

**Thermo Scientific**  
**Synchronis HPLC Columns**  
Technical Guide Version 2



# Consistent, predictable separations

column after column, time after time

**Thermo**  
SCIENTIFIC



## Thermo Scientific Synchronis Columns

When developing a new method, one of the most important goals for the chromatographer is to achieve a consistent, reproducible separation. The selection of a highly reproducible HPLC column is essential if this goal is to be attained.

Our Synchronis™ HPLC columns are manufactured, packed and tested in ISO9000 accredited facilities. Each lot of silica is tested for the physical properties of the silica support and only released for production if it meets the stringent test specifications.


Each bonded lot of chromatographic packing material is rigorously tested for primary and secondary interactions with the bonded phase.

New, enhanced, automated packing methods drive consistency even further and every column is individually tested to ensure that it meets the required quality.

These extensive testing and quality control procedures ensure the delivery of a consistent product, column after column.

**Predictability you can count on,  
it's a beautiful thing.**





Thermo Scientific Synchronis columns are available in a range of chemistries to give reproducible separations in reversed phase, HILIC and normal phase chromatography.

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#### Thermo Scientific Synchronis Stationary Phases

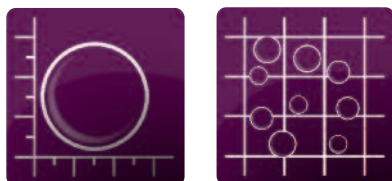
C18	10-12
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# Thermo Scientific Synchronis Testing and Quality Control

## Silica Characterization

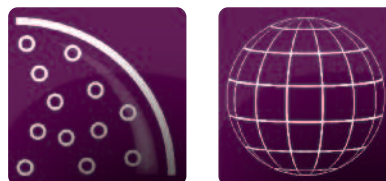
Consistent separations require a rugged, reproducible silica backbone and to achieve this consistency, strict control of the physical properties of the silica particles is essential. Each manufactured lot of Synchronis silica is tightly controlled and extensively tested for its particle size and distribution, pore size and surface area and elemental purity. Only those batches which meet the rigorous quality control specifications are used.

### Particle size and distribution



Tight control of the particle classification process ensures that a narrow particle size distribution is achieved around the target particle size, an important consideration for consistent chromatographic efficiency. Each manufactured lot of Synchronis silica is tested for its particle size and distribution using a laser particle size analyser. Two particle sizes are available: 1.7  $\mu\text{m}$  for rapid UHPLC separations and 5  $\mu\text{m}$  for the more traditional HPLC analysis.

### Pore size and surface area



Well controlled pore size and surface area are key to ensuring consistent carbon load and retentive properties of the chromatographic media. Each batch of Synchronis silica is tested for its pore size and surface area using liquid nitrogen adsorption.

Synchronis columns are based on highly pure 100 Å silica, with a surface area of 320  $\text{m}^2/\text{g}$ , compared to 200  $\text{m}^2/\text{g}$  for typical silica based material. This greater surface area ensures good retention of analytes having a range of hydrophobicity, away from the solvent front. The high surface area also allows for higher sample loading.

### Silica purity (metals content)

The purity of the silica support is of particular importance when considering the separation of polar and basic compounds. Older, less pure silica supports contain a greater number of metallic impurities. The presence of certain metallic impurities with electron withdrawing properties (particularly aluminium) in silica can activate the silanols so that they become highly acidic, which can lead to peak tailing for basic solutes. Metallic impurities can also complex with chelating solutes, resulting in asymmetrical or tailing peaks. In extreme cases, these interactions may be strong enough to result in complete retention of the solute.

Each batch of Synchronis silica is tested for metals content using atomic emission spectroscopy. The specification and typical results are shown below.

Metal	Na (ppm)	Mg (ppm)	Al (ppm)	Ca (ppm)	Fe (ppm)	Zr (ppm)
Specification	<10	<10	<10	<10	<10	<10
Batch A	0.9	0.3	<1	<0.5	0.9	0.5
Batch B	0.8	<0.1	<1	<0.5	0.9	1.1
Batch C	1.1	<0.1	<1	<0.5	1.5	1.4
Batch D	1.1	<0.1	<1	<0.5	0.8	1.4
Batch E	1.3	0.4	1.4	0.8	1.1	1.2

## Bonded Phase Characterization

Synchronis columns are bonded and endcapped with a range of stationary phases to effect different selectivity in separation. Whatever the bonded phase, rigorous testing and precise control of the bonding process are essential to achieve consistent chromatography. Each batch of Synchronis chromatographic media is tested for carbon load and characterised by stringent chromatographic testing before it is used to pack columns.

### Carbon loading and surface coverage

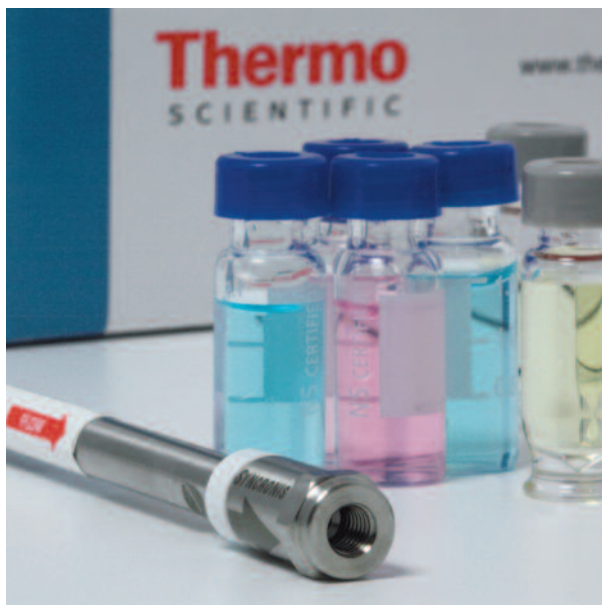


The hydrophobic retention of a stationary phase is directly dependent on the carbon loading on the silica. Precise control of the batch to batch carbon loading is therefore a critical factor in ensuring consistent retention times. Synchronis reversed phase columns are densely bonded and double endcapped to minimise the number of residual silanols available to interact with basic analytes. Each batch of bonded phase is tested for carbon load using a total carbon analyser.

### Chromatographic tests

The retention properties of a reversed-phase packing material can be categorized into hydrophobic interactions, which include the measure of the hydrophobicity of the ligand and its density, steric or shape selectivity and secondary interactions such as silanol and surface metal activity. The impact that interactions between analytes and silanols have on the chromatographic performance depends on the pH of the mobile phase. Silanols on the silica surface can hydrogen bond (both as a donor and acceptor) and dissociated silanols can ion exchange with protonated bases.

To ensure consistent, predictable separations, the chromatographic media packed into Synchronis columns is extensively characterized using a series of diagnostic chromatographic tests, based on those developed by Tanaka<sup>1</sup>. These tests rigorously probe interactions between analytes and stationary phase, measuring hydrophobicity, shape selectivity and secondary interactions with bases, acids and chelators.





# Thermo Scientific Synchronis Testing and Quality Control

## Test 1: Hydrophobic Interactions

### Hydrophobic Retention



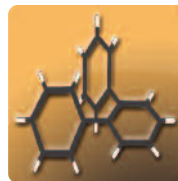
The first hydrophobic interaction that is measured is Hydrophobic Retention (HR). The capacity factor of a neutral, hydrophobic hydrocarbon (pentylbenzene) gives a measure of the hydrophobicity of the stationary phase and therefore a measure of the carbon load on the silica.

### Hydrophobic Selectivity



The second measurement of hydrophobic interaction that is carried out is Hydrophobic Selectivity (HS). The selectivity factor between pentylbenzene and butylbenzene provides a measure of the surface coverage of the phase; these two alkylbenzenes differ by one methylene group and their selectivity is dependent on the density of the bonded ligand.

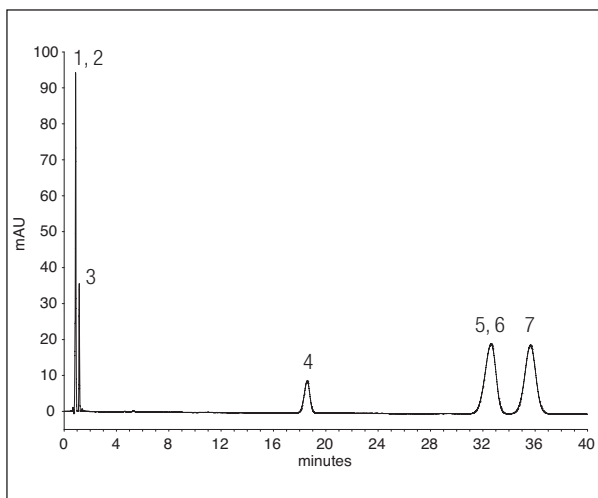
### Steric Selectivity



Steric Selectivity (SS) is the measurement of the ability of the stationary phase to distinguish between molecules with similar structures and hydrophobicity but different shapes. The selectivity factor between o-terphenyl and triphenylene is indicative of steric selectivity as the former has the ability to twist and bend, while the latter has a rigid structure and is retained quite differently.

### Hydrogen Bonding Capacity

The Hydrogen Bonding Capacity (HBC) of the stationary phase is probed by determining the selectivity factor between caffeine and phenol. This provides a measure of the number of available silanol groups and the degree of endcapping. A low value indicates a low level of silanols available to hydrogen bond with caffeine and therefore an indication of the thoroughness of the endcapping.



Column: Synchronis C18, 5 µm, 100 mm x 4.6 mm

Mobile phase:	Water: Methanol (35:65)
Flow rate:	1.0 mL/min
Temperature:	40 °C
Detection:	254 nm
Injection volume:	10 µL

1. Theophylline
2. Caffeine
3. Phenol
4. Butylbenzene
5. o-Terphenyl
6. Pentylbenzene
7. Triphenylene

Example chromatogram for Test 1: Hydrophobic Interactions

## Test 2: Interactions with Basic and Chelating Compounds

### Activity towards basic compound

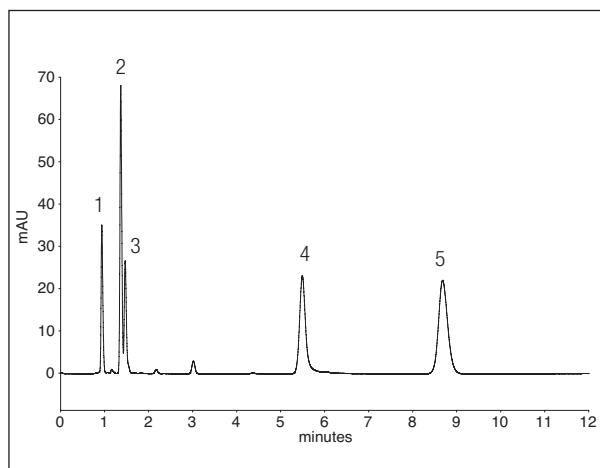
The presence of dissociated silanols at  $\text{pH} > 7$  can cause poor peak shapes of protonated basic compounds, such as amitriptyline. Secondary ion exchange and silanolic interactions can cause shifts in retention and asymmetrical peaks. The capacity factor and tailing factor of amitriptyline are indicative of the overall performance of the column. Synchronis columns exhibit excellent peak shape for amitriptyline, demonstrating a highly deactivated silica.

### Activity towards chelators

Silica surface metal interactions can cause changes in selectivity and peak shape for analytes which are able to chelate. Changes in the capacity factor and tailing factor of quinizarin, which is a chelator, are indicative of secondary interactions with metallic impurities in the silica. The excellent peak shape observed with Synchronis columns is indicative of the exceptionally low metals content.

### Ion-exchange capacity at pH 7.6 (IEC7)

The selectivity factor between benzylamine and phenol is used to measure the total silanol activity on the surface of the silica. At  $\text{pH} > 7$  the silanol groups are dissociated and combine with the ion exchange sites to influence the retention of benzylamine.



Example chromatogram for Test 2:  
Interactions with basic and chelating compounds

Column: Synchronis C18, 5  $\mu\text{m}$ , 100 mm x 4.6 mm

Mobile phase: 10 mM Phosphate (pH 7.6):  
Methanol (20:80)

Flow rate: 1.0 mL/min

Temperature: 40 °C

Detection: 254 nm

Injection volume: 5  $\mu\text{L}$

1. Theophylline
2. Benzylamine
3. Phenol
4. Quinizarin
5. Amitriptyline

# Thermo Scientific Synchronis Testing and Quality Control



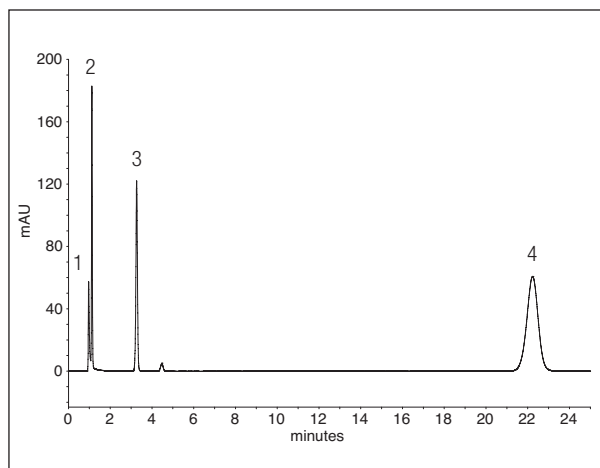
## Test 3: Interactions with Acidic Compounds

### Activity towards acids

The inertness of the stationary phase towards acidic compounds is also important for consistent retention and selectivity as acidic compounds may become adsorbed onto reversed phase packing materials. The capacity factor and tailing factor of chlorocinnamic acid are measured to test the applicability of the stationary phase to acidic analytes. Synchronis columns exhibit excellent peak shape, indicating a high degree of inertness towards acidic compounds.

### Ion exchange capacity at pH 2.7 (IEC2)

Tanaka<sup>1</sup> showed that the retention of protonated amines at pH<3 could be used to measure the ion exchange sites on the silica surface. Silanol groups (Si-OH) are undissociated at pH<3 and therefore cannot contribute to the retention of protonated amines, but the acidic silanols in the dissociated form (SiO<sup>-</sup>) can. The latter contribute to the retention of the protonated amines. The contribution of the free silanols to retention can be estimated by the selectivity factor between benzylamine and phenol, at pH 2.7.



Example chromatogram for Test 3: Interactions with acidic compounds

Column: Synchronis C18, 5  $\mu$ m, 100 mm x 4.6 mm

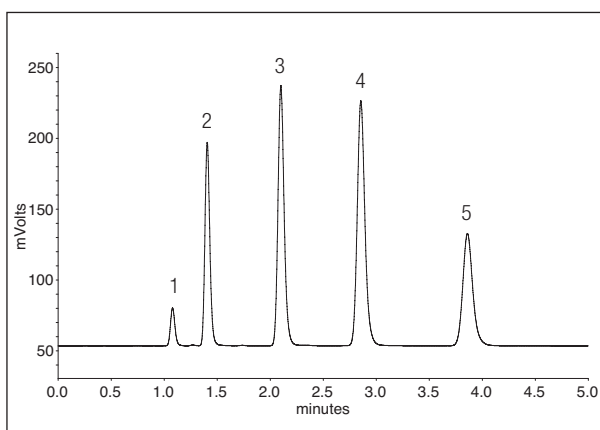
Mobile phase:	10 mM Phosphate (pH 2.7): Methanol (45:55)
Flow rate:	1.0 mL/min
Temperature:	40 °C
Detection:	254 nm
Injection volume:	5 $\mu$ L

1. Theophylline
2. Benzylamine
3. Phenol
4. Chlorocinnamic Acid



## Test 4: Normal Phase

Unbonded Synchronis silica chromatographic media is a polar stationary phase, which gives excellent reproducibility in normal phase chromatography. Each batch of Synchronis silica is tested under normal phase conditions.



Column: Synchronis Silica, 5  $\mu$ m, 150 mm x 4.0 mm

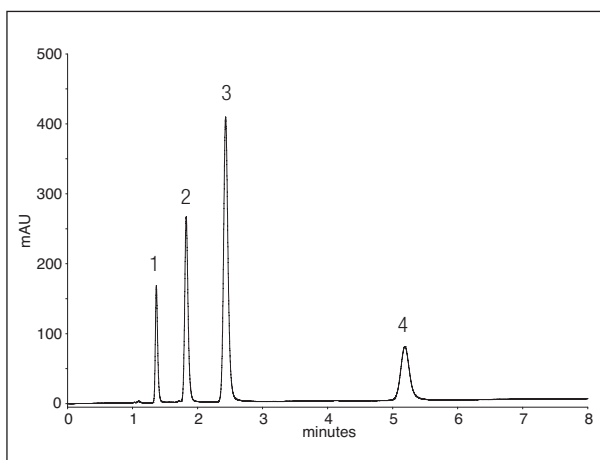
Mobile phase:	Iso-octane:Ethanol: Water (85:14.7:0.3)
Flow rate:	1.25 mL/min
Temperature:	40 °C
Detection:	254 nm
Injection volume:	2 $\mu$ L

1. Toluene
2. Nitrobenzene
3. o-nitroaniline
4. m-nitroaniline
5. p-nitroaniline

Example chromatogram for Test 4: Normal phase retention and selectivity

## Test 5: Ion Exchange

Synchronis amino chromatographic media is a polar bonded stationary phase, which gives excellent reproducibility in normal phase chromatography. Each batch of Synchronis amino media is tested under ion exchange chromatographic conditions.



Column: Synchronis Amino, 5  $\mu$ m, 150 mm x 4.6 mm

Mobile phase:	50 mM Phosphate (pH 3.0)
Flow rate:	1.0 mL/min
Temperature:	40 °C
Detection:	254 nm
Injection volume:	10 $\mu$ L

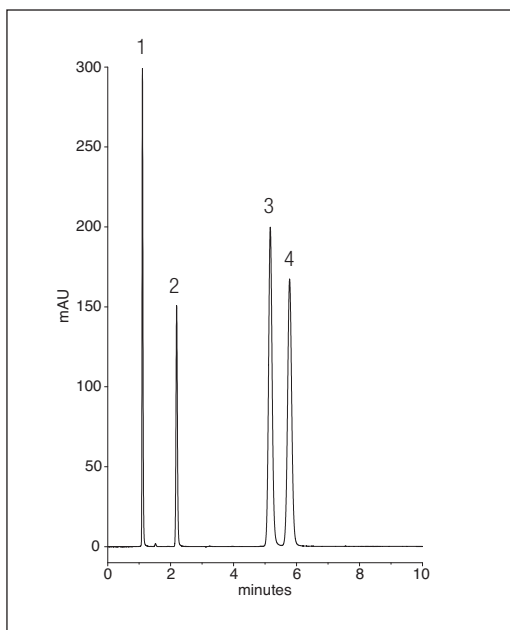
1. Uracil
2. Cytidine monophosphate
3. Adenosine monophosphate
4. Guanosine monophosphate

Example chromatogram for Test 5: Ion exchange retention and selectivity

# Thermo Scientific Synchronis Testing and Quality Control

## Test 6: HILIC Retention and Selectivity

Synchronis HILIC chromatographic media is a polar bonded stationary phase, which gives enhanced retention of polar and hydrophilic analytes. Each batch of Synchronis HILIC media is tested under HILIC conditions.



Column: Synchronis HILIC, 5  $\mu$ m, 150 mm x 4.6 mm

Mobile phase: 100 mM Acetate (pH 5):  
Acetonitrile (10:90)

Flow rate: 1.0 mL/min

Temperature: 40 °C

Detection: 254 nm

Injection volume: 10  $\mu$ L

1. Benzophenone
2. Uracil
3. Cytosine
4. Acyclovir

Example chromatogram for Test 6: HILIC retention and selectivity

## Column Packing

Every Synchronis column is individually tested and will not be released unless it meets the required retention, efficiency and peak symmetry. This testing is used to confirm the quality of the column packing process and the stability of the packed bed inside the column.

To ensure the most consistent results column after column, all Synchronis columns are packed using automated workstations.

To ensure that the measurements are a true indication of the quality of the packing, the testing of individual columns is performed on a highly optimised system.



## Summary of Tests Performed on Thermo Scientific Synchronis Columns

	Test	C18	C8	aQ	Phenyl	Amino	Silica	HILIC
Silica	Particle size and distribution	Y	Y	Y	Y	Y	Y	Y
	Pore size and surface area	Y	Y	Y	Y	Y	Y	Y
Bonded phase	Carbon Load	Y	Y	Y	Y	Y		Y
Chromatographic	Hydrophobic retention	Y	Y	Y	Y			
	Hydrophobic selectivity	Y	Y	Y	Y			
	Steric selectivity	Y	Y	Y	Y			
	Hydrogen bonding capacity	Y	Y	Y	Y			
	Activity towards basic compounds	Y	Y	Y	Y			
	Ion exchange capacity (pH 7.6)	Y	Y	Y	Y			
	Activity towards acidic compounds	Y	Y	Y	Y			
	Ion exchange capacity (pH 2.7)	Y	Y	Y	Y			
	Anion exchange test					Y		
	Normal phase test						Y	
	HILIC retention and selectivity							Y
Column packing	Reversed phase packing test	Y	Y	Y	Y			
	Normal phase packing test					Y	Y	
	HILIC packing test							Y



# Thermo Scientific

## Synchronis C18

### Specifications

<b>Particle size</b>	1.7 µm, 5 µm	<b>Carbon load</b>	16 %
<b>Pore size</b>	100 Å	<b>Endcapped</b>	Y
<b>Surface area</b>	320 m <sup>2</sup> /g	<b>USP classification</b>	L1
<b>pH range</b>	2 - 9		

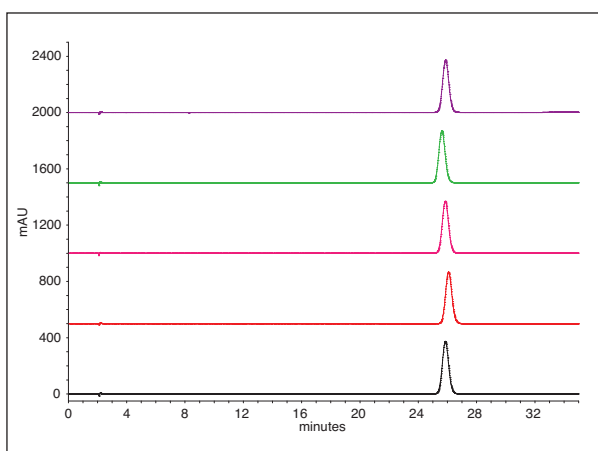
### Key features/benefits

- Outstanding reproducibility
- Highly pure, high surface area silica
- High carbon load for increased retention
- Double endcapped for extra surface coverage
- Highly inert towards basic compounds
- Rigorously tested to ensure quality



### Outstanding column to column reproducibility

When developing a new method, one of the most important goals for the chromatographer is to achieve a consistent, reproducible separation. The selection of a highly reproducible HPLC column is essential if this goal is to be attained.



Column: Synchronis C18, 5 µm, 250 mm x 4.0 mm

Mobile phase:	Water: Methanol (4:1)
Flow rate:	1.0 mL min <sup>-1</sup>
Temperature:	25 °C
Detection:	265 nm
Injection volume:	10 µL

1. Zidovudine

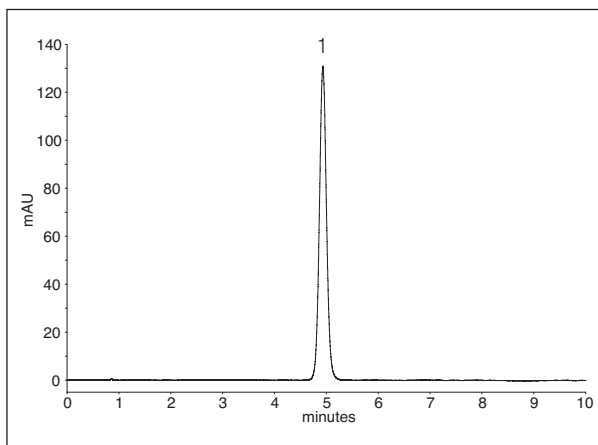
Synchronis C18 columns show excellent column to column reproducibility

Column	Retention Time (min)	Efficiency	Peak Area
1	25.82	62069	11532105
2	26.03	61688	11543904
3	25.90	62657	11527718
4	25.66	61317	11463444
5	25.92	63142	11520618
Inter-column precision (% RSD)	0.52	1.18	0.27

Synchronis C18 columns show excellent column to column reproducibility, as illustrated here by the analysis of zidovudine using five separate columns. The reproducibility in terms of retention time and peak area is less than or equal to 0.5 %, column to column. This indicates that the columns are well packed.

The variation in peak area is 0.27 %, which is important for quantitation of analytes.

#### Application: Chloramphenicol (USP)



Column: Synchronis C18, 5 µm, 100 mm x 4.6 mm

Mobile phase: Water: MeOH: Glacial Acetic Acid (54.9:45:0.1)

Flow rate: 1.0 mL/min

Temperature: 25 °C

Detection: 280 nm

Injection volume: 10 µL

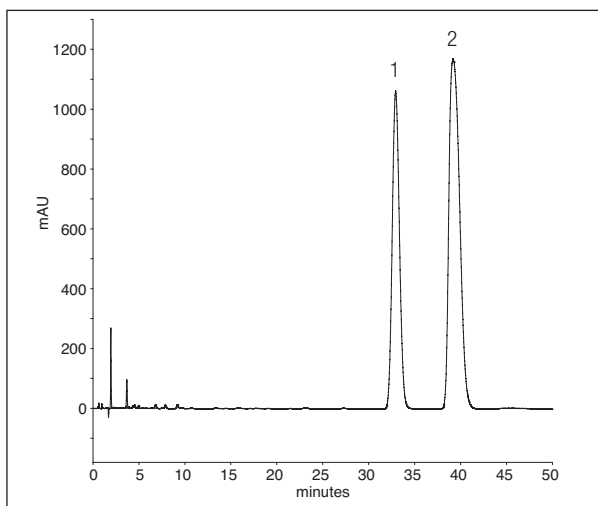
1. Chloramphenicol

Parameter	USP specification	Measured (6 replicate injections)
Efficiency (N)	> 1800	6164
Tailing factor	< 2	1.06
%RSD Retention time	< 1 %	0.03 %
%RSD Peak area	< 1 %	0.32 %

# Thermo Scientific

## Synchronis C18

### Application: Ibuprofen and Valerophenone (USP)



Column: Synchronis C18, 5  $\mu$ m, 150 mm x 4.0 mm

Mobile phase:	Water/Phosphoric Acid (pH 2.5): Acetonitrile (66.3:33.7)
Flow rate:	2.0 mL/min
Temperature:	30 °C
Detection:	214 nm
Injection volume:	5 $\mu$ L

1. Valerophenone  
2. Ibuprofen

Parameter	USP Specification	Measured Valerophenone (5 replicate injections)	Measured Ibuprofen (5 replicate injections)
Resolution	> 2.0	–	3.56
Relative retention time	~ 0.8	0.84	–
Efficiency (N)	–	8317	5872
Tailing factor	–	1.11	1.38
%RSD Retention time	–	0.50 %	0.77 %
%RSD Peak area	–	0.50 %	0.27 %

### Ordering Information

Description	Particle size	Length (mm)	2.1 mm ID	3.0 mm ID	4.0 mm ID	4.6 mm ID
Synchronis C18	1.7 $\mu$ m	30	97102-032130	–	–	–
		50	97102-052130	97102-053030	–	97102-054630
		100	97102-102130	97102-103030	–	–
	5 $\mu$ m	30	97105-032130	97105-033030	97105-034030	97105-034630
		50	97105-052130	97105-053030	97105-054030	97105-054630
		100	97105-102130	97105-103030	97105-104030	97105-104630
	5 $\mu$ m	150	97105-152130	97105-153030	97105-154030	97105-154630
		250	97105-252130	97105-253030	97105-254030	97105-254630
Drop-in guard cartridges (4/pk)	5 $\mu$ m	10	97105-012101	97105-013001	97105-014001	–



# Thermo Scientific Synchronis C8

## Specifications

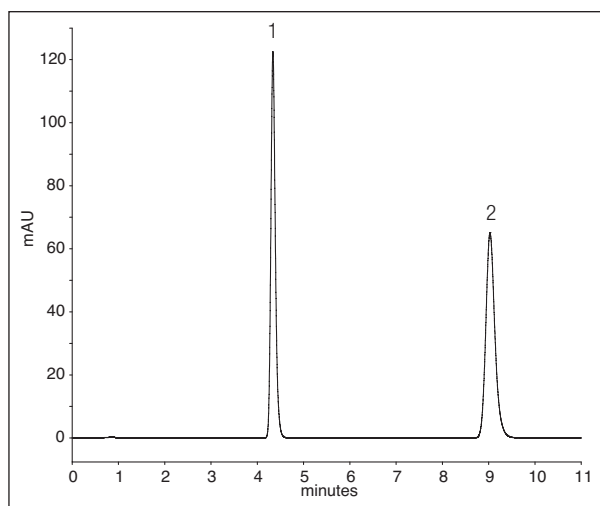
<b>Particle size</b>	1.7 µm, 5 µm	<b>Carbon load</b>	10 %
<b>Pore size</b>	100 Å	<b>Endcapped</b>	Y
<b>Surface area</b>	320 m <sup>2</sup> /g	<b>USP classification</b>	L7
<b>pH range</b>	2 - 8		

## Key features/benefits

- Outstanding reproducibility
- Highly pure, high surface area silica
- Less hydrophobic than C18
- Double endcapped for extra surface coverage
- Highly inert towards basic compounds
- Rigorously tested to ensure quality

Synchronis C8 columns are less hydrophobic than the C18 and are therefore particularly useful where the lesser degree of hydrophobicity is needed in order to successfully retain compounds of interest. Synchronis C8 columns can also be used where it is desirable to elute compounds more quickly.

## Application: Fenoprofen (USP)



Column: Synchronis C8, 5 µm, 150 mm x 4.6 mm

Mobile phase:	Acetonitrile:Water: Phosphoric Acid (50:49.6:0.4)
Flow rate:	2.0 mL/min
Temperature:	30 °C
Detection:	272 nm
Injection volume:	20 µL

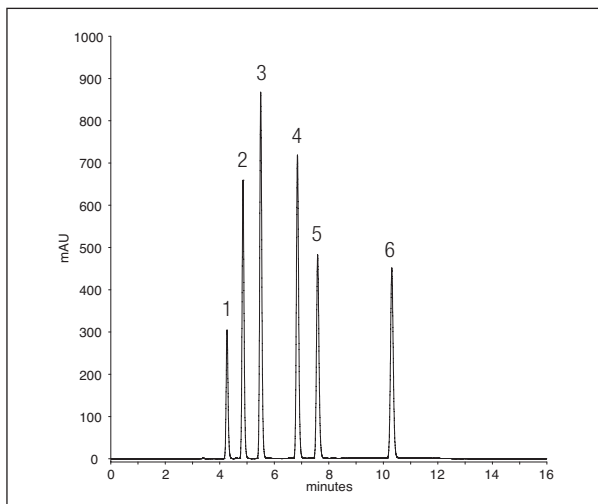
1. Fenoprofen
2. Gemfibrozil

Parameter	USP Specification	Measured Fenoprofen (5 replicate injections)	Measured Gemfibrozil (5 replicate injections)
Resolution	> 8	—	17.6
Relative retention time	~ 0.5	0.48	—
Efficiency (N)	> 3000	9812	10254
Tailing factor	< 2	1.21	1.22
%RSD Retention time	< 2 %	0.13 %	0.14 %
%RSD Peak area	< 2 %	1.6 %	1.8 %

# Thermo Scientific

## Synchronis C8

### Application: Uron Herbicides



Column: Synchronis C8, 5 µm, 150 mm x 4.6 mm

Mobile phase:	A: Water B: Acetonitrile
Gradient:	35 to 60 % B in 10 minutes
Flow rate:	1.0 mL/min
Temperature:	30 °C
Detection:	240 nm
Injection volume.:	20 µL

1. Tebuthiuron
2. Metoxuron
3. Monuron
4. Chlorotoluron
5. Diuron
6. Linuron

Herbicide	RT (%RSD) (6 replicate injections)	Peak Area (%RSD) (6 replicate injections)	Peak Asymmetry
1 - Tebuthiuron	0.31	0.95	1.17
2 - Metoxuron	0.25	0.64	1.18
3 - Monuron	0.18	0.20	1.16
4 - Chlorotoluron	0.12	0.55	1.15
5 - Diuron	0.10	0.37	1.19
6 - Linuron	0.05	0.65	1.13

### Ordering Information

Description	Particle size	Length (mm)	2.1 mm ID	3.0 mm ID	4.0 mm ID	4.6 mm ID
Synchronis C8	1.7 µm	30	97202-032130	—	—	—
		50	97202-052130	97202-053030	—	97202-054630
		100	97202-102130	97202-103030	—	—
	5 µm	30	97205-032130	97205-033030	97205-034030	97205-034630
		50	97205-052130	97205-053030	97205-054030	97205-054630
		100	97205-102130	97205-103030	97205-104030	97205-104630
Drop-in guard cartridges (4/pk)	5 µm	150	97205-152130	97205-153030	97205-154030	97205-154630
		250	97205-252130	97205-253030	97205-254030	97205-254630
		10	97205-012101	97205-013001	97205-014001	—

# Thermo Scientific Synchronis aQ

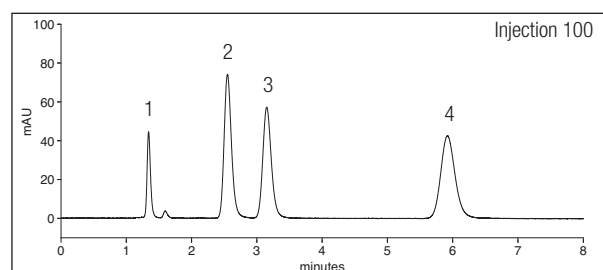
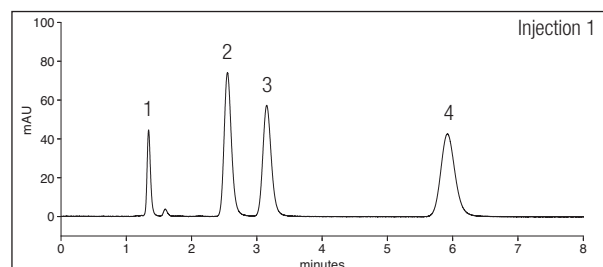
## Specifications

Particle size	1.7 µm, 5 µm	Carbon load	19 %
Pore size	100 Å	Endcapped	Polar
Surface area	320 m <sup>2</sup> /g	USP classification	L1
pH range	2 - 8		

### Key features/benefits

- Stability in 100 % aqueous mobile phase
- Outstanding reproducibility
- Highly pure, high surface area silica
- Highly inert towards basic compounds
- Rigorously tested to ensure quality

### Stability in 100% aqueous mobile phase

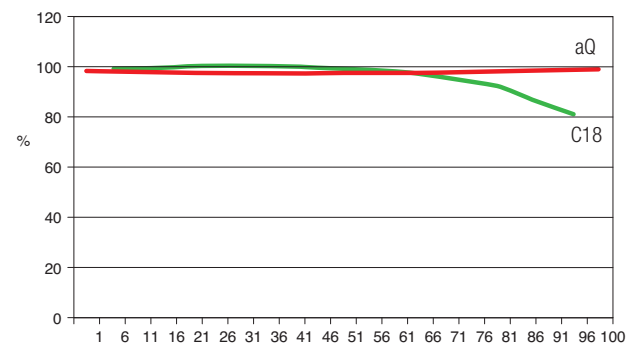


Column: Synchronis aQ, 5 µm, 100 mm x 4.6 mm

Mobile phase:	50 mM Aqueous K <sub>2</sub> HPO <sub>4</sub> (pH 6)
Flow rate:	0.7 mL/min
Temperature:	30 °C
Detection:	260 nm
Injection volume:	2 µL

1. Cytidine-5'-diphosphate
2. Adenosine-5'-triphosphate
3. Adenosine-5'-diphosphate
4. Adenosine-5'-monophosphate

In comparison to a conventionally endcapped C18, the Synchronis aQ polar end-capped C18 stationary phase exhibits superior stability towards aqueous mobile phase. Synchronis aQ shows no degradation in performance after 100 injections in a buffered 100 % aqueous eluent.



In contrast, the performance of the C18 packing begins to deteriorate appreciably after roughly 50-60 replicate injections of the mixture of analytes. The decline in chromatographic performance is more pronounced for the later-eluting compounds. As shown on the left, there is a 20 % decrease in retention time for adenosine monophosphate on the C18 column.

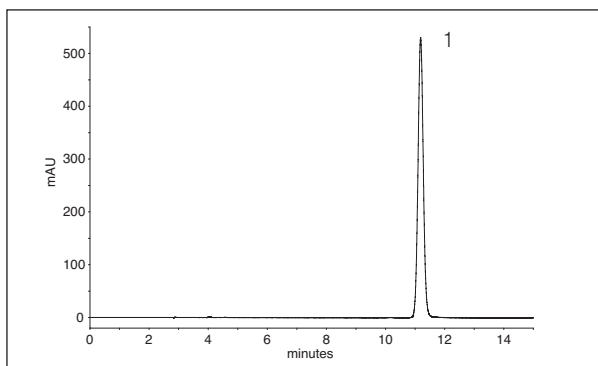
Stability of Synchronis aQ in 100 % aqueous mobile phase

Comparison of relative retention time for 5-AMP on Synchronis aQ and C18 over 100 injections

# Thermo Scientific

## Synchronis aQ

### Application: Lamivudine (USP)



Column: Synchronis aQ, 5 µm, 250 mm x 4.6 mm

Mobile phase: 25 mM, NH<sub>4</sub>OAc (pH = 3.81):  
MeOH (95:5)

Flow rate: 1.0 mL/min

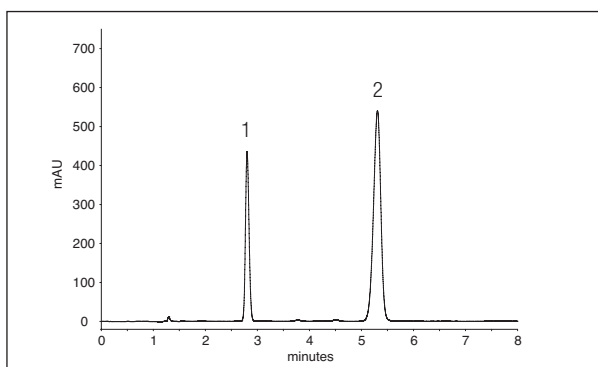
Temperature: 35 °C

Detection: 277 nm

Injection volume: 10 µL

1. Lamivudine

### Application: Amoxicillin and Potassium Clavulanate (USP)



Column: Synchronis aQ, 5 µm, 300 mm x 4.0 mm

Mobile phase: Phosphate Buffer (pH 4.4):  
MeOH (95:5)

Flow rate: 2.0 mL/min

Temperature: 25 °C

Detection: 210 nm

Injection volume: 20 µL

1. Amoxicillin  
2. Potassium Clavulanate

Parameter	USP Specification	Measured Amoxicillin (6 replicate injections)	Measured K Clavulanate (6 replicate injections)
Resolution	> 3.5	—	12.8
Efficiency (N)	> 550	7598	6475
Tailing factor	< 1.5	1.15	0.92
%RSD Retention time	< 2 %	0.29 %	0.36 %
%RSD Peak area	< 2 %	0.30 %	0.29 %

### Ordering Information

Description	Particle size	Length (mm)	2.1 mm ID	3.0 mm ID	4.0 mm ID	4.6 mm ID
Synchronis aQ	1.7 µm	30	97302-032130	—	—	—
		50	97302-052130	97302-053030	—	97302-054630
		100	97302-102130	97302-103030	—	—
	5 µm	30	97305-032130	97305-033030	97305-034030	97305-034630
		50	97305-052130	97305-053030	97305-054030	97305-054630
		100	97305-102130	97305-103030	97305-104030	97305-104630
Drop-in guard cartridges (4/pk)	5 µm	150	97305-152130	97305-153030	97305-154030	97305-154630
		250	97305-252130	97305-253030	97305-254030	97305-254630
		10	97305-012101	97305-013001	97305-014001	—

# Thermo Scientific

## Synchronis Phenyl

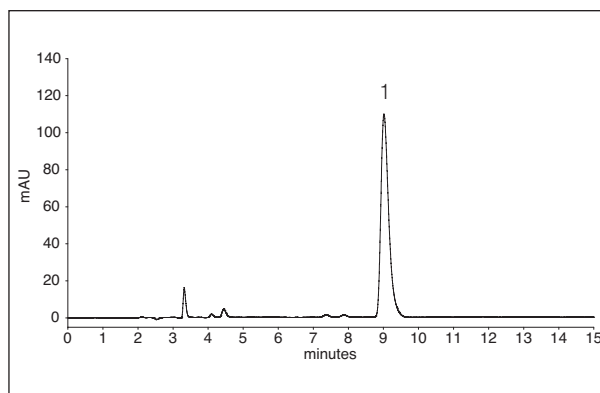
### Specifications

Particle size	1.7 µm, 5 µm	Carbon load	11 %
Pore size	100 Å	Endcapped	Yes
Surface area	320 m <sup>2</sup> /g	USP classification	L11
pH range	2 - 8		

### Key features/benefits

- Outstanding reproducibility
- Highly pure, high surface area silica
- Alternative selectivity to C18
- Double endcapped for extra surface coverage
- Highly inert towards basic compounds
- Rigorously tested to ensure quality

### Application: Oxacillin Sodium (USP)



Column: Synchronis Phenyl, 5 µm, 300 mm x 4.0 mm

Mobile phase:	Phosphate Buffer: MeCN:MeOH (70:30:10)
Flow rate:	1.0 mL/min (2 mL/min in USP method)
Temperature:	25 °C
Detection:	225 nm
Injection volume:	10 µL

1. Oxacillin Sodium (0.11 mg/mL)

Parameter	USP Specification	Measured (6 replicate injections)
Efficiency (N)	> 2000	7904
Tailing factor	< 1.6	1.42
%RSD Retention time	< 2 %	0.03 %
%RSD Peak area	< 2 %	0.29 %

### Ordering Information

Description	Particle size	Length (mm)	2.1 mm ID	3.0 mm ID	4.0 mm ID	4.6 mm ID
Synchronis Phenyl	1.7 µm	30	97902-032130	—	—	—
		50	97902-052130	97902-053030	—	97902-054630
		100	97902-102130	97902-103030	—	—
	5 µm	30	97905-032130	97905-033030	97905-034030	97905-034630
		50	97905-052130	97905-053030	97905-054030	97905-054630
		100	97905-102130	97905-103030	97905-104030	97905-104630
	5 µm	150	97905-152130	97905-153030	97905-154030	97905-154630
		250	97905-252130	97905-253030	97905-254030	97905-254630
		10	97905-012101	97905-013001	97905-014001	—
Drop-in guard cartridges (4/pk)	5 µm	10	97905-012101	97905-013001	97905-014001	—

# Thermo Scientific Synchronis Amino

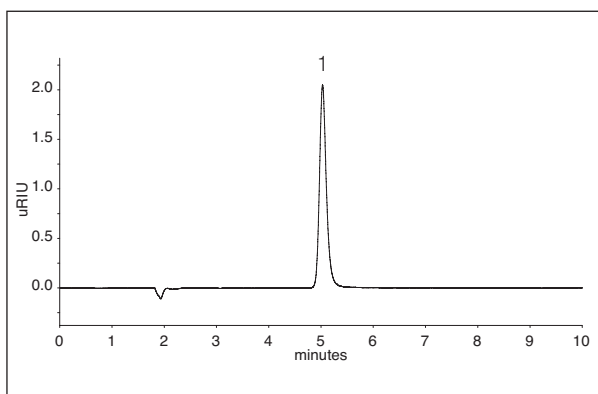
## Specifications

<b>Particle size</b>	1.7 µm, 5 µm	<b>Carbon load</b>	4 %
<b>Pore size</b>	100 Å	<b>Endcapped</b>	Yes
<b>Surface area</b>	320 m <sup>2</sup> /g	<b>USP classification</b>	L8
<b>pH range</b>	2 - 8		

## Key features/benefits

- Outstanding reproducibility for reversed phase, normal phase, ion exchange and HILIC
- Highly pure, high surface area silica
- Alternative selectivity to C18
- Double endcapped for extra surface coverage
- Rigorously tested to ensure quality

## Application: Lactulose



Column: Synchronis Amino 5 µm, 150 mm x 4.6 mm

Mobile phase: Water: MeCN (30:70)  
Flow rate: 1.0 mL/min  
Temperature: 35 °C  
Detection: RI  
Injection volume: 5 µL

1. Lactulose

Ordering Information

Description	Particle size	Length (mm)	2.1 mm ID	3.0 mm ID	4.0 mm ID	4.6 mm ID
Synchronis Amino	1.7 µm	30	97702-032130	—	—	—
		50	97702-052130	97702-053030	—	97702-054630
		100	97702-102130	97702-103030	—	—
	5 µm	30	97705-032130	97705-033030	97705-034030	97705-034630
		50	97705-052130	97705-053030	97705-054030	97705-054630
		100	97705-102130	97705-103030	97705-104030	97705-104630
		150	97705-152130	97705-153030	97705-154030	97705-154630
		250	97705-252130	97705-253030	97705-254030	97705-254630
Drop-in guard cartridges (4/pk)	5 µm	10	97705-012101	97705-013001	97705-014001	—



# Thermo Scientific

## Synchronis Silica

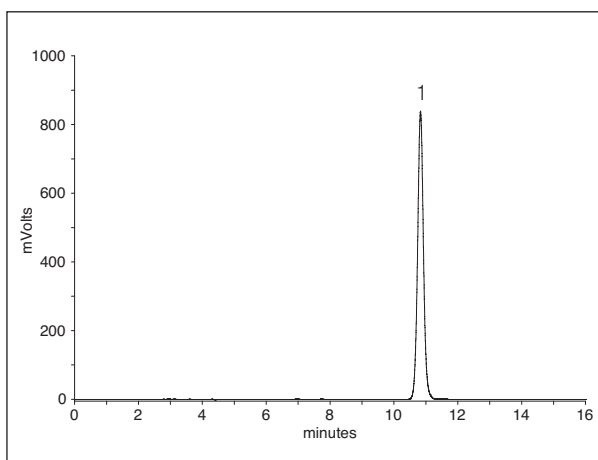
### Specifications

Particle size	1.7 µm, 5 µm	Carbon load	–
Pore size	100 Å	Endcapped	–
Surface area	320 m <sup>2</sup> /g	USP classification	L3
pH range	2 - 8		

### Key features/benefits

- Highly pure, high surface area silica
- Excellent reproducibility for normal phase chromatography
- Rigorously tested to ensure quality

### Application: Cetirizine (USP)



Column: Synchronis Silica, 5 µm, 250 mm x 4.6 mm

Mobile phase: Acetonitrile:Water:Sulfuric Acid  
(93:6.6:0.4)

Flow rate: 1.0 mL/min

Temperature: 30 °C

Detection: 230 nm

Injection volume: 10 µL

1. Cetirizine

Parameter	USP Specification	Measured (6 replicate injections)
Tailing factor	< 2.0	1.05
%RSD Peak area	< 2 %	0.17 %

### Ordering Information

Description	Particle size	Length (mm)	2.1 mm ID	3.0 mm ID	4.0 mm ID	4.6 mm ID
Synchronis Silica	1.7 µm	30	97002-032130	—	—	—
		50	97002-052130	97002-053030	—	97002-054630
		100	97002-102130	97002-103030	—	—
	5 µm	30	97005-032130	97005-033030	97005-034030	97005-034630
		50	97005-052130	97005-053030	97005-054030	97005-054630
		100	97005-102130	97005-103030	97005-104030	97005-104630
		150	97005-152130	97005-153030	97005-154030	97005-154630
		250	97005-252130	97005-253030	97005-254030	97005-254630
Drop-in guard cartridges (4/pk)	5 µm	10	97005-012101	97005-013001	97005-014001	—

# Thermo Scientific Synchronis HILIC

## Specifications

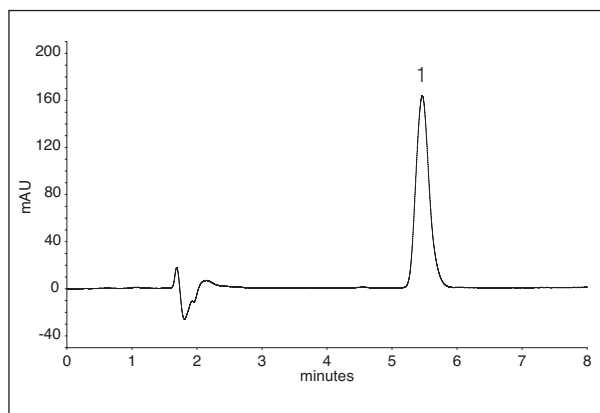
Particle size	5 µm	Carbon load	5 %
Pore size	100 Å	Endcapped	–
Surface area	320 m <sup>2</sup> /g	USP classification	–
pH range	2 - 8		

## Key features/benefits

- Highly pure, high surface area silica
- Zwitterionic bonded phase
- Enhanced retention of polar and hydrophilic analytes
- Excellent reproducibility
- Rapid equilibration
- Rigorously tested to ensure quality

Synchronis HILIC is based on highly pure, high surface area silica particles. The zwitterionic modified stationary phase results in total charge equalisation and therefore a neutral (uncharged) but highly polar surface. Synchronis HILIC columns offer enhanced retention of polar and hydrophilic analytes.

## Application: Allantoin



Column: Synchronis HILIC, 5 µm, 100 mm x 4.6 mm

Mobile phase: Ammonium Formate Buffer (pH 3):  
MeCN (10:90)

Flow rate: 1.0 mL/min

Temperature: 30 °C

Detection: 210 nm

Injection volume: 10 µL

1. Allantoin

Description	Particle size	Length (mm)	2.1 mm ID	3.0 mm ID	4.0 mm ID	4.6 mm ID
Synchronis HILIC	1.7 µm	30	97502-032130	–	–	–
		50	97502-052130	97502-053030	–	97502-054630
		100	97502-102130	97502-103030	–	–
	5 µm	30	97505-032130	97505-033030	97505-034030	97505-034630
		50	97505-052130	97505-053030	97505-054030	97505-054630
		100	97505-102130	97505-103030	97505-104030	97505-104630
		150	97505-152130	97505-153030	97505-154030	97505-154630
Drop-in guard cartridges (4/pk)	5 µm	250	97505-252130	97505-253030	97505-254030	97505-254630
		10	97505-012101	97505-013001	97505-014001	–

Ordering Information

## 1.7 $\mu\text{m}$ Particles for UHPLC Applications

1.7  $\mu\text{m}$  particles give higher efficiency than 3  $\mu\text{m}$  or 5  $\mu\text{m}$  particles and this efficiency is delivered over a greater range of optimum linear velocity. This makes it possible to operate at higher flow rates without losing performance. Because shorter columns packed with 1.7  $\mu\text{m}$  particles give equivalent efficiency to longer columns packed with 5  $\mu\text{m}$  particles faster analysis and solvent savings for the chromatographer become a reality.

### Three Tips for Method Transfer

1. To maintain an equivalent separation when transferring a method it is important to keep the linear velocity constant between the original and new method.
2. Sub-2  $\mu\text{m}$ -based methods are most often transferred to smaller volume columns, so the same injection volume will take up a larger proportion of the new column, possibly leading to band broadening. It is therefore important to scale down the injection volume to match the change in column volume.
3. Geometrical transfer of the gradient requires calculation of the number of column volumes of mobile phase in each segment (time interval) of the gradient in the original method to ensure that the new calculated gradient takes place over the same number of column volumes, for the new column.

We also offer a convenient HPLC method transfer calculator at the Chromatography Resource Center  
[www.thermoscientific.com/crc](http://www.thermoscientific.com/crc)

### System Considerations

With 1.7  $\mu\text{m}$  particles, analyses can be performed with a high linear velocity through the column without loss in performance, provided the LC system is optimized to operate under these conditions. In order to produce fast, efficient chromatography, all system components for the assay should also be considered. Modern ultra high pressure liquid chromatography (UHPLC) instruments, including the Thermo Scientific Accela High Speed LC, will take account of these factors.

There are three major system considerations to remember when using short columns packed with 1.7  $\mu\text{m}$  particles.

1. The system volume (connecting tubing ID and length, injection volume, UV detector flow cell volume) must be minimized.
2. The detector time constant and sampling rate need to be carefully selected.
3. When running fast gradients pump delay volume needs to be minimal.



# Resources

## for Chromatographers

Available now, the Thermo Scientific Chromatography Columns and Consumables 2012/2013 catalog. Beyond this catalog, our Chromatography team shares its extensive expertise through our web-based Chromatography Resource Center and the Separated by Experience e-newsletter.

The Chromatography Resource Center, accessed at [www.thermoscientific.com/crc](http://www.thermoscientific.com/crc) provides technical support, applications, technical tips and literature to help you move your separations forward, quickly and easily.

The bi-monthly Separated by Experience e-newsletter keeps you up-to-date on the latest technical and product information of interest to chromatographers. Valuable information developed by chromatographers for chromatographers.

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**USA and Canada** +1 800 332 3331  
**France** +33 (0)1 60 92 48 34  
**Germany** +49 (0) 2423 9431 20 or 21  
**United Kingdom** +44 (0)1928 534110  
**Japan** +81 3 5826 1615

**China** +86 21 68654588 +86 10 84193588  
**+86 20 83145199 800 810 5118**  
**India** +91 22 6742 9494  
**Australia** 1 300 735 292 (free call domestic)  
**New Zealand** 0800 933 966 (free call domestic)  
**All Other Enquiries** +44 (0) 1928 534 050

**Technical Support**  
**North America** +1 800 332 3331  
**Outside North America** +44 (0) 1928 534 440

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