ACE® C18-AR

A C18 bonded phase with unique selectivity

- Guaranteed reproducibility
- Exceptional bonded phase stability
- Hydrophobic and aromatic “mixed mode” interaction
- High efficiency 2µm, 3µm, 5µm and 10µm particles for UHPLC and HPLC

ACE®
UHPLC and HPLC Columns

Explore the Advantages of ACE® C18-AR

- Provides alternative selectivity to "standard" C18 columns – additionally recommended for compounds with aromatic functionality
- Ultra inert, ultra high purity silica, for excellent peak shape and reproducibility
- Compatible with highly aqueous mobile phases to enable the retention and separation of polar compounds
- Exceptional bonded phase stability for elevated temperature applications
- Ultra low bleed phase ensures UV and LC/MS compatibility
- Available in high throughput column dimensions
- High efficiency 2µm, 3µm, 5µm and 10µm particles for UHPLC and HPLC

Contents

Why do I need another new C18 phase?

The use of an ultra pure, ultra inert silica has many recognised benefits, including improved reproducibility, lifetime and chromatographic performance (particularly with basic molecules). However, since the ultra inert silica surface effectively no longer contributes to the separation, C18 columns manufactured with high purity silicas show near identical selectivity. It is therefore highly likely that a problem separation on one leading brand will not be significantly improved by changing to an alternative manufacturer's equivalent product.

For many years, experienced chromatographers have been seeking phases with the proven performance and reproducibility benefits shown by such leading C18 column brands, but which additionally provide the alternative selectivity required for their challenging applications.

How is ACE C18-AR different?

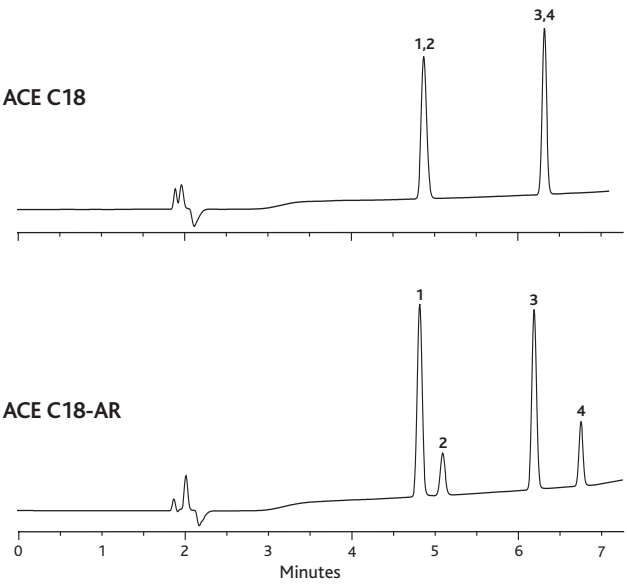
C18 bonded phases currently dominate the HPLC market, with recent surveys indicating that they are still responsible for 50-60% of all HPLC columns sold. However, in recent years the use of Phenyl bonded phases has grown significantly, due to the alternative selectivity they provide. It is estimated that Phenyl phases now account for 10-15% of HPLC column sales, making them the largest sub-category after C18 phases.

The ACE C18-AR phase utilises a specially developed ligand combining a C18 chain with integral phenyl functionality, thus combining the benefits of both C18 and Phenyl characteristics into a single phase. Based upon the same ultra inert, ultra pure, ultra reproducible silica platform as ACE C18, the unique ACE C18-AR phase provides an alternative selectivity to C18 columns.

"We required a C18 phase that provided different chromatography and improved resolution – ACE C18-AR delivered"

Senior Analyst, Leading Pharmaceutical Company

ACE C18-AR shows alternative selectivity to C18 bonded columns



Compounds:1) 4-acetamidophenol 2) 4-aminobenzoic acid 3) 4-hydroxybenzoic acid 4) caffeine
Column: 150 x 4.6mm, 3µm Flow Rate: 1.00ml/min Temperature: 40°C Detection: UV, 240nm

Mobile Phase: A. 0.1% v/v formic acid in H_2O
B. 0.1% v/v formic acid in MeCN

Gradient:

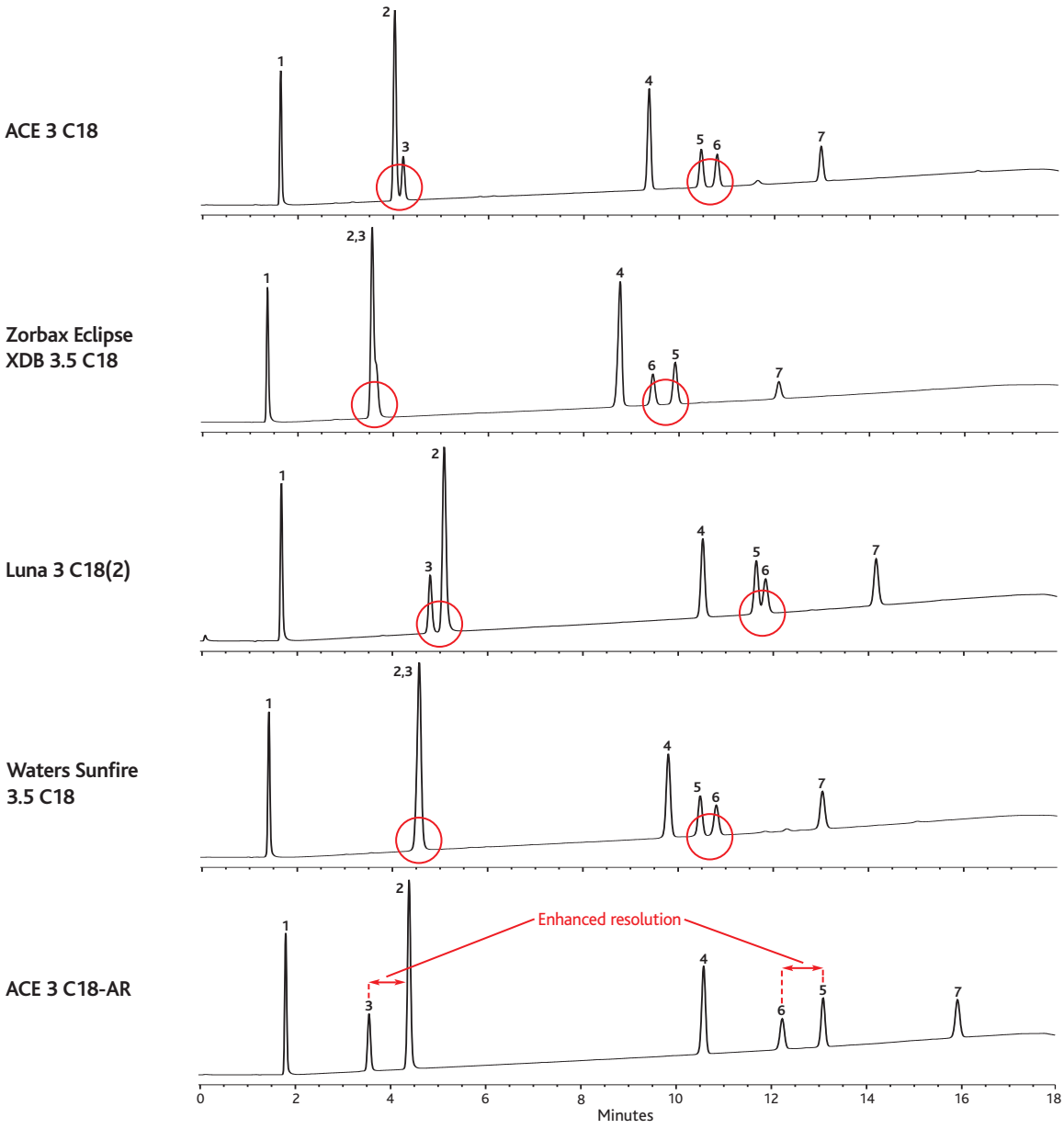
T(mins)	%B
0	5
9	35

When should I use ACE C18-AR?

Due to their similar hydrophobic characteristics, ACE C18-AR columns may be used for applications in which "standard" C18 columns would normally be considered. However, due to its integral phenyl functionality, ACE C18-AR is additionally recommended for separations that involve compounds containing aromatic functionality.

As the applications contained within this booklet demonstrate, ACE C18-AR can be used to improve separations that are proving problematic on C18 columns. The unique ACE C18-AR phase provides an alternative selectivity to C18 columns, but remains a valid selection for methods in which C18 bonded columns are specified. In many instances, the same evaluation conditions that prove unsuitable for the C18 column prove suitable for the C18-AR column, avoiding the need for lengthy method redevelopment.

Application #1 - Water Soluble Vitamins



Sample: 1) pyridoxine 2) p-aminobenzoic acid 3) pantothenic acid 4) folic acid 5) cyanocobalamin 6) d-biotin 7) riboflavin Column Dimensions: 150 x 4.6mm Flow Rate: 1.50ml/min
Mobile Phase: A) 20mM KH_2PO_4 (pH 2.8) B) 20mM KH_2PO_4 (pH 2.8) in 50:50 v/v MeOH/H_2O Linear Gradient 20% to 70% B over 15 minutes Temperature: 40°C Detection: UV, 205nm

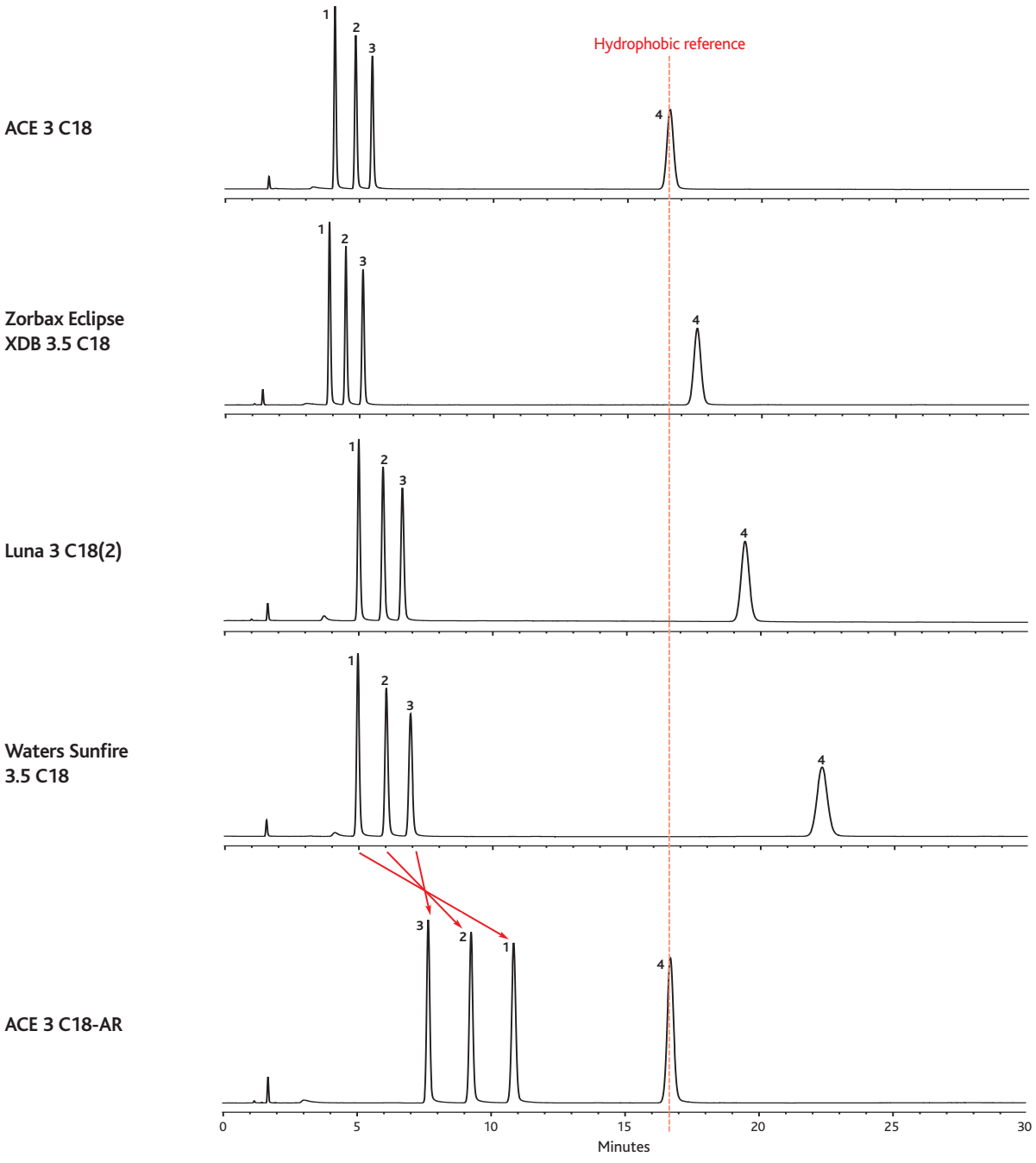
Comparative data may not be representative of all applications. Please see page 13 for acknowledgement of trademarks.

This test containing water soluble vitamins illustrates that leading C18 column brands provide similar selectivity. After optimisation of temperature and gradient, an acceptable separation is achieved on the ACE C18, with critical pair 2,3 just baseline resolved. To improve method robustness it may be preferable to try and further improve resolution. Since the evaluation conditions are already optimal, we now investigate whether changing to an alternative C18 column brand will improve the separation of our critical pairs (peaks 2,3 and 5,6). This approach is representative of a method development strategy currently performed in many laboratories.

As the above results demonstrate, both the Zorbax XDB C18 and Sunfire C18 columns no longer resolve critical pair 2,3, whereas the Luna C18(2) column shows slightly improved resolution of critical pair 2,3 but now critical pair 5,6 is only partially resolved.

However, the unique ACE C18-AR phase provides a completely different retention profile to those obtained with the leading C18 column brands. Resolution of both critical pairs is significantly improved and method robustness is no longer an issue. Indeed, further optimisation of both column dimensions and evaluation conditions (to reduce analysis time) is now possible.

Application #2 - Aromatic Nitrobenzenes



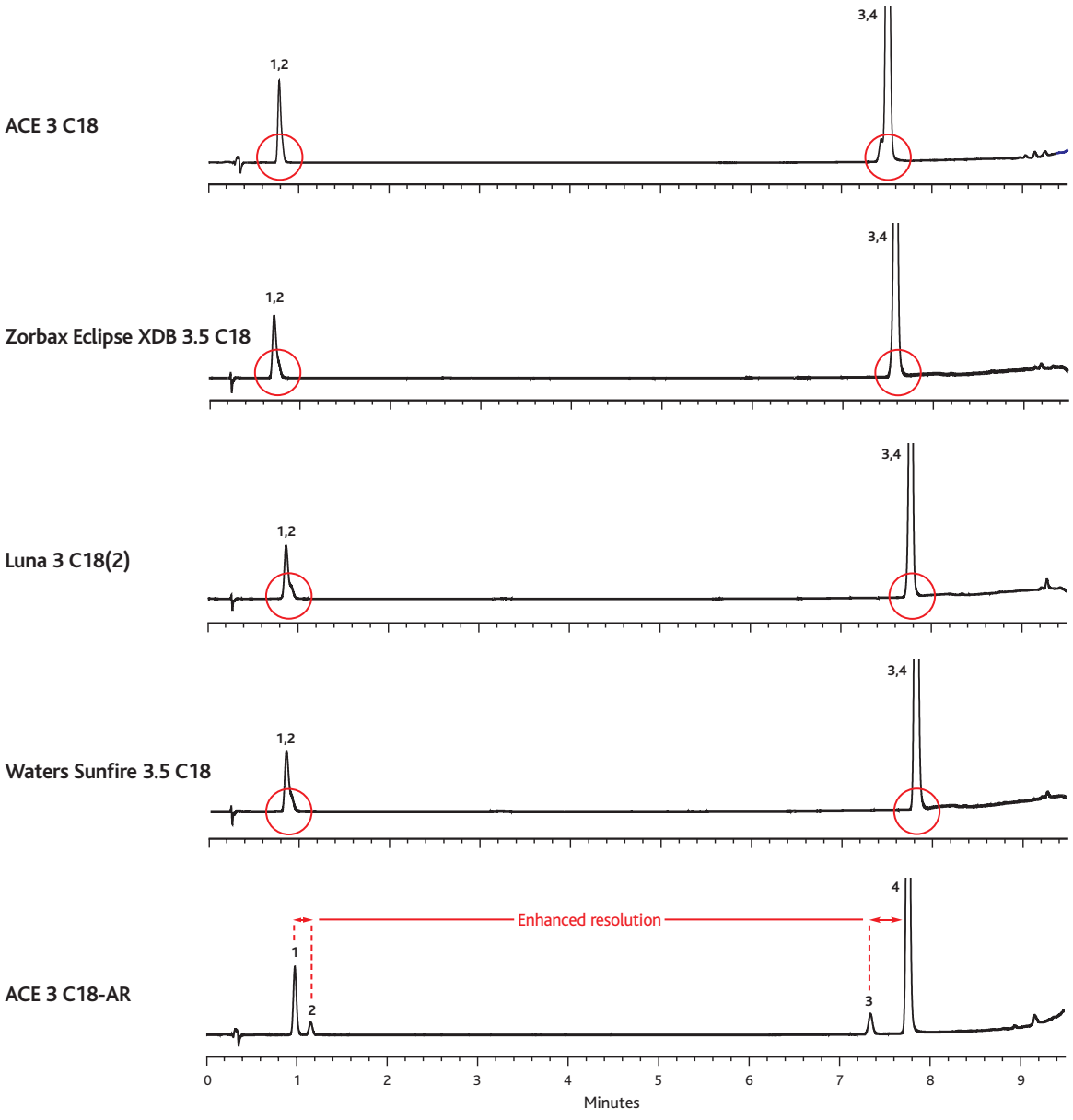
Sample: 1) 1,3,5-trinitrobenzene 2) 1,3-dinitrobenzene 3) nitrobenzene 4) neutral molecule (reference) Mobile Phase: 50:50 v/v MeOH/H_2O
Column Dimensions: 150 x 4.6mm Flow Rate: 1.00ml/min Temperature: 40°C Detection: UV, 210nm

Comparative data may not be representative of all applications. Please see page 13 for acknowledgement of trademarks.

This test containing aromatic nitrobenzene compounds performed under simple isocratic conditions again shows that the leading C18 column brands provide near identical selectivity. The differences in absolute retention (as illustrated by the neutral reference marker) are due to purely hydrophobic effects and related to parent silica characteristics (eg: surface area).

As the ACE C18-AR illustrates above, hydrophobic retention with a neutral marker is matched to its C18 equivalent, but selectivity towards aromatic nitrobenzene compounds is significantly enhanced - with increased retention and a complete reversal of elution order. This retention profile is completely different to that obtained with a standard C18 phase, and results from the integral phenyl functionality contained within the ACE C18-AR ligand.

Application #3 - Sulphur Compounds



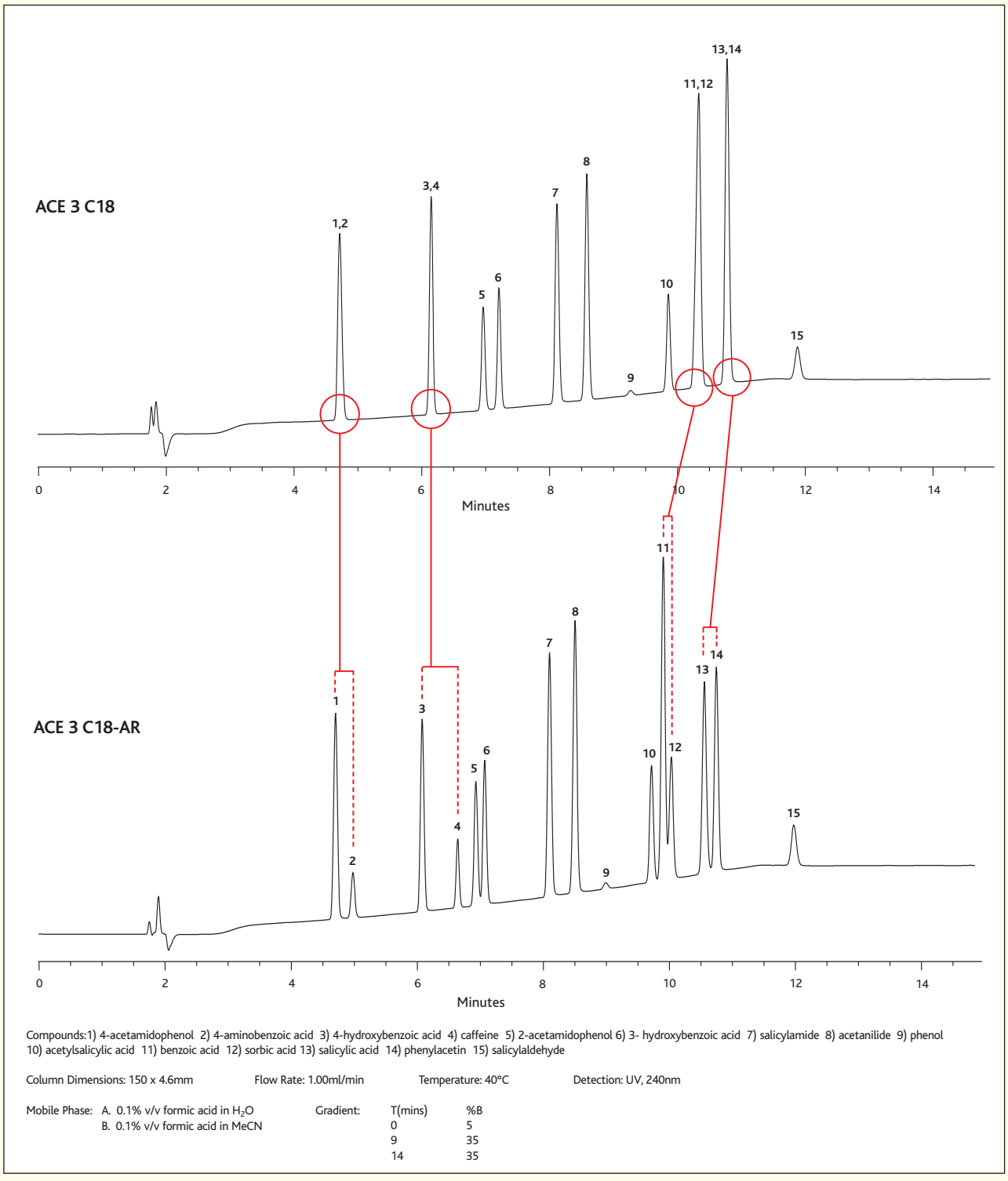
Sample: 1) methyl phenyl sulphoxide 2) methyl phenyl sulphone 3) toluene 4) thioanisole
Mobile Phase: A) H_2O B) MeOH T = 0 mins; 30% B; T = 5.0 mins, 30% B; T = 9.0 mins, 95% B
Column Dimensions: 50 x 2.1mm Flow Rate: 0.50ml/min Temperature: 22°C Detection: UV, 254nm

Comparative data may not be representative of all applications. Please see page 13 for acknowledgement of trademarks.

This difficult separation of sulphur compounds again shows that the leading C18 column brands provide essentially the same separation, with two pairs of co-eluting peaks obtained.

However, the C18-AR column again provides a completely different separation to the leading C18 column brands. The additional aromatic (π-π) interaction provided by the ACE C18-AR column enables both critical pairs 1,2 and 3,4 to be fully resolved.

Application #4 - Analgesics Separation



Compounds:1) 4-acetamidophenol 2) 4-aminobenzoic acid 3) 4-hydroxybenzoic acid 4) caffeine 5) 2-acetamidophenol 6) 3- hydroxybenzoic acid 7) salicylamide 8) acetanilide 9) phenol 10) acetylsalicylic acid 11) benzoic acid 12) sorbic acid 13) salicylic acid 14) phenylacetin 15) salicylaldehyde

Column Dimensions: 150 x 4.6mm Flow Rate: 1.00ml/min Temperature: 40°C Detection: UV, 240nm

Mobile Phase: A. 0.1% v/v formic acid in H_2O
B. 0.1% v/v formic acid in MeCN

Gradient:

T(mins)	%B
0	5
9	35
14	35

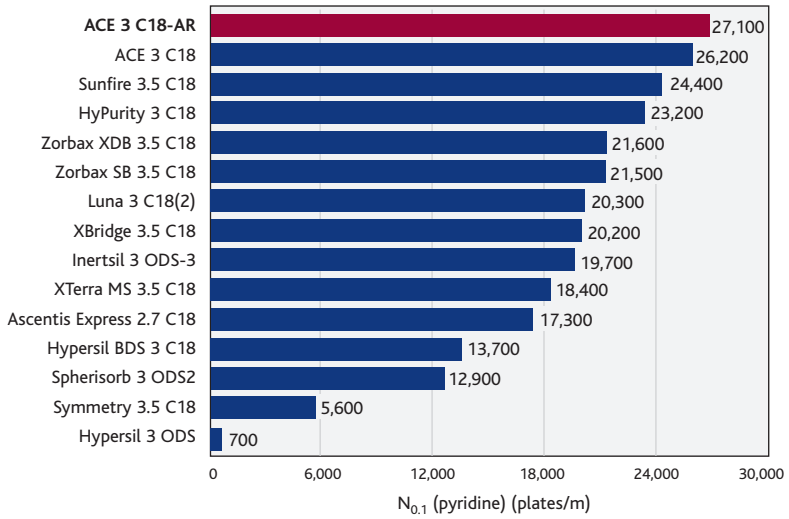
The above application shows the separation of analgesics on an ACE C18 column, with 4 pairs of co-eluting peaks observed. This separation is also consistent with those that can be expected with other leading C18 column brands, which exhibit very similar selectivity due to the same (predominantly hydrophobic) interaction.

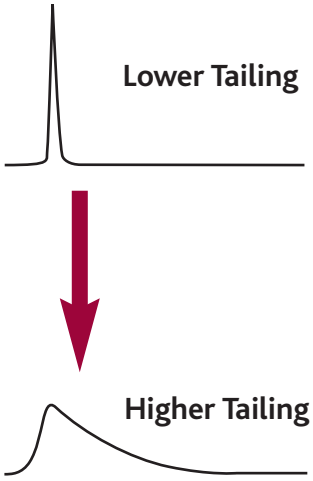
Based upon the same ultra inert, ultra high purity silica platform as ACE C18, the unique ACE C18-AR phase provides an alternative selectivity which enables resolution of all 15 components, including the 4 critical pairs previously identified. The same evaluation conditions that proved unsuitable for the ACE C18 were found to be suitable for the ACE C18-AR column, avoiding the need for lengthy method redevelopment.

Comparison of Column Inertness

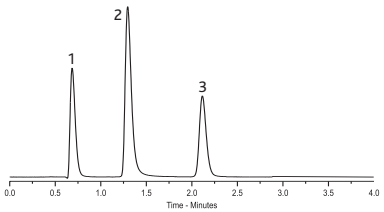
- Leading 3µm, small pore C18 column brands
- 50 x 2.1mm i.d. LC/MS compatible dimensions
- Basic molecule inertness test
- Peak efficiency and asymmetry investigation

Peak Efficiency Comparison

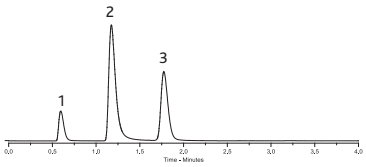




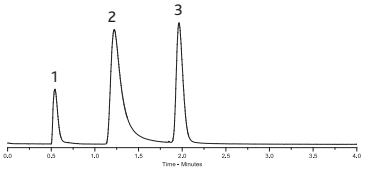
ACE 3 C18-AR
$N_{0.1}$(pyr) = 27,100pl/m



Waters XTerra MS 3.5 C18
$N_{0.1}$(pyr) = 18,400pl/m



Waters Symmetry 3.5 C18
$N_{0.1}$(pyr) = 5,600pl/m



Column Dimensions: 50 x 2.1mm Sample: 1) uracil 2) pyridine 3) phenol Mobile Phase: 40:60 v/v MeOH/H_2O Flow Rate: 0.20ml/min Temperature: 22°C Wavelength: 254nm

Comparative data may not be representative of all applications. Please see page 13 for acknowledgement of trademarks.

Conclusion:

Significant differences in efficiency, peak shape and selectivity are seen when analysing pyridine – a small highly basic molecule.

Increased tailing and retention are indicative of undesirable secondary interactions between pyridine and silanol groups on the stationary phase surface. These interactions can also result in poor column reproducibility.

ACE C18 columns have been previously independently tested and found to be exceptionally efficient and extremely inert. The ACE C18-AR maintains this excellent performance.

ACE® Stationary Phases Virtually Eliminate the Negative Effects of Silanols on UHPLC and HPLC Separations

Further inertness test data is contained within the ACE HPLC column catalogue and other ACE literature. Additionally, a Comparison Guide to C18 Columns is also available, detailing material characteristics for over 50 HPLC column brands and comparing performance with a number of test probes. Please contact your local distributor to request your copies.

Compatible with Highly Aqueous Mobile Phases

Whilst primarily designed to show alternative selectivity to "standard" C18 columns, ACE C18-AR is also resistant to retention loss in 100% aqueous mobile phases, and may be used with fast gradients where the requirement for rapid re-equilibration and resistance to retention loss are essential.

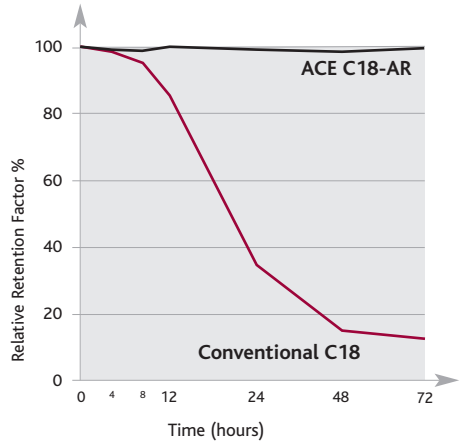
Maximum Reproducibility under High Aqueous Conditions

When separating very polar, water soluble compounds, highly aqueous (>95%) mobile phases are often required to achieve sufficient retention. However, operating a conventional C18 column under such conditions can lead to poor chromatographic reproducibility. Over time, peaks will elute with shorter and shorter retention times and resolution between peaks will deteriorate.

This retention loss was originally believed to be due to "Phase Collapse", whereby the bonded phase ligands become matted down and thus offer a reduced interaction with the sample. However, more recent studies suggest that "Pore De-Wetting" is actually occurring. The mobile phase is excluded from the pores under highly aqueous conditions and the retention loss is due to a loss of accessible surface area.

The integral phenyl functionality of the ACE C18-AR protects against pore de-wetting and subsequent retention loss, resulting in highly reproducible chromatography even under highly aqueous conditions.

Reproducible Chromatography with 100% Aqueous Mobile Phase



Comparative data may not be representative of all applications.

Ultra Inert Silica for Excellent Chromatography

Many columns designed for use under high aqueous conditions are compromised by the low purity silica employed and exhibit poor peak shape with polar basic molecules. This results in poor chromatography and ultimately leads to poor column reproducibility.

ACE C18-AR columns are manufactured from the same ultra inert, high purity silica as all ACE phases – ensuring excellent chromatography and excellent reproducibility are obtained.

Leading Competitor Comparison – Hydrophilic Bases

Sample: 1) nicotine 2) benzylamine 3) procainamide 4) salbutamol 5) phenol Mobile Phase: 3.3:96.7 MeOH/20mM KH_2PO_4 (pH 2.7) Dimensions: 150 x 4.6mm i.d. Flow Rate: 1.0ml/min, Temperature: 60°C, Wavelength: 210nm

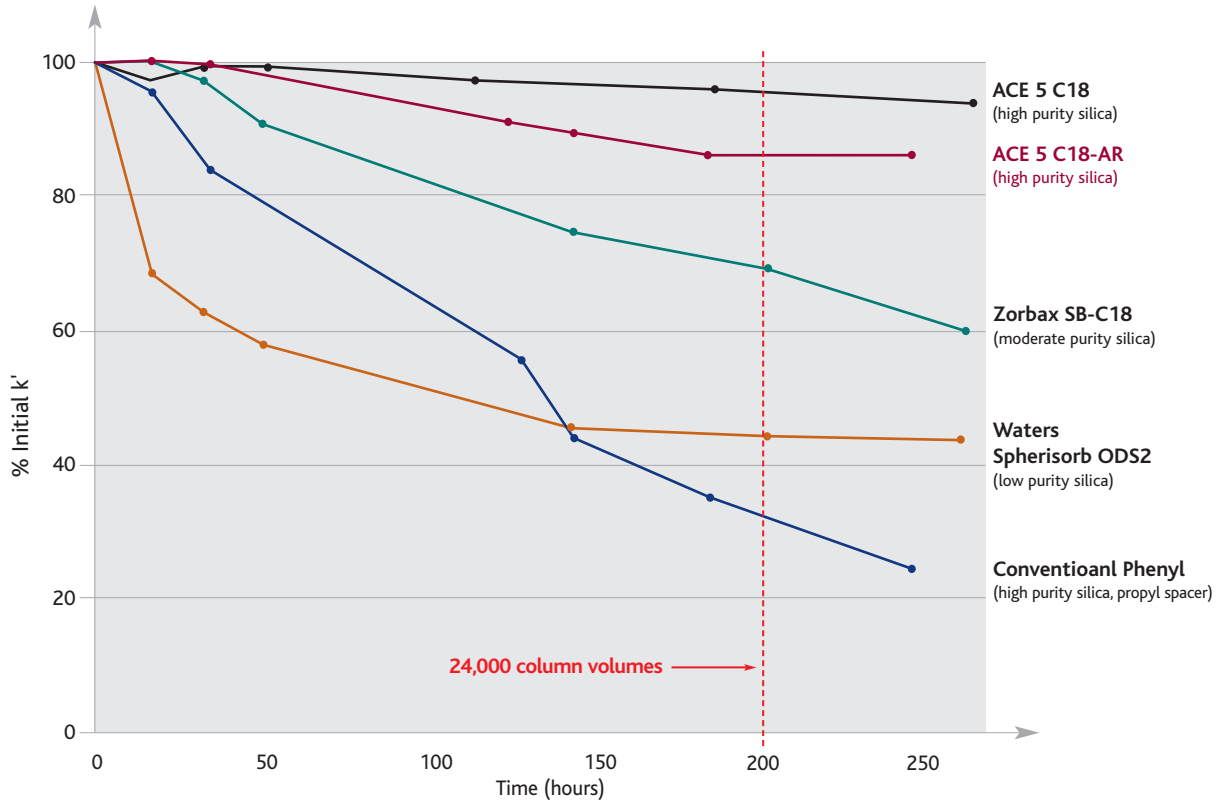
Comparative data may not be representative of all applications. Please see page 13 for acknowledgement of trademarks.

The Zorbax SB-Aq column shows a dramatic loss of performance for peaks 1 and 3, whereas the ultra inert ACE C18-AR column maintains excellent peak shape with hydrophilic bases.

Temperature and pH Stability

At low pH, column deterioration is caused by hydrolysis of the bonded phase, with a decrease in retention observed. The nature of the bonded phase, the purity of the silica surface and bonding density are all critical parameters. The use of a lower purity silica, a shorter ligand and a lower bonding density are all factors that will contribute to accelerated ligand cleavage and reduced column lifetime.

Accelerated Column Stability Study - 80°C at pH 1.9



Acidic Exposure Conditions: Mobile Phase: 5:95 MeOH/0.1% TFA in H_2O (pH 1.9) Column Dimensions: 50 x 2.1mm
Flow Rate: 0.20ml/min
Temperature: 80°C

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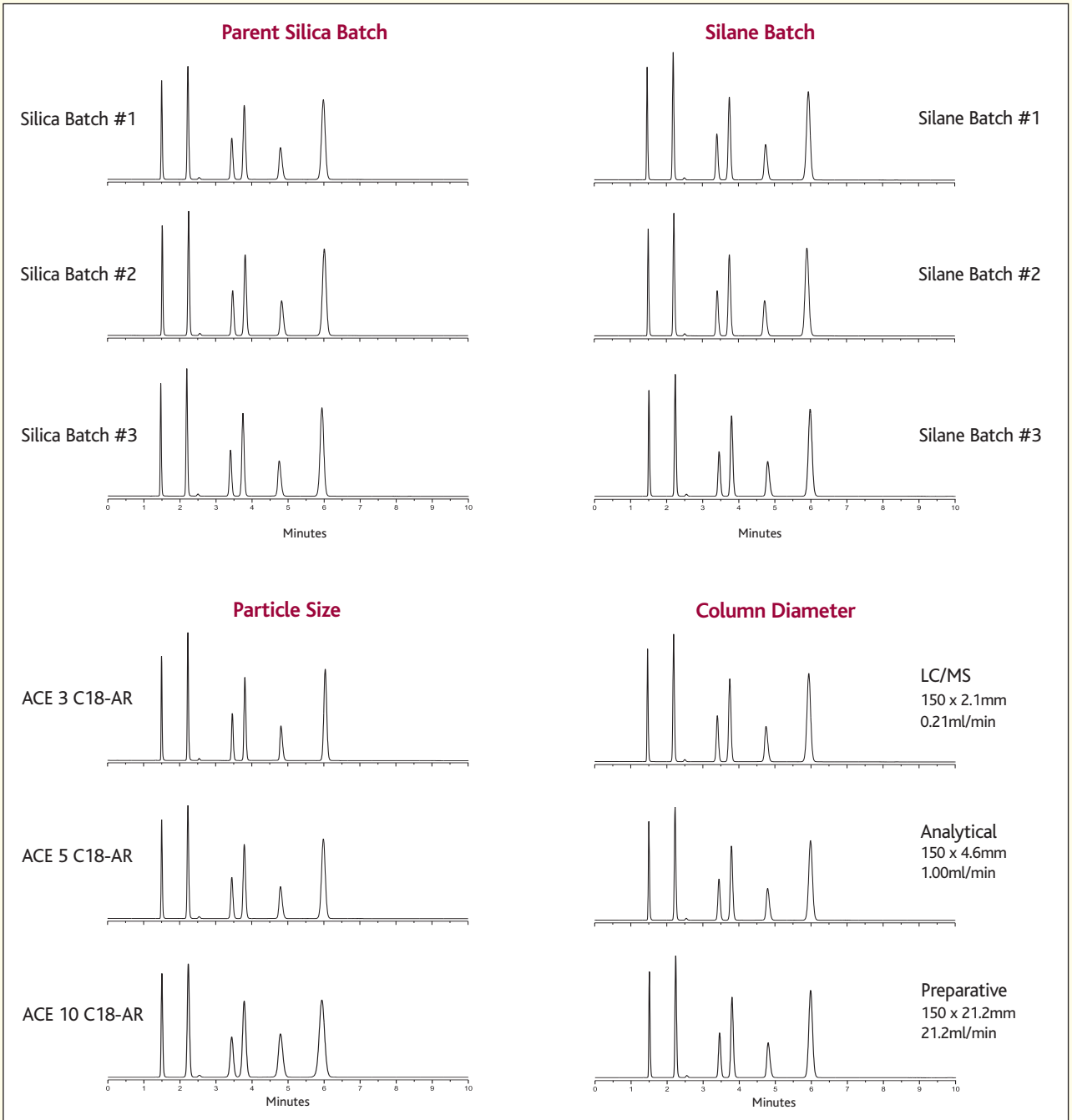
Using conditions designed to accelerate column degradation, the ACE C18-AR phase shows little retention loss, with lifetime equivalent to the highly robust ACE C18 phase. Both phases are manufactured from the same ultra pure silica, and out-last the Zorbax SB C18, a phase previously recognised to provide excellent stability for high temperature and low pH applications.

As expected, a C18 bonded column based upon a low purity silica (Waters Spherisorb ODS2) shows a greatly reduced lifetime under these accelerated conditions.

Of particular note is the result comparing the lifetime of a conventional phenyl column to the ACE C18-AR. Despite the use of an ultra pure silica, the lifetime of the phenyl column is diminished compared with the ACE C18-AR, suggesting that the ACE C18-AR may be suitable for applications in which conventional phenyl columns are seen to exhibit reduced lifetime.

Guaranteed Reproducibility and Fully Scalable

Of equal importance to alternative selectivity is excellent reproducibility. Variations between different batches of stationary phase are the most common cause of customer concern. ACE stationary phases virtually eliminate the unpredictable negative effects of silanols on HPLC and UHPLC separations by maintaining a rigid control of the complete manufacturing process and establishing tight specifications for purity, selectivity, retention, efficiency and asymmetry. Therefore, as demonstrated in the figure below absolute batch-to-batch and column-to-column reproducibility are guaranteed for all ACE C18-AR columns.



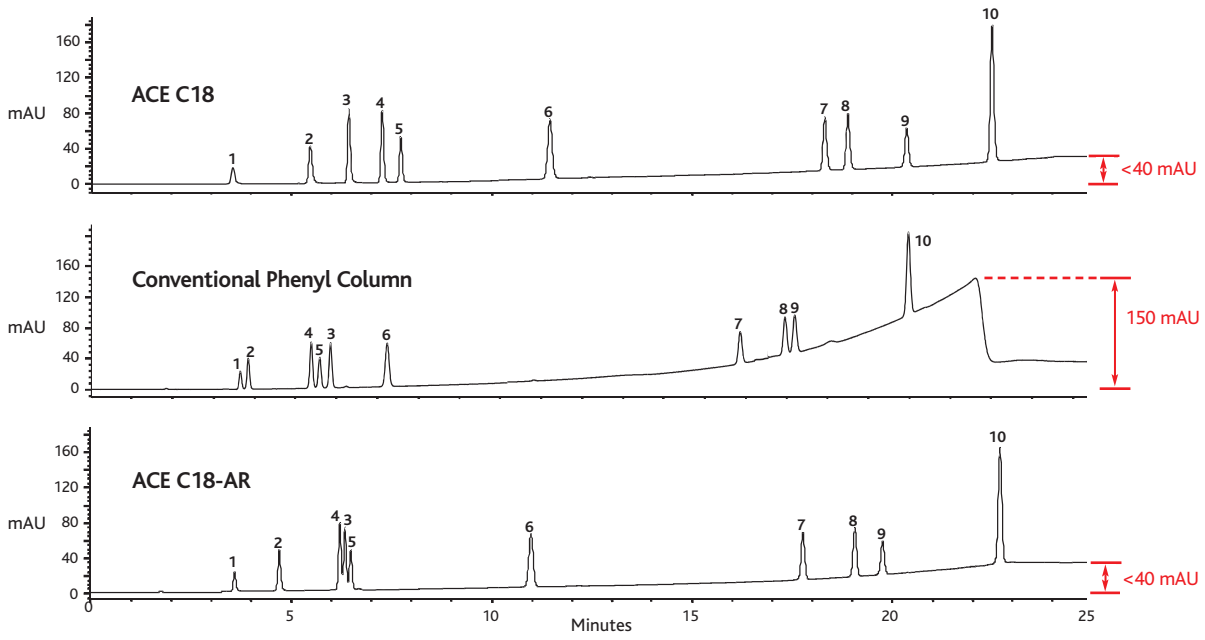
Column: ACE 5 C18-AR, 150 x 4.6mm (unless specified otherwise)
Sample: 1) uracil 2) 4-hydroxybenzoic acid 3) acetylsalicylic acid 4) benzoic acid 5) 2-hydroxybenzoic acid 6) ethyl paraben
Mobile Phase: 35:65 MeCN/0.1%TFA in H_2O Temperature: 22°C Wavelength: 254nm Flow 1.00ml/min (unless specified otherwise)

The availability of 2µm, 3µm, 5µm and 10µm particle sizes combined with a range of column dimensions from capillary through to preparative scale ensures that methods can be reproducibly scaled up or down. The chromatograms above demonstrate the excellent reproducibility achieved when silica batch and silane batch are changed, and the reproducible scalability obtained when changing particle size and column diameter.

Low Bleed for UV and LC/MS Compatibility

Many phases exhibit bleed of the bonded phase, which can be most clearly seen under gradient conditions when baseline stability is affected. Whilst most ultra pure C18 phases would be expected to give low column bleed, careful selection of an alternative selectivity bonded phase is required, to ensure that column bleed does not cause unforeseen problems when analysing at low UV wavelengths or by LC/MS.

ACE C18-AR Exhibits Low Column Bleed for UV



Column Dimensions: 150 x 4.6mm Flow Rate: 1.00ml/min Temperature: 60°C Detection: UV, 214nm

Compounds: 1) nicotine 2) benzylamine 3) procainamide 4) terbutaline 5) salbutamol 6) phenol 7) internal standard A 8) internal standard B 9) diphenhydramine 10) nortriptyline

Mobile Phase: A. 20mM KH_2PO_4 in H_2O (pH 2.7) B. 35:65 (v/v) 20mM KH_2PO_4 in H_2O (pH 2.7) / MeOH

Gradient:

T(mins)	%B
0	5
20	95
25	95
26	5

Comparative data may not be representative of all applications.

This example compares the low bleed characteristics of an ultra pure ACE C18 column (top) with the moderate bleed typical of a conventional phenyl column (middle). The ACE C18-AR column (bottom) shows improved bleed levels compared to the phenyl column and offers bleed levels comparable to the ACE C18 column, despite containing an integral phenyl functionality which provides the alternative selectivity.

For MS detection, the use of non-C18 phases has traditionally presented additional challenges and in extreme instances, column bleed can swamp the detector signal and mask the analyte of interest. TIC trace and MS spectra comparisons also show that ACE C18-AR columns provide extremely low levels of bleed, comparable to levels from a blank column run (with no column attached) and to bleed levels from leading C18 columns. Other typical bonded phases that might be considered to provide alternative selectivity to C18 columns (i.e. conventional phenyl, polar embedded, PFP and AQ type surface chemistries) would all be expected to show higher levels of bleed.

Conclusion:

The ACE C18-AR phase combines a low bleed level (typical of leading C18 column brands) with an alternative selectivity, thus providing the analyst with a valuable method development tool.

ACE® Excel® UHPLC columns

ACE Excel UHPLC C18-AR Column Advantages

- **High efficiency 2µm, 3µm and 5µm particles**
- **Compatible with all UHPLC and HPLC systems**
- **Exceptional reproducibility and column lifetime**
- **Fully scalable with other ACE particle sizes**
- **Rugged and reliable day-to-day performance**
- **Robust up to 1,000 bar (15,000psi)**

ACE C18-AR is available as Excel UHPLC high efficiency 2µm, 3µm and 5µm particle size columns, for demanding UHPLC applications. Selectivity is unchanged from the 3µm, 5µm and 10µm ACE HPLC C18-AR columns, making scale-up from UHPLC to HPLC, or vice versa, simple and reproducible.

ACE Excel UHPLC C18-AR columns are fully compatible with all commercial UHPLC systems and are stable up to 1,000 bar (15,000psi). The low dead volume dual compatible UHPLC/HPLC 'Excel' column hardware has been optimised to take full advantage of the low dispersion of modern UHPLC instruments. Additionally, all ACE Excel UHPLC columns are manufactured using a proprietary HSC™ (**H**igh **S**tability **C**olumn) manufacturing process that results in ultra robust UHPLC columns.

To further extend ACE C18-AR column lifetimes at UHPLC column pressures, ACE UHPLC pre-column filters are recommended (see page 12).

ACE columns have led the way in offering C18 bonded phases with the advantage of 'extra selectivity'. The ACE C18-AR and other ACE 'extra selectivity' phases, such as the C18-PFP, C18-Amide, CN-ES and SuperC18 have proved to be extremely valuable tools for achieving separations that may not be possible with 'standard' C18 bonded phases. These 'extra selectivity' phases are not meant to replace 'standard' C18 bonded phases, but rather complement them and so provide chromatographers with powerful, additional mechanisms of separation that can be used to achieve better overall chromatographic results.

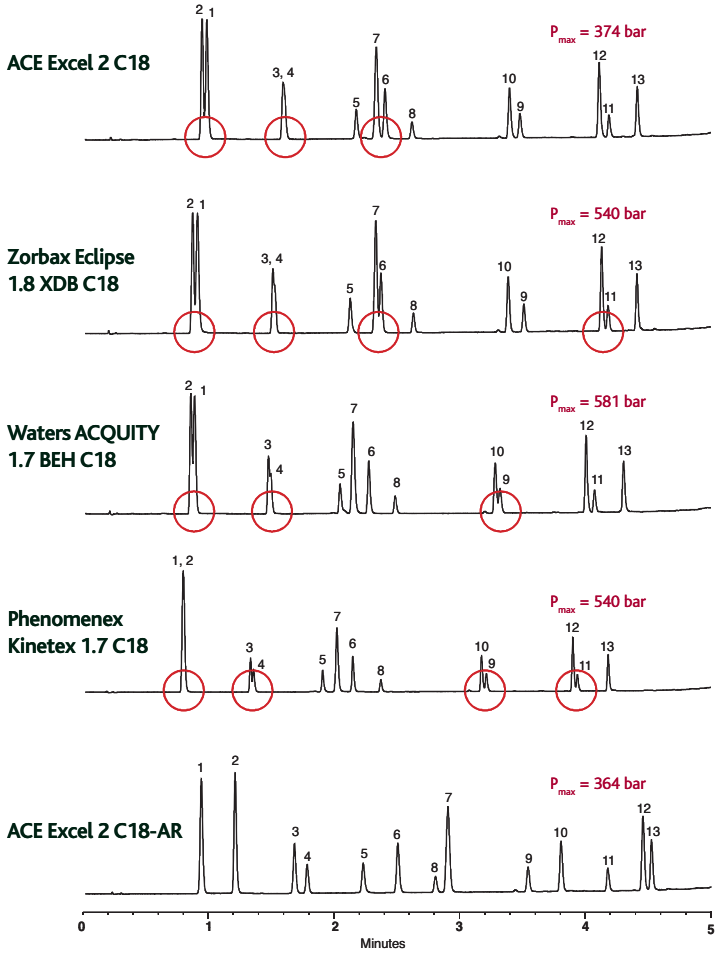
The availability of ACE Excel UHPLC columns means that chromatographers can combine the power of bonded phase selectivity with the efficiency and speed of UHPLC, providing chromatographers with more choices to achieve better results.

ACE® Excel® delivers excellent resolution and peak shape

Application #1501 – Pharmaceuticals and Related Compounds by UHPLC

Mobile Phase: A = 5 mM formic acid in H_2O and B = 5 mM formic acid in MeOH
Gradient: 3 to 100% B in 5 minutes
Flow Rate: 0.6 ml/min
Temperature: 40°C
Detection: UV, 254 nm
Column Dimensions: 50 x 2.1mm

1. paracetamol
2. hydrochlorothiazide
3. methylphenylsulphoxide
4. methylphenylsulphone
5. aspirin
6. phenacetin
7. 1,3-dinitrobenzene
8. 1,2,4-trimethoxybenzene
9. ethylbenzoate
10. nimesulide
11. ibuprofen
12. indomethacin
13. mefenamic acid



Comparative data may not be representative of all applications.
Please see p.13 for acknowledgement of trademarks.

The above example highlights that these leading C18 brands provide similar selectivity and fail to fully resolve the components under these conditions, with 2 or more critical pairs non baseline resolved in each case.

The unique selectivity of the ACE Excel C18-AR phase enables improved separation.

Material Characteristics

PHASE	FUNCTIONAL GROUP	ENDCAPPED	PARTICLE SIZE (µm)	PORE SIZE (Å)	SURFACE AREA (m^2/g)	CARBON LOAD (%)	RECOMMENDED pH RANGE	USP LISTING
ACE C18-AR	Proprietary octadecyl with embedded phenyl functionality	Yes	2, 3, 5, 10	100	300	15.5	2.0-8.0[a]	L1

[a] For optimum column lifetime, a pH range of 2-8 is recommended. To increase column lifetime at high pH, organic buffers, low buffer concentrations, high % organic solvent and low temperatures must be considered. Further information is contained within "A Guide to HPLC and LC-MS Buffer Selection" by John Dolan - please contact your distributor to request your FREE copy or visit www.ace-hplc.com.

UHPLC and HPLC Column Options

ACE C18-AR columns are offered in 2 different hardware formats. ACE Excel UHPLC columns are recommended for more demanding UHPLC applications where high pressures and/or flow rates are typically used. ACE HPLC columns are available in a wider range of dimensions from capillary to preparative scale. Identical column selectivity is achieved with both hardwares.

ACE Excel C18-AR UHPLC Columns

ACE Excel C18-AR UHPLC columns are available with 2µm, 3µm and 5µm particles, using unique Excel® hardware specially optimised to take full advantage of low dispersion modern UHPLC instruments. All ACE Excel UHPLC columns are manufactured using a proprietary HSC™ (High Stability Column) manufacturing process that results in ultra robust UHPLC columns rated for use at pressures up to 1,000bar/15,000psi.

ACE Excel 2µm C18-AR UHPLC/HPLC Columns (supplied in dual compatible UHPLC/HPLC hardware format with 1000bar/15000psi pressure limit)

COLUMN DIAMETER	COLUMN LENGTH								PRE-COLUMN FILTER[1]
	20 mm	30 mm	35 mm	50 mm	75 mm	100 mm	125 mm	150 mm	
2.1mm	EXL-109-0202U	EXL-109-0302U	EXL-109-3502U	EXL-109-0502U	EXL-109-7502U	EXL-109-1002U	EXL-109-1202U	EXL-109-1502U	EXL-PCF10
3.0mm	EXL-109-0203U	EXL-109-0303U	EXL-109-3503U	EXL-109-0503U	EXL-109-7503U	EXL-109-1003U	EXL-109-1203U	EXL-109-1503U	EXL-PCF10
4.6mm	EXL-109-0246U	EXL-109-0346U	EXL-109-3546U	EXL-109-0546U	EXL-109-7546U	EXL-109-1046U	EXL-109-1246U	EXL-109-1546U	EXL-PCF10

ACE Excel 3µm C18-AR UHPLC/HPLC Columns (supplied in dual compatible UHPLC/HPLC hardware format with 1000bar/15000psi pressure limit)

COLUMN DIAMETER	COLUMN LENGTH									PRE-COLUMN FILTER[1]
	20 mm	30 mm	35 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	
2.1mm	EXL-119-0202U	EXL-119-0302U	EXL-119-3502U	EXL-119-0502U	EXL-119-7502U	EXL-119-1002U	EXL-119-1202U	EXL-119-1502U	EXL-119-2502U	EXL-PCF10
3.0mm	EXL-119-0203U	EXL-119-0303U	EXL-119-3503U	EXL-119-0503U	EXL-119-7503U	EXL-119-1003U	EXL-119-1203U	EXL-119-1503U	EXL-119-2503U	EXL-PCF10
4.6mm	EXL-119-0246U	EXL-119-0346U	EXL-119-3546U	EXL-119-0546U	EXL-119-7546U	EXL-119-1046U	EXL-119-1246U	EXL-119-1546U	EXL-119-2546U	EXL-PCF10

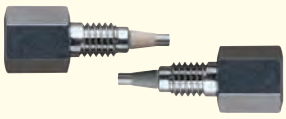
ACE Excel 5µm C18-AR UHPLC/HPLC Columns (supplied in dual compatible UHPLC/HPLC hardware format with 1000bar/15000psi pressure limit)

COLUMN DIAMETER	COLUMN LENGTH									PRE-COLUMN FILTER[1]
	20 mm	30 mm	35 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	
2.1mm	EXL-129-0202U	EXL-129-0302U	EXL-129-3502U	EXL-129-0502U	EXL-129-7502U	EXL-129-1002U	EXL-129-1202U	EXL-129-1502U	EXL-129-2502U	EXL-PCF10
3.0mm	EXL-129-0203U	EXL-129-0303U	EXL-129-3503U	EXL-129-0503U	EXL-129-7503U	EXL-129-1003U	EXL-129-1203U	EXL-129-1503U	EXL-129-2503U	EXL-PCF10
4.6mm	EXL-129-0246U	EXL-129-0346U	EXL-129-3546U	EXL-129-0546U	EXL-129-7546U	EXL-129-1046U	EXL-129-1246U	EXL-129-1546U	EXL-129-2546U	EXL-PCF10

[1] 10/pk. Compatible with all UHPLC column brands and all UHPLC instruments. For inlet connections onto a Waters Acquity system a pre-column filter incorporating the unique Waters Acquity column port profile (p/n EXL-PCF10/ACQ) is alternatively recommended.

ACE Pre-column Filters for UHPLC

To further extend column lifetimes under UHPLC conditions the use of ACE UHPLC Pre-column filters is recommended. ACE UHPLC Pre-column filters are pressure rated to 1,000bar (15,000psi), can be installed simply in seconds and are compatible with all manufacturers' UHPLC instruments and all brands of UHPLC columns. Please contact us for further information.



ACE UHPLC Pre-column Filters
(p/n EXL-PCF10, 10 pack and p/n EXL-PCF10/ACQ, 10 pack)

ACE UHPLC Column Connectors

ACE UHPLC column connectors are ultra low dispersion and compatible with all brands of UHPLC columns and all manufacturers' instruments. They are pressure rated to 1,700 bar (25,000 psi). These connectors are simple to install and are reusable. Please contact us for further information.

ACE UHPLC Column Connector
(p/n EXL-CC10, 10 pack)

ACE C18-AR HPLC Columns

ACE C18-AR HPLC columns are available with 3µm, 5µm and 10µm particles, in a wider range of dimensions than available in the ACE Excel UHPLC column format. For optimum column lifetime, a maximum operating pressure of 275bar/4,000psi is recommended.

ACE 3µm C18-AR HPLC Columns (supplied in HPLC hardware format with 275bar/4000psi pressure limit)

COLUMN DIAMETER	COLUMN LENGTH									GUARD CARTRIDGE
	20 mm	30 mm	35 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	
1.0mm	-	ACE-119-0301	ACE-119-3501	ACE-119-0501	ACE-119-7501	ACE-119-1001	ACE-119-1201	ACE-119-1501	ACE-119-2501 [b]	ACE-119-0101GD[1]
2.1mm	ACE-119-0202[4]	ACE-119-0302	ACE-119-3502	ACE-119-0502	ACE-119-7502	ACE-119-1002	ACE-119-1202	ACE-119-1502	ACE-119-2502 [b]	ACE-119-0102GD[2]
3.0mm	ACE-119-0203[4]	ACE-119-0303	ACE-119-3503	ACE-119-0503	ACE-119-7503	ACE-119-1003	ACE-119-1203	ACE-119-1503	ACE-119-2503 [b]	ACE-119-0103GD[3]
4.0mm	-	-	ACE-119-3504	ACE-119-0504	ACE-119-7504	ACE-119-1004	ACE-119-1204	ACE-119-1504	ACE-119-2504 [b]	ACE-119-0103GD[3]
4.6mm	ACE-119-0246[4]	ACE-119-0346	ACE-119-3546	ACE-119-0546	ACE-119-7546	ACE-119-1046	ACE-119-1246	ACE-119-1546	ACE-119-2546 [b]	ACE-119-0103GD[3]

[b] Consider operating pressure limitations for maximum column lifetime

ACE 5µm C18-AR HPLC Columns (supplied in HPLC hardware format with 275bar/4000psi pressure limit)

COLUMN DIAMETER	COLUMN LENGTH									GUARD CARTRIDGE
	20 mm	30 mm	35 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	
1.0mm	-	ACE-129-0301	ACE-129-3501	ACE-129-0501	ACE-129-7501	ACE-129-1001	ACE-129-1201	ACE-129-1501	ACE-129-2501	ACE-129-0101GD[1]
2.1mm	ACE-129-0202[4]	ACE-129-0302	ACE-129-3502	ACE-129-0502	ACE-129-7502	ACE-129-1002	ACE-129-1202	ACE-129-1502	ACE-129-2502	ACE-129-0102GD[2]
3.0mm	ACE-129-0203[4]	ACE-129-0303	ACE-129-3503	ACE-129-0503	ACE-129-7503	ACE-129-1003	ACE-129-1203	ACE-129-1503	ACE-129-2503	ACE-129-0103GD[3]
4.0mm	-	-	ACE-129-3504	ACE-129-0504	ACE-129-7504	ACE-129-1004	ACE-129-1204	ACE-129-1504	ACE-129-2504	ACE-129-0103GD[3]
4.6mm	ACE-129-0246[4]	ACE-129-0346	ACE-129-3546	ACE-129-0546	ACE-129-7546	ACE-129-1046	ACE-129-1246	ACE-129-1546	ACE-129-2546	ACE-129-0103GD[3]
7.75mm	-	-	-	ACE-129-0508	ACE-129-7508	ACE-129-1008	ACE-129-1208	ACE-129-1508	ACE-129-2508	ACE-129-0110GD[5]
10mm	-	-	-	ACE-129-0510	ACE-129-7510	ACE-129-1010	ACE-129-1210	ACE-129-1510	ACE-129-2510	ACE-129-0110GD[5]
21.2mm	-	-	-	ACE-129-0520	ACE-129-7520	ACE-129-1020	ACE-129-1220	ACE-129-1520	ACE-129-2520	ACE-129-0110GD[5]
30mm	-	-	-	ACE-129-0530	ACE-129-7530	ACE-129-1030	ACE-129-1230	ACE-129-1530	ACE-129-2530	ACE-129-0120GD[6]

ACE 10µm C18-AR HPLC Columns (supplied in HPLC hardware format with 275bar/4000psi pressure limit)

COLUMN DIAMETER	COLUMN LENGTH									GUARD CARTRIDGE
	20 mm	30 mm	35 mm	50 mm	75 mm	100 mm	125 mm	150 mm	250 mm	
4.6mm	ACE-139-0246[4]	ACE-139-0346	ACE-139-3546	ACE-139-0546	ACE-139-7546	ACE-139-1046	ACE-139-1246	ACE-139-1546	ACE-139-2546	ACE-139-0103GD[3]
7.75mm	-	-	-	ACE-139-0508	ACE-139-7508	ACE-139-1008	ACE-139-1208	ACE-139-1508	ACE-139-2508	ACE-139-0110GD[5]
10mm	-	-	-	ACE-139-0510	ACE-139-7510	ACE-139-1010	ACE-139-1210	ACE-139-1510	ACE-139-2510	ACE-139-0110GD[5]
21.2mm	-	-	-	ACE-139-0520	ACE-139-7520	ACE-139-1020	ACE-139-1220	ACE-139-1520	ACE-139-2520	ACE-139-0110GD[5]
30mm	-	-	-	ACE-139-0530	ACE-139-7530	ACE-139-1030	ACE-139-1230	ACE-139-1530	ACE-139-2530	ACE-139-0120GD[6]

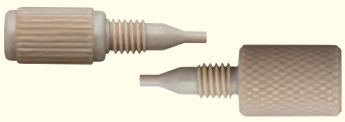
[1] 5 pack, use with cartridge holder H0001 and column coupler C0001
[2] 5 pack, use with integral microbore cartridge holder H0004 (not 20mm column length)
[3] 5 pack, use with integral analytical cartridge holder H0005 (not 20mm column length)
[4] When using guards, cartridge holder H0001 and column coupler C0001 required
[5] 3 pack – use with semi-prep cartridge holder H0002 and column coupler C0001
[6] 3 pack – use with prep cartridge holder H0009 and column coupler C0002

ACE C18-AR Capillary and Nano HPLC Columns

ACE C18-AR capillary and nano columns are available in 0.5mm (500µm), 300µm, 100µm and 75µm internal diameters with 3µm and 5µm particle sizes. Please enquire for further information.

ACE Pre-column Filters for HPLC

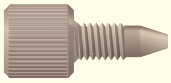
To further extend column lifetimes under HPLC conditions the use of ACE HPLC Pre-column filters is recommended. ACE HPLC Pre-column filters are simple to install and replace, are compatible with all HPLC column brands and systems and offer effective low cost column protection. Contact us for further details.



ACE Analytical and Microbore Pre-column Filters
(p/n ACE-CS210, 10 pack and p/n ACE-HP210, 10 pack)

ACE HPLC Column Connectors

ACE HPLC column connectors are compatible with all brands of HPLC columns and all manufacturers' instruments. Please contact us for further information.



ACE Fingertight HPLC Column Connector
(p/n ACE-CC10, 10 pack)

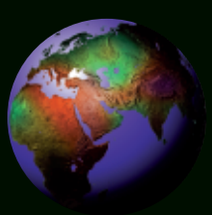
ACE UHPLC and HPLC Method Development Kits

Method Development kits enable the optimum bonded phase for an application to be identified. ACE columns are available with a range of unique, highly selective phases in 2µm, 3µm, 5µm and 10µm particle sizes. Please enquire for further information.

Free HPLC Technical Guides and Slide Chart

To receive your FREE copies of these guides or the HPLC Column slide chart contact your local distributor or email: info@ace-hplc.com

ACE® products are available through our international network of distributors



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