

U.S. Patent No. 7, 563, 367

Setting the Standard for pH Method Development

Rugged reversed phase HPLC columns that offer extended lifetime at extreme pH conditions and excellent stability for reproducible, high efficiency separations.

- Take full advantage of high and low pH conditions (pH 1-12) to manipulate selectivity
- Expect longer column lifetime with patented TWIN-NX™ technology
- For analytical and preparative separations of basic and acidic compounds

If Gemini analytical columns do not provide at least an equivalent separation as compared to a competing column of similar particle size, similar phase and dimensions, send in your comparative data within 45 days and keep the Gemini column for FREE.

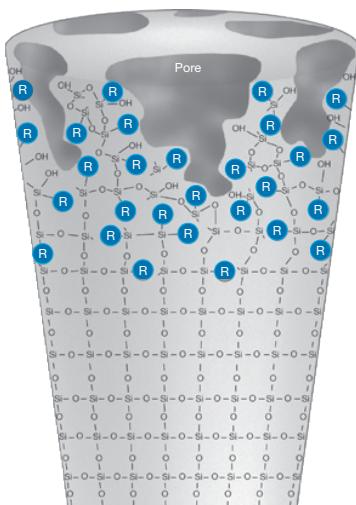
Phase	Description	USP Classification
NX C18	The most rugged Gemini column, offering 5 times the durability of previous generation hybrid columns	L1
C6-Phenyl	A low bleed phenyl phase. For UV and MS detection, which offers an aromatic selectivity complementary to C18 phases	L11
C18	Selectivity, high structural integrity and increased loadability for preparative and purification applications in pre-packed columns and bulk media	L1



HPLC — GEMINI

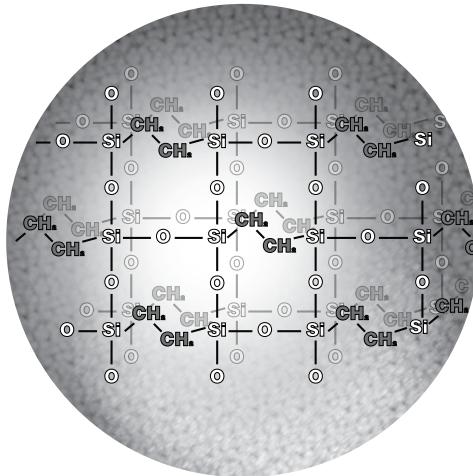
TWIN™ (Two-In-One) Technology™

During the final stage of silica manufacturing a unique silica-organic layer is grafted to create a completely new composite particle. Since the internal base silica is unaltered by this manufacturing process, the particle retains its mechanical strength and rigidity along with excellent efficiency, while the silica-organic shell protects the particle from chemical attack.



Second-Generation TWIN-NX™ Technology

TWIN-NX technology uses an improved patented organo-silica grafting process which incorporates highly stabilizing ethane cross-linking. These organic groups are evenly incorporated into the grafted layers on the silica surface while maintaining a pure silica core. This not only provides resistance to high pH attack, but also maintains the high efficiency and mechanical strength of a silica particle.



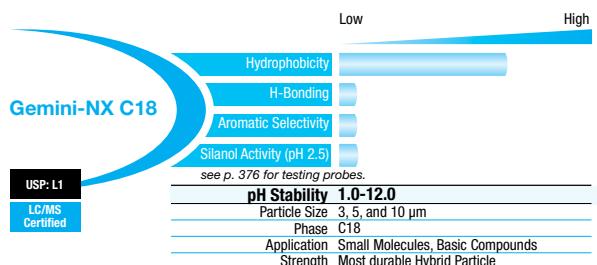
Gemini is a registered trademark of Phenomenex, Inc.
TWIN-NX is a trademark of Phenomenex, Inc.

Gemini®

U.S. Patent No. 7, 563, 367

Gemini-NX C18

- Control selectivity of ionizable compounds for optimized methods
- Consistent performance in both volatile and non-volatile buffers
- High sample loading capacity for metabolite identification and preparative purification
- pH stable 1-12 for durability



Material Characteristics

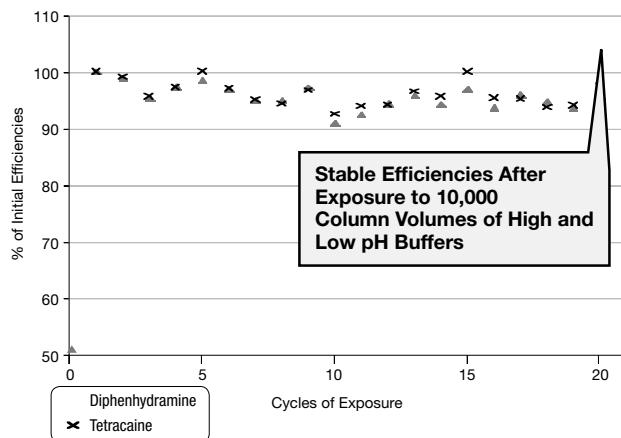
Packing Material	Particle Shape/Size (µm)	Pore Size (Å)	Surface Area (m²/g)	Carbon Load %	End Capping
Gemini-NX C18	Spherical 3, 5, 10	110	375	14	TMS



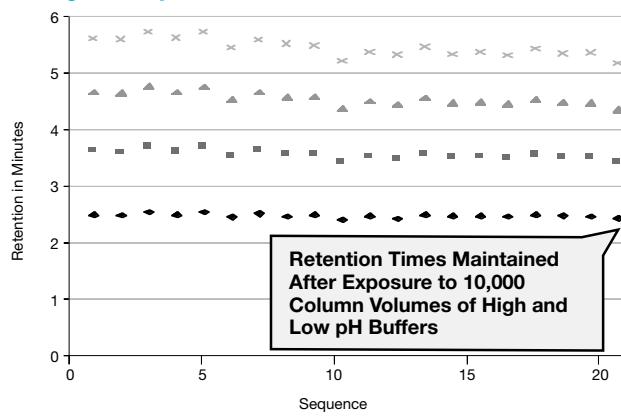
GEMINI | HPLC

Gemini-NX Tested for Extreme Durability in Changing Mobile Phase pH

Column Efficiencies Maintained in High pH Testing for 20 Cycles



Retention Times of Four Probes Maintained in Neutral pH Testing for 20 Cycles



Column Used:

Column: Gemini-NX 5 µm C18
Dimensions: 150 x 4.6 mm
Part No.: 00F-4454-E0

Step 1

24x High pH Flush Procedures

Mobile Phase: A: 10 mM Ammonium Bicarbonate pH 10.5
B: Acetonitrile
Gradient: 5 % to 95 % B in 6 min
Hold at 95 % B for 2 min
Re-equilibrate: 5 % B for 2 min
Flow Rate: 1.5 mL/min

Step 2

High pH Testing

Isocratic: 10 mM Ammonium Bicarbonate pH 10.5 / Acetonitrile (50:50)
Flow Rate: 1.5 mL/min
Detection: UV @ 230 nm
Samples: 1. Tetracaine
2. Diphenhydramine

Step 3

1x Neutral Flush Procedure

Mobile Phase: A: Water
B: Acetonitrile
Gradient: 5 % B for 2 min
5 % to 100 % B in 3 min
Hold at 100 % B for 5 min
Flow Rate: 1.5 mL/min

Step 4

Neutral pH Testing

Isocratic: Water / Acetonitrile (35:65)
Flow Rate: 1.0 mL/min
Detection: UV @ 254 nm
Samples: 1. Acetophenone
2. Benzene
3. Toluene
4. Acenaphthene

Step 5

24x Low pH Flush Procedure

Mobile Phase: A: 0.5 % Formic Acid in Water
B: 0.5 % Formic Acid in Acetonitrile, pH 2.0
Gradient: 5 % to 95 % B in 6 min
Hold at 95 % B for 2 min
Re-equilibrate: 5 % B for 2 min
Flow Rate: 1.5 mL/min

Step 6

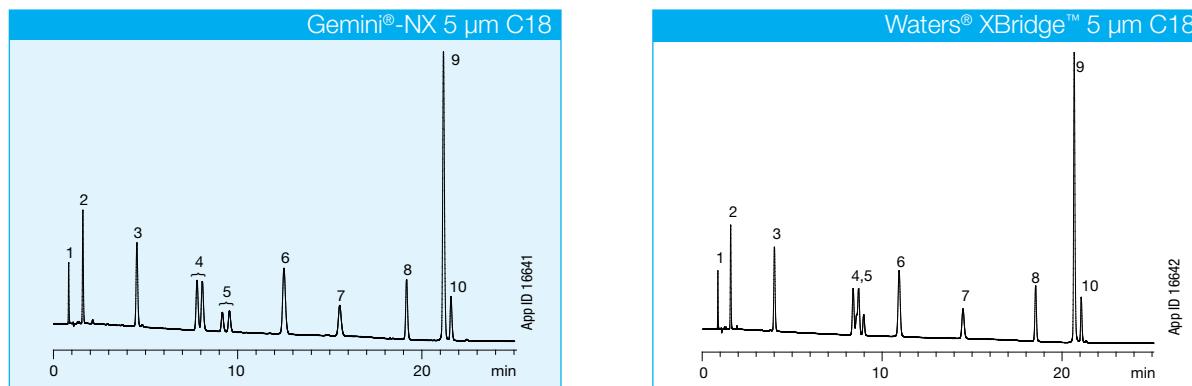
Neutral pH Flush Repeats
Repeats for 20 Cycles



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Polar Bases at High pH, pH 10.5



Y-axis normalized for all chromatograms.

Polar Bases (Beta Blockers) at High pH

Conditions for all columns:

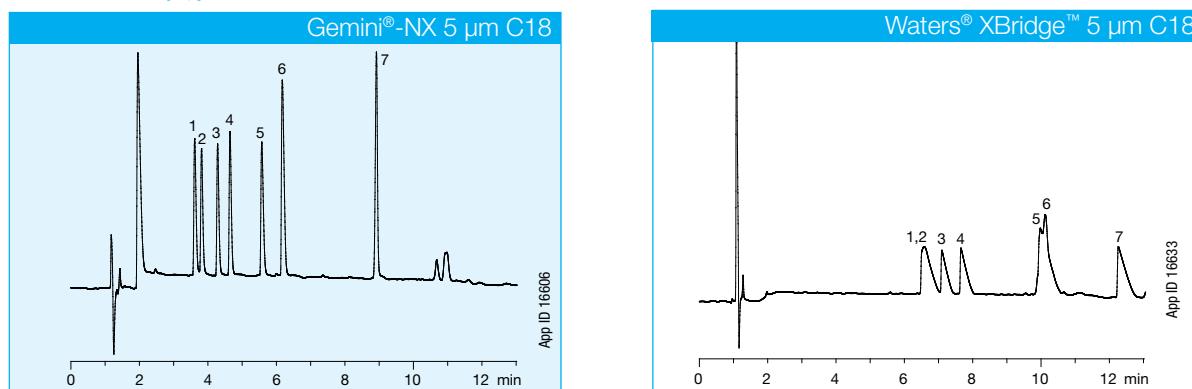
Dimensions: 150 x 4.6 mm
Mobile Phase: A: 10 mM Ammonium Bicarbonate pH 10.5
B: Acetonitrile
Gradient: A/B (85:15) to (70:30) in 15 min to (50:50) in 5 min, Hold for 5 min
Flow Rate: 1.5 mL/min
Temperature: Ambient
Detection: UV @ 230 nm

- Sample:**
1. Bisoprolol Contaminant
 2. Sotalol
 3. Atenolol
 4. Labetalol (Diastereoisomeric Pair)
 5. Nadolol (Diastereoisomeric Pair)
 6. Pindolol
 7. Metoprolol
 8. Bisoprolol
 9. Propranolol
 10. Alprenolol



HPLC | GEMINI

Polar Bases at Low pH, pH 2.7



Y-axis normalized for all chromatograms.

Polar Bases (Antihistamines) in Formic Acid

Conditions for all columns:

Dimensions: 150 x 4.6 mm
Mobile Phase: A: 0.1 % Formic Acid in Water
B: 0.1 % Formic Acid in Acetonitrile
Gradient: A/B (90:10) to (50:50) in 10 min
Flow Rate: 1.5 mL/min
Temperature: Ambient
Detection: UV @ 210 nm

- Sample:**
1. Pyrilamine
 2. Tripelennamine
 3. Chlorpheniramine
 4. Brompheniramine
 5. Chlorpyramine
 6. Diphenhydramine
 7. Loratadine

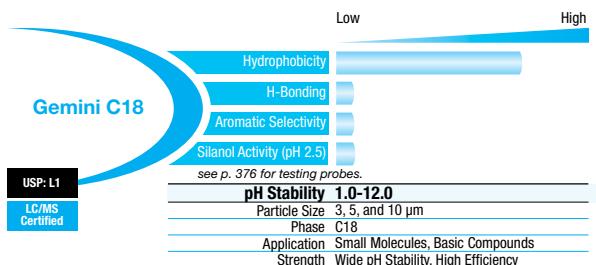
Comparative chromatograms may not be representative of all applications.

Gemini®

U.S. Patent No. 7, 563, 367

Gemini C18

- Increased loading and retention of basic compounds
- Wide pH stability from 1-12
- Silica efficiency and mechanical strength
- Excellent media for process-scale purification



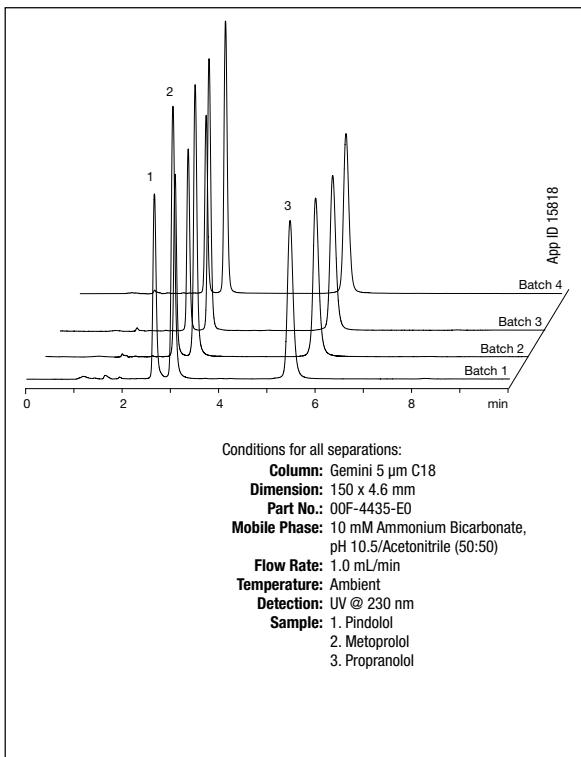
Material Characteristics

Packing Material	Particle Shape/Size (µm)	Pore Size (Å)	Surface Area (m²/g)	Carbon Load %	End Capping
Gemini C18	Spherical 3,5,10	110	375	14	TMS

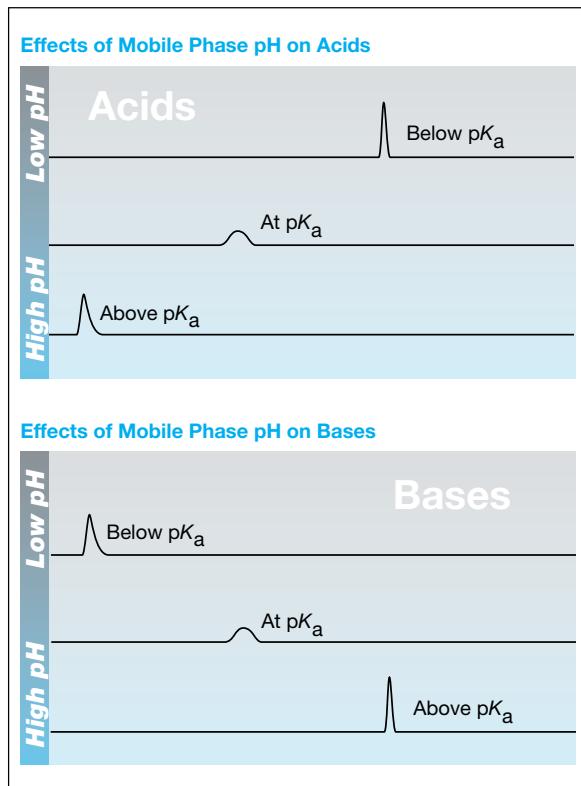


GEMINI | HPLC

Batch-to-Batch Reproducibility



pH Quick Guide

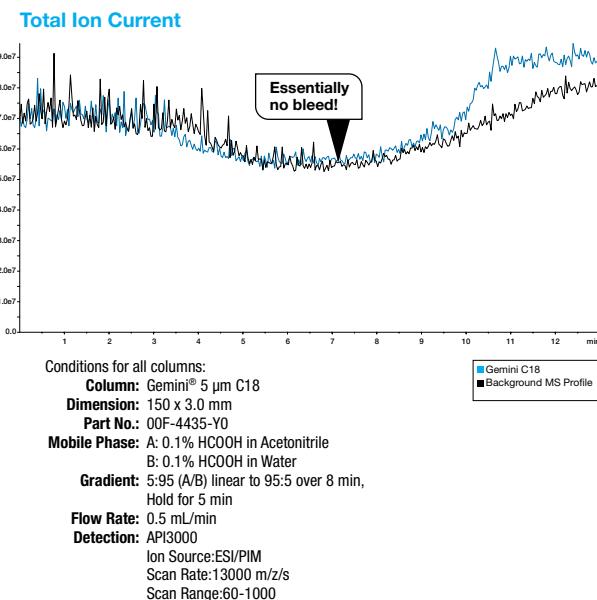


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Virtually No LC/MS Bleed

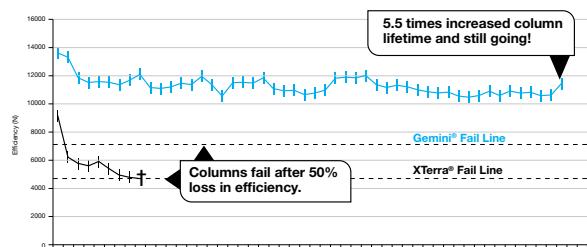
The increased stability of Gemini® columns provide the ultra-low bleed profile required for high sensitivity LC/MS applications. The advanced TWIN™ Technology used for Gemini columns limit phase cleavage and stabilizes the silica surface. When compared against a background MS profile, Gemini columns demonstrate virtually no column bleed across a wide mass range.



Extended Column Lifetime

The TWIN™ Technology engineering of Gemini® provide stability and increased column lifetime. Whether used under isocratic or gradient conditions, Gemini columns out-perform and outlasts pH stable columns. This is illustrated below.

Lifetime and Efficiency Comparison**

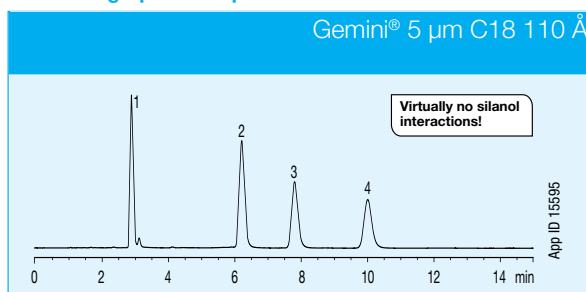


†Efficiency and lifetime comparison based on average of two columns each run in parallel.

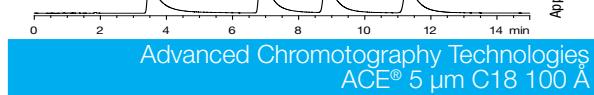
Conditions for all columns:

- Columns:** Gemini® 5 µm C18
Waters® Xterra® 5 µm MS C18
- Dimensions:** 150 x 4.6 mm
- Mobile Phase:** Acetonitrile/50 mM Methylpyrrolidine Buffer, pH 11.5 (50:50)
- Flow Rate:** 1 mL/min
- Temperature:** Ambient
- Detection:** UV @ 254 nm
- Sample:** Diphenhydramine

Chromatographic Comparisons**



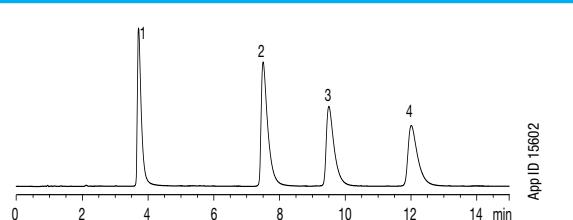
Agilent Technologies
ZORBAX® 5 µm Extend-C18 80 Å



Tricyclic Antidepressants at Neutral pH

Conditions for all columns:

- Dimensions:** 150 x 4.6 mm
- Mobile Phase:** 20 mM Phosphate buffer pH 7.0/Acetonitrile/
Methanol (30:35:35)
- Flow Rate:** 1.5 mL/min
- Detection:** UV @ 254 nm
- Sample:** 1. Nortriptyline
2. Imipramine
3. Amitriptyline
4. Clomipramine



**The comparative data presented here may not be representative for all applications.
Gemini® is a registered trademark of Phenomenex, Inc.
TWIN™ and Two-In-One Technology™ are trademarks of Phenomenex, Inc.
Xterra® is a registered trademark of Waters® Corp.
ZORBAX® is a registered trademark of Agilent Technologies.
ACE® is a registered trademark of Advanced Chromatography Technologies.
Phenomenex is not associated in any way with Waters® Corp, Agilent Technologies or ACT.

Gemini®

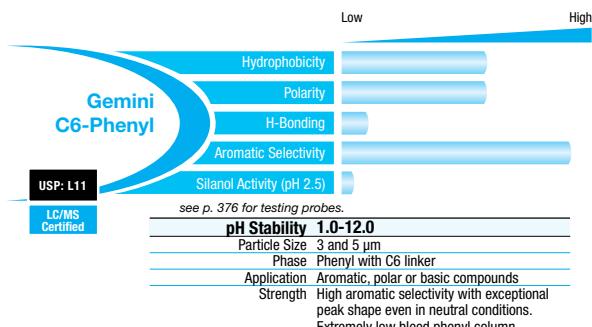
U.S. Patent No. 7, 563, 367

Gemini C6-Phenyl

- Good selectivity for aromatic compounds
- Extremely low UV and MS bleed
- Wide pH stability from 1-12

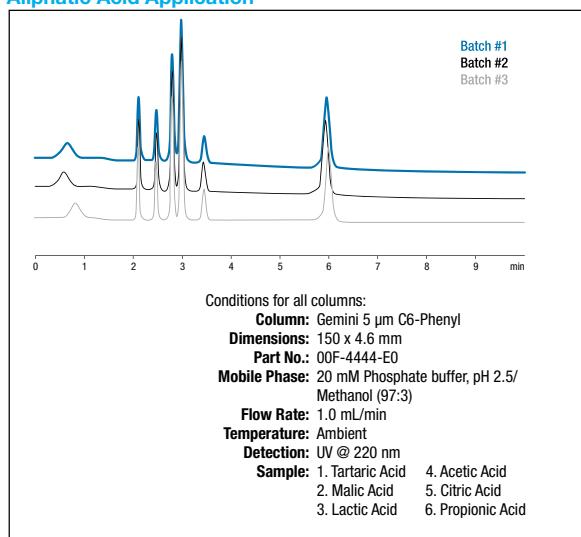
Material Characteristics

Packing Material	Particle Shape/Size (μm)	Pore Size (Å)	Surface Area (m^2/g)	Carbon Load %	End Capping
Gemini C6-Phenyl	Spherical 3.5	110	375	12	TMS



Reproducible Phenyl Phase

Aliphatic Acid Application

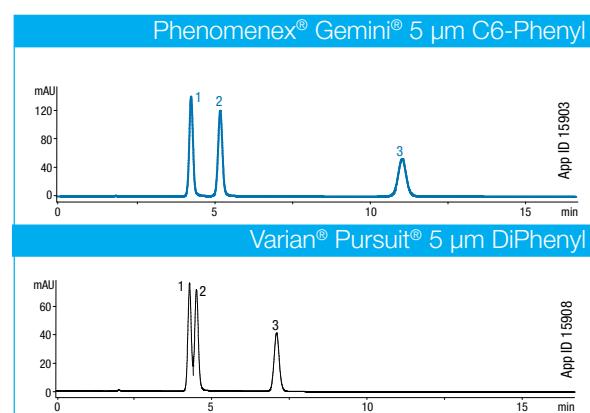


GEMINI | HPLC

Enhanced Performance for Aromatic Compounds

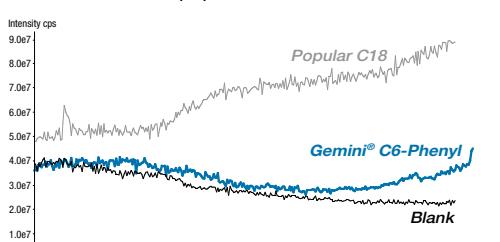
Sulfa Drug Application

RESOLUTION	Pursuit® 5 μm DiPhenyl	Gemini® 5 μm C6-Phenyl
$Rs_{1,2}$	1.0	4.0
$Rs_{2,3}$	9.8	16.0



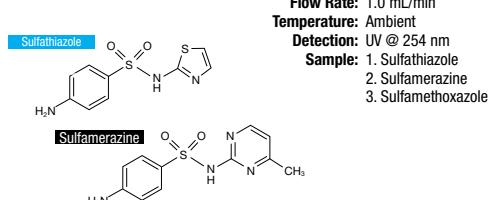
Low Bleed Phenyl Phase

One of the weaknesses of traditional phenyl phases has been excessive bleed in UV and MS. Gemini C6-Phenyl columns demonstrate far lower bleed than many other phenyl columns. Indeed, in this example the Gemini C6-Phenyl column shows lower bleed than a popular C18 column.



Conditions for all columns:

- Dimensions: 150 x 3.0 mm
- Mobile Phase: A: 0.1 % Formic acid in Water
B: 0.1 % Formic acid in Acetonitrile
- Gradient: 5 % B to 95 % B in 10 min, then hold 95 % B for 2 min
- Flow Rate: 0.6 mL/min
- Temperature: Ambient
- MS Detection: ESI + ion mode, M/Z 100-700



The comparative data presented here may not be representative for all applications. Pursuit® is a registered trademark of Varian, Inc.

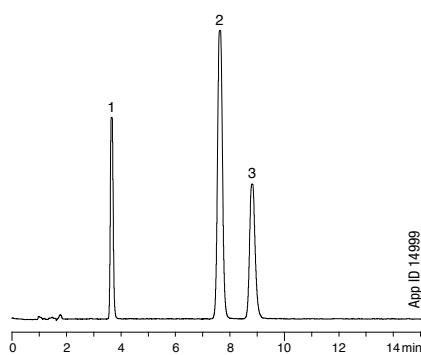
Gemini®

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Applications

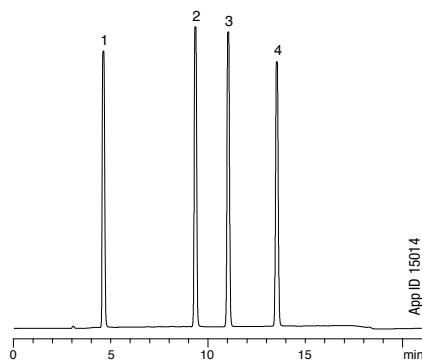
Local Anesthetics

Column: Gemini 5 μm C18
Dimensions: 150 x 4.6 mm
Part No.: 00F-4435-E0
Mobile Phase: 10 mM NH_4HCO_3 , pH 10.5 / Acetonitrile (50:50)
Flow Rate: 1 mL/min
Temperature: 25 °C
Detection: UV @ 210 nm
Sample: 1. Procaine
2. Lidocaine
3. Tetracaine



Caffeine and Metabolites

Column: Gemini 5 μm C18
Dimensions: 150 x 4.6 mm
Part No.: 00F-4435-E0
Mobile Phase: A: 20 mM Ammonium acetate, pH 7.5
B: Acetonitrile
Gradient: 98:2 (A/B) linear to 80:20 over 15 min, Hold for 3 min
Flow Rate: 1 mL/min
Temperature: 25 °C
Detection: UV @ 273 nm
Sample: 1. Xanthine 3. Theophylline
2. Theobromine 4. Caffeine



HPLC | GEMINI

Clinical Solution

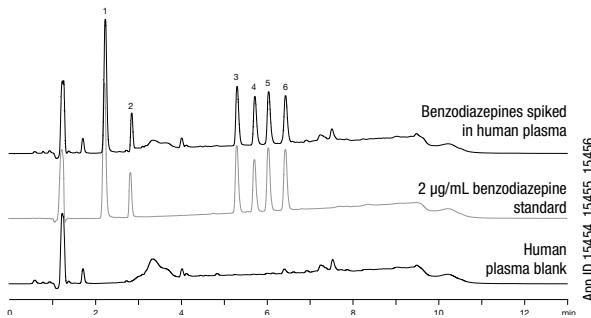
Benzodiazepines in Plasma

SPE Conditions

Sample: 0.5 mL Human Plasma + 0.5 mL Water + 0.1 mL std (2.0 $\mu\text{g}/\text{mL}$ in Water)
Sorbent: Strata-X 30 mg/1 mL tubes
Part No.: 8B-S100-TAK
Condition: 1 mL Methanol followed by 1 mL Water
Wash: 1 mL Water, 1 mL of 40 % Methanol
Elution: 1 mL Methanol, evaporated to dryness under gentle N_2 flow
Reconstitute: with 100 μL water

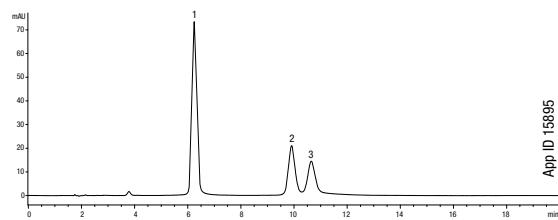
HPLC Conditions

Column: Gemini 5 μm C18
Dimensions: 150 x 3.0 mm
Part No.: 00F-4435-Y0
Mobile Phase: A: 0.1 % Formic acid in Water
B: 0.1 % Formic acid in Acetonitrile
Gradient: 80:20 (A/B) linear to 20:80 over 8 min, Hold for 1 min
Flow Rate: 0.8 mL/min
Temperature: 22 °C
Detection: UV @ 254 nm
Sample: 1. Chlordiazepoxide 4. Clonazepam
2. Flurazepam 5. Temazepam
3. Oxazepam 6. Diazepam



Flavonoids

Column: Gemini 5 μm C6-Phenyl
Dimensions: 150 x 4.6 mm
Part No.: 00F-4444-E0
Mobile Phase: 0.1 % Formic acid in Water/Methanol (45:55)
Flow Rate: 1 mL/min
Detection: UV @ 254 nm
Sample: 1. Quercetin
2. Kaempferol
3. Isorhamnetin



Gemini®

guarantee

If Gemini analytical columns do not provide at least an equivalent separation as compared to a competing column of similar particle size, similar phase and dimensions, send in your comparative data within 45 days and keep the Gemini column for FREE.

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Ordering Information

3 µm Microbore, Minibore and Narrow Bore Columns (mm)										SecurityGuard™ Cartridges (mm)
Phases	50 x 1.0	20 x 2.0	30 x 2.0	50 x 2.0	100 x 2.0	150 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	4 x 2.0*
C18	00B-4439-A0	00M-4439-B0	00A-4439-B0	00B-4439-B0	00D-4439-B0	00F-4439-B0	00B-4439-Y0	00D-4439-Y0	00F-4439-Y0	/10pk
C6-Phenyl	00B-4443-A0	—	00A-4443-B0	00B-4443-B0	00D-4443-B0	00F-4443-B0	00B-4443-Y0	00D-4443-Y0	00F-4443-Y0	AJ0-7596
NX C18	—	00M-4453-B0	00A-4453-B0	00B-4453-B0	00D-4453-B0	00F-4453-B0	00B-4453-Y0	00D-4453-Y0	00F-4453-Y0	AJ0-8367

for ID: 2.0-3.0 mm

3 µm Analytical Columns (mm)							SecurityGuard™ Cartridges (mm)
Phases	20 x 4.0	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0*
C18	00M-4439-D0	00A-4439-E0	00B-4439-E0	00D-4439-E0	00F-4439-E0	00G-4439-E0	/10pk
C6-Phenyl	—	00A-4443-E0	00B-4443-E0	00D-4443-E0	00F-4443-E0	00G-4443-E0	AJ0-7597
NX C18	—	—	00B-4453-E0	00D-4453-E0	00F-4453-E0	00G-4453-E0	AJ0-8368



for ID: 3.2-8.0 mm

5 µm Minibore and Narrow Bore Columns (mm)								SecurityGuard™ Cartridges (mm)	
Phases	30 x 2.0	50 x 2.0	150 x 2.0	250 x 2.0	50 x 3.0	100 x 3.0	150 x 3.0	250 x 3.0	4 x 2.0*
C18	00A-4435-B0	00B-4435-B0	00F-4435-B0	00G-4435-B0	00B-4435-Y0	00D-4435-Y0	00F-4435-Y0	00G-4435-Y0	/10pk
C6-Phenyl	00A-4444-B0	00B-4444-B0	00F-4444-B0	—	00B-4444-Y0	—	00F-4444-Y0	00G-4444-Y0	AJ0-7596
NX C18	00A-4454-B0	00B-4454-B0	00F-4454-B0	—	00B-4454-Y0	00D-4454-Y0	00F-4454-Y0	00G-4454-Y0	AJ0-8367

for ID: 2.0-3.0 mm

5 µm Analytical Columns (mm)						SecurityGuard™ Cartridges (mm)
Phases	30 x 4.6	50 x 4.6	100 x 4.6	150 x 4.6	250 x 4.6	4 x 3.0*
C18	00A-4435-E0	00B-4435-E0	00D-4435-E0	00F-4435-E0	00G-4435-E0	/10pk
C6-Phenyl	00A-4444-E0	00B-4444-E0	00D-4444-E0	00F-4444-E0	00G-4444-E0	AJ0-7597
NX C18	—	00B-4454-E0	00D-4454-E0	00F-4454-E0	00G-4454-E0	AJ0-8368

For Gemini Capillary HPLC Columns, Guards, and Adapter, contact your Phenomenex technical consultant or local distributor.



for ID: 3.2-8.0 mm

5 µm Semi-Prep Columns (mm)				SecurityGuard™ Cartridges (mm)
Phases	150 x 10	250 x 10	10 x 10 ^c	
C18	00F-4435-N0	00G-4435-N0	—	/3pk
C6-Phenyl	—	00G-4444-N0	AJ0-7598	AJ0-7314
NX C18	00F-4454-N0	00G-4454-N0	AJ0-8369	/3pk

for ID: 9-16 mm

Axia™ Packed Preparative Columns (mm)								SecurityGuard™ Cartridges (mm)
Phases	50 x 21.2	100 x 21.2	150 x 21.2	250 x 21.2	50 x 30	75 x 30	15 x 21.2**	15 x 30.0*
5 µm							/ea	/ea
C18	00B-4435-P0-AX	00D-4435-P0-AX	00F-4435-P0-AX	00G-4435-P0-AX	00B-4435-U0-AX	00C-4435-U0-AX	AJ0-7846	AJ0-8308
C6-Phenyl	—	00D-4444-P0-AX	00F-4444-P0-AX	00G-4444-P0-AX	—	00C-4444-U0-AX	AJ0-7841	AJ0-8303
5 µm							/ea	/ea
NX C18	00B-4454-P0-AX	00D-4454-P0-AX	00F-4454-P0-AX	00G-4454-P0-AX	00B-4454-U0-AX	00C-4454-U0-AX	AJ0-8370	AJ0-8371
10 µm							/ea	/ea
C18	00B-4436-P0-AX	00D-4436-P0-AX	00F-4436-P0-AX	00G-4436-P0-AX	00B-4436-U0-AX	—	AJ0-7846	AJ0-8308
10 µm							/ea	/ea
NX C18	00B-4455-P0-AX	00D-4455-P0-AX	00F-4455-P0-AX	00G-4455-P0-AX	—	—	AJ0-8370	AJ0-8371

for ID: 18-29 mm 30-49 mm

Axia™ Packed Preparative Columns (mm) continued								SecurityGuard™ Cartridges (mm)
Phases	100 x 30	150 x 30	250 x 30	50 x 50	100 x 50	150 x 50	250 x 50	15 x 30.0*
5 µm					—	—	—	/ea
C18	00D-4435-U0-AX	00F-4435-U0-AX	00G-4435-U0-AX	00B-4435-V0-AX	—	—	—	AJ0-8308
C6-Phenyl	00D-4444-U0-AX	—	00G-4444-U0-AX	—	—	—	—	AJ0-8303
5 µm					—	—	—	/ea
NX C18	00D-4454-U0-AX	00F-4454-U0-AX	00G-4454-U0-AX	00B-4454-V0-AX	—	—	—	AJ0-8371
10 µm					—	—	—	/ea
C18	00D-4436-U0-AX	00F-4436-U0-AX	00G-4436-U0-AX	00B-4436-V0-AX	00D-4436-V0-AX	00F-4436-V0-AX	00G-4436-V0-AX	AJ0-8308
10 µm					—	—	—	/ea
NX C18	00D-4455-U0-AX	00F-4455-U0-AX	00G-4455-U0-AX	00B-4455-V0-AX	00D-4455-V0-AX	00F-4455-V0-AX	00G-4455-V0-AX	AJ0-8371

for ID: 30-49 mm

- For PREP Columns & Bulk Media, see p. 303
- For SecurityGuard Holders and Cartridges, see p. 244
- For MercuryMS LC/MS Columns, Cartridges, and Cartridge Holders, Inquire.

*SecurityGuard™ Analytical Cartridges require holder, Part No.: KJ0-4282

**SemiPrep SecurityGuard™ Cartridges require holder, Part No.: AJ0-7220

***PREP SecurityGuard™ Cartridges require holder, Part No.: AJ0-8223

****PREP SecurityGuard™ Cartridges require holder, Part No.: AJ0-8277