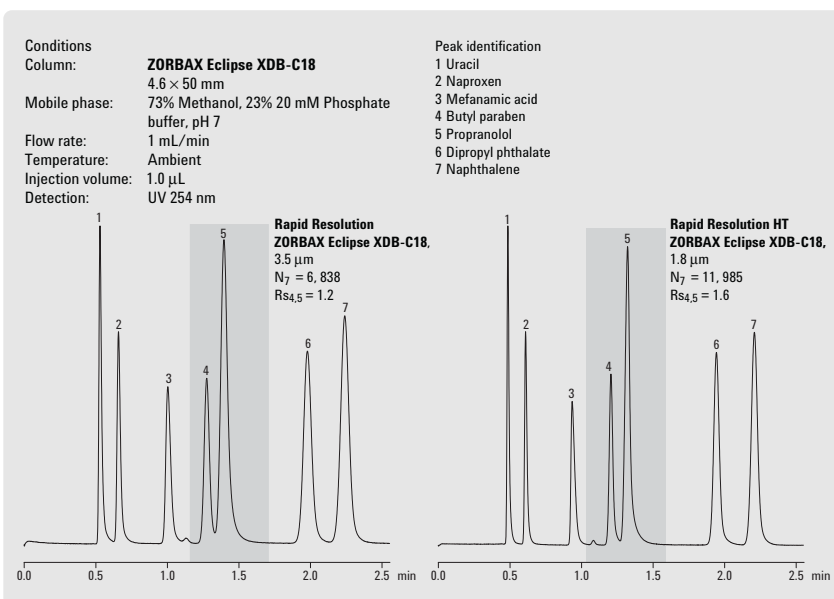
Eclipse XDB HPLC Column Technology Provides:

Rapid Resolution for High-Throughput Analysis

For the highest resolution with the fastest analysis, Rapid Resolution HT Eclipse XDB columns, packed with industry leading 1.8- μ m particles, provide the highest possible resolution. Figure 13 shows the enhanced resolution possible with a mixture of closely eluting compounds when using the Rapid Resolution HT columns with 1.8- μ m particles over the Rapid Resolution column with 3.5- μ m particles. The resolution of butyl paraben and propranolol improves by 33% on the Rapid Resolution HT column, while the total analysis time is still only 2.5 minutes.

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 13
Particle Size Comparison - Smallest Particle Size for Highest Resolution and Efficiency.



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-CN	80Å	180 m ² /g	60 °C	2.0-8.0	Double	4.3%

ZORBAX Eclipse XDB Column Ordering Information

Column description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	Eclipse XDB-Phenyl USP L11	Eclipse XDB-CN USP L10
Standard columns						
Semi-Prep	9.4 × 250	5	990967-202	990967-206		
Analytical	4.6 × 250	5	990967-902	990967-906	990967-912	990967-905
Analytical	4.6 × 150	5	993967-902	993967-906	993967-912	993967-905
Analytical	4.6 × 50	5	946975-902	946975-906		
Rapid Resolution	4.6 × 150	3.5	963967-902	963967-906	963967-912	963967-905
Rapid Resolution	4.6 × 100	3.5	961967-902	961967-906		961967-905
Rapid Resolution	4.6 × 75	3.5	966967-902	966967-906	966967-912	966967-905
Rapid Resolution	4.6 × 50	3.5	935967-902	935967-906	935967-912	
Rapid Resolution HT**	4.6 × 50	1.8	922975-902			
Rapid Resolution HT, 3/pk	4.6 × 50	1.8	922975-932			
Solvent Saver	3.0 × 250	5	990967-302	990967-306	990967-312	990967-305
Solvent Saver	3.0 × 150	5	993967-302	993967-306	993967-312	993967-305
Solvent Saver Plus	3.0 × 150	3.5	963954-302	963954-306	963954-312	963954-305
Solvent Saver Plus	3.0 × 100	3.5	961967-302	961967-306	961967-312	
Solvent Saver Plus	3.0 × 75	3.5	966954-302			
Narrow Bore	2.1 × 150	5	993700-902	993700-906	993700-912	993700-905
Narrow Bore	2.1 × 50	5	960967-902	960967-906	960967-912	960967-905
Narrow Bore RR*	2.1 × 150	3.5	930990-902	930990-906		
Narrow Bore RR	2.1 × 100	3.5	961753-902	961753-906		961753-905
Narrow Bore RR	2.1 × 75	3.5	966735-902			
Narrow Bore RR	2.1 × 50	3.5	971700-902	971700-906	971700-906	
Narrow Bore RRHT	2.1 × 50	1.8	922700-902			
Narrow Bore RRHT	2.1 × 50	1.8	922700-932			
MicroBore RR	1.0 × 150	3.5	963600-902	963600-906		
MicroBore RR	1.0 × 50	3.5	965600-902	965600-906		
MicroBore RR	1.0 × 30	3.5	961600-902	961600-906		
MicroBore Guard cartridges, 3/pk	1.0 × 17	5	5185-5921	5185-5921		
Guard Cartridges, 4/pk	4.6 × 12.5	5	820950-925	820950-926	820950-927	820950-935
Guard Cartridges, 4/pk	2.1 × 12.5	5	821125-926	821125-926	821125-926	821125-935
Guard Hardware Kit			820888-901	820888-901	820888-901	820888-901
High-Throughput Cartridge Columns (require Hardware Kit 820555-901)						
Rapid Resolution Cartridge	4.6 × 30	3.5	933975-902	933975-906		
Rapid Resolution Cartridge, 3/pk	4.6 × 30	3.5	933975-932	933975-936		
Rapid Resolution Cartridge	4.6 × 15	3.5	931975-902	931975-906		
Rapid Resolution Cartridge, 3/pk	4.6 × 15	3.5	931975-932	931975-936		
Rapid Resolution Cartridge	2.1 × 30	3.5	973700-902	973700-906		
Rapid Resolution Cartridge, 3/pk	2.1 × 30	3.5	973700-932	973700-936		
Rapid Resolution Cartridge	2.1 × 15	3.5	975700-902	975700-906		
Rapid Resolution Cartridge, 3/pk	2.1 × 15	3.5	975700-932	975700-936		
RR Rapid Resolution HT Cartridge	4.6 × 50	1.8	925975-902	925975-906		
RR Rapid Resolution HT Cartridge, 3/pk	4.6 × 50	1.8	925975-932			
Rapid Resolution HT Cartridge	4.6 × 30	1.8	923975-902			
Rapid Resolution HT Cartridge, 3/pk	4.6 × 30	1.8	923975-932			
Rapid Resolution HT Cartridge	4.6 × 15	1.8	921975-902			
Rapid Resolution HT Cartridge, 3/pk	4.6 × 15	1.8	921975-932			
Rapid Resolution HT Cartridge	2.1 × 50	1.8	925700-902			
Rapid Resolution HT Cartridge, 3/pk	2.1 × 50	1.8	925700-932			
Rapid Resolution HT Cartridge	2.1 × 30	1.8	923700-902			
Rapid Resolution HT Cartridge, 3/pk	2.1 × 30	1.8	923700-932			
Rapid Resolution HT Cartridge	2.1 × 15	1.8	921700-902			
Rapid Resolution HT Cartridge, 3/pk	2.1 × 15	1.8	921700-932			
Hardware Kit for High-Throughput Columns			820555-901	820555-901		
PrepHT Cartridges (end fittings required)						
PrepHT Cartridge	21.2 × 250	7	977250-102	977250-106		
PrepHT Cartridge	21.2 × 150	7	977150-102	977150-106		
PrepHT Cartridge	21.2 × 150	5	970150-902	970150-906		
PrepHT Cartridge	21.2 × 100	5	970100-902	970100-906		
PrepHT Cartridge	21.2 × 50	5	970050-902	970050-906		
PrepHT Guard Cartridge	17 × 7.5	5	820212-925	820212-926		
Guard Hardware Kit			820444-901	820444-901		
PrepHT End Fittings (2) (required for use)			820400-901	820400-901		
Capillary Glass-lined Columns						
Capillary	0.5 × 250	5	5064-8286			
Capillary	0.5 × 150	5	5064-8287			
Capillary RR	0.5 × 150	3.5	5064-8288			
Capillary RR	0.5 × 35	3.5	5064-8298			
Capillary	0.3 × 250	5	5064-8269			
Capillary	0.3 × 150	5	5064-8291			
Capillary RR	0.3 × 150	3.5	5064-8271			
Capillary	0.5 × 35	5	5064-8296			
Capillary	0.3 × 35	5	5064-8297			

ZORBAX Eclipse XDB Column Ordering Information (continued)

Column description	Size (mm)	Particle Size (µm)	Eclipse XDB-C18 USP L1	Eclipse XDB-C8 USP L7	Eclipse XDB-Phenyl USP L11	Eclipse XDB-CN USP L10
Agilent Cartridge Columns						
Analytical	4.6 × 250	5	7995118-585	7995108-585		
Analytical	4.6 × 150	5	7995118-595	7995108-595		
Rapid Resolution	4.6 × 75	3.5	7995118-344	7995108-344		
Solvent Saver Plus	3.0 × 75	3.5	7995230-344			
Guard Cartridges, 10/pk	4.0 × 4	5	7995118-504	7995118-504		
Cartridge Holder			5021-1845	5021-1845		

*RR: Rapid Resolution 3.5-µm columns.

**RRHT Rapid Resolution HT 1.8-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.

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Luna® is a registered trademark of Phenomenex.

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.

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