Technical Guide

Thermo Scientific Syncronis HPLC Columns

Consistent, predictable separations,
Column after column, time after time

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

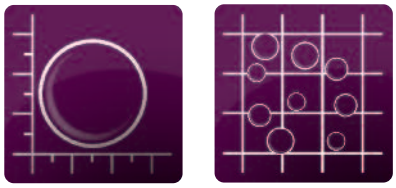
Testing and Quality Control

Thermo Scientific Syncronis Stationary Phases

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 Syncronis 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 Syncronis silica is tested for its particle size and distribution using a laser particle size analyser. Two particle sizes are available: 1.7 µm for rapid UHPLC separations and 5 µm 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 Syncronis silica is tested for its pore size and surface area using liquid nitrogen adsorption.

Syncronis columns are based on highly pure 100 Å silica, with a surface area of 320m^2/g, compared to 200m^2/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 Syncronis 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

Syncronis 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 Syncronis chromatographic media is tested for carbon load and characterised by stringent chromatographic testing before it is used to pack columns.

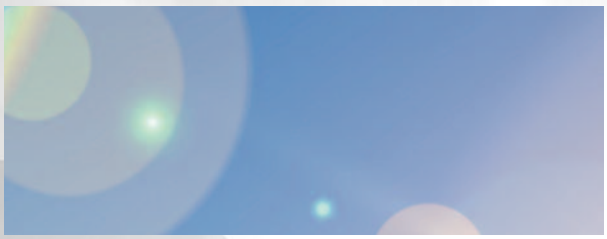
Carbon loading and surface coverage

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. Syncronis 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 Syncronis columns is extensively characterized using a series of diagnostic chromatographic tests, based on those developed by Tanaka[1]. These tests rigorously probe interactions between analytes and stationary phase, measuring hydrophobicity, shape selectivity and secondary interactions with bases, acids and chelators.

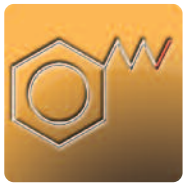


Test 1: Hydrophobic Interactions

Hydrophobic Retention

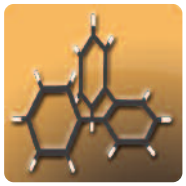
The first hydrophobic interaction that is measured is Hydrophobic Retention (HR). The capacity factor of a neutral, hydrophobic hydrocarbon (pentylbenzene) gives a measure of the hydrophobicity of the stationary phase and therefore a measure of the carbon load on the silica.

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.

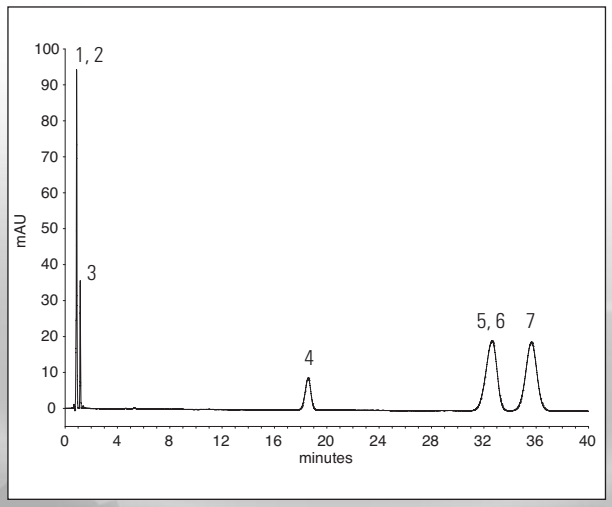
Steric Selectivity



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.



Example chromatogram for Test 1: Hydrophobic Interactions

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

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. Caffiene
3. Phenol
4. Butylbenzene
5. o-Terphenyl
6. Pentylbenzene
7. Triphenylene

Test 2: Interactions with Basic and Chelating Compounds

Activity towards basic compound

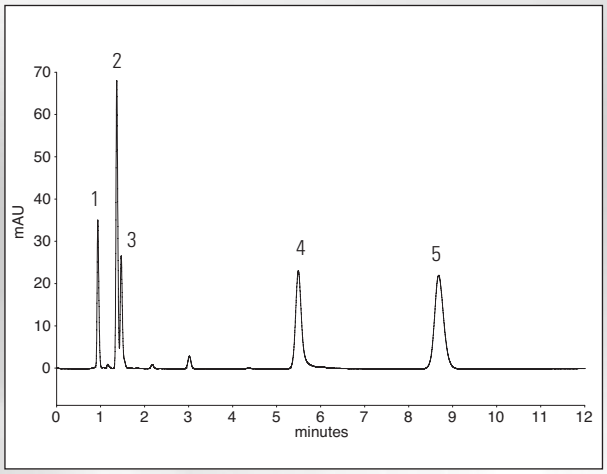
The presence of dissociated silanols at pH>7 can cause poor peak shapes of protonated basic compounds, such as amitriptyline. Secondary ion exchange and silanolic interactions can cause shifts in retention and asymmetrical peaks. The capacity factor and tailing factor of amitriptyline are indicative of the overall performance of the column. Syncronis 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 Syncronis 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 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: Syncronis C18, 5µm, 100mm x 4.6mm

Mobile phase:	10mM Phosphate (pH 7.6): Methanol (20:80)
Flow rate:	1.0 mL/min
Temperature:	40°C
Detection:	254 nm
Injection volume:	5 µL

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

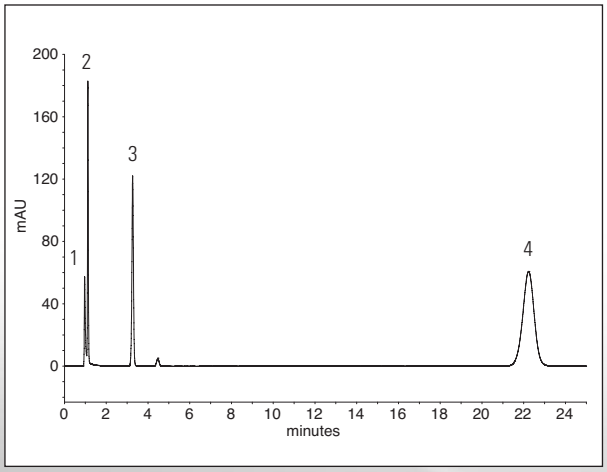
Test 3: Interactions with Acidic Compounds

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. Syncronis columns exhibit excellent peak shape, indicating a high degree of inertness towards acidic compounds.

Ion exchange capacity at pH 2.7 (IEC2)

Tanaka[1] 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^-) 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

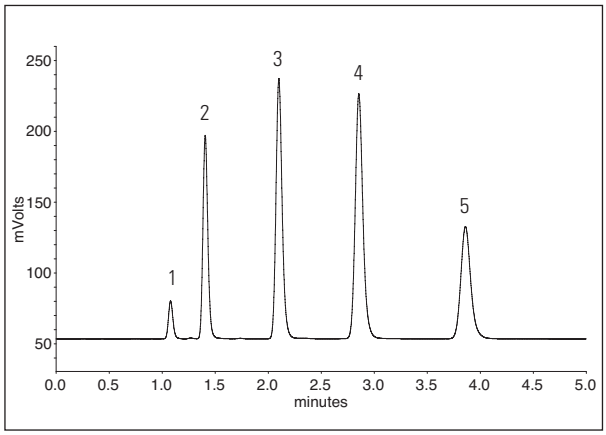
Column: Syncronis C18, 5µm, 100mm x 4.6mm

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

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

Test 4: Normal Phase

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



Column: Syncronis Silica, 5µm, 150mm x 4.0mm

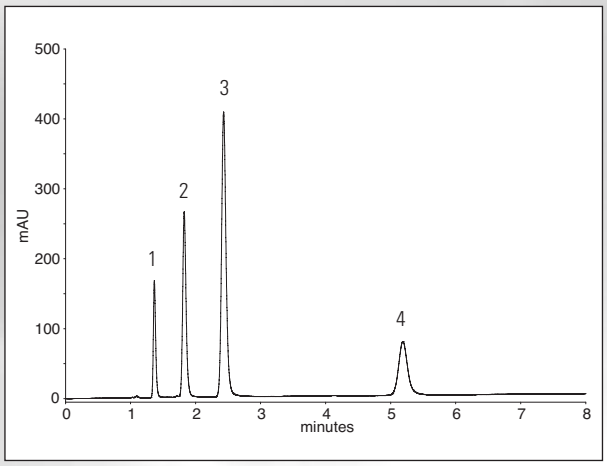
Mobile phase:	Iso-octane:Ethanol: Water (85:14.7:0.3)
Flow rate:	1.25 mL/min
Temperature:	40°C
Detection:	254 nm
Injection volume:	2 µL

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

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



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

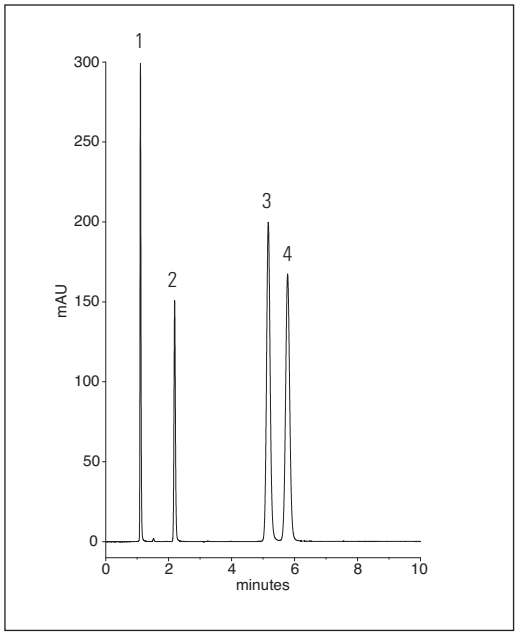
Mobile phase:	50 mM Phosphate (pH 3.0)
Flow rate:	1.0 mL/min
Temperature:	40°C
Detection:	254 nm
Injection volume:	10 µL

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

Example chromatogram for Test 5: Ion exchange retention and selectivity

Test 6: HILIC Retention and Selectivity

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



Column: Syncronis HILIC, 5µm, 150mm x 4.6mm

Mobile phase:	100mM Acetate (pH 5): Acetonitrile (10:90)
Flow rate:	1.0 mL/min
Temperature:	40°C
Detection:	254 nm
Injection volume:	10 µL

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

Example chromatogram for Test 6: HILIC retention and selectivity

Column Packing

Every Syncronis 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 Syncronis 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.

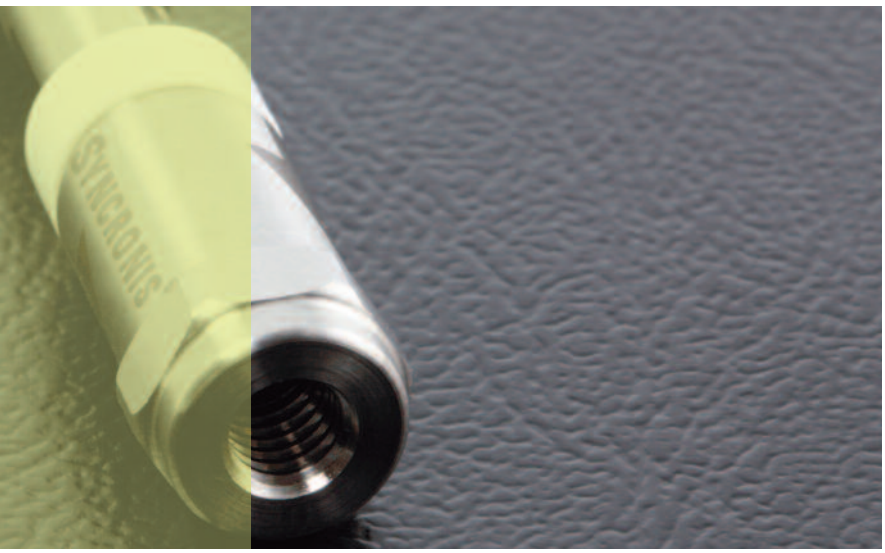
Summary of Tests Performed on Thermo Scientific Syncronis Columns

	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 Syncronis C18

Specifications

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

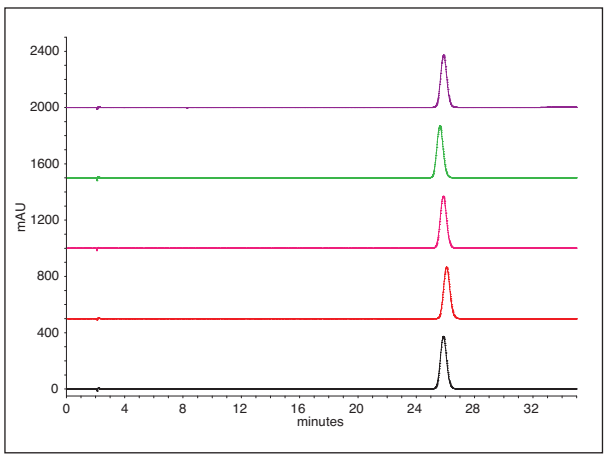


Key features/benefits

- 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.



Syncronis C18 columns show excellent column to column reproducibility

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

Mobile phase:	Water: Methanol (4:1)
Flow rate:	1.0 mL min^{-1}
Temperature:	25°C
Detection:	265 nm
Injection volume:	10 µL

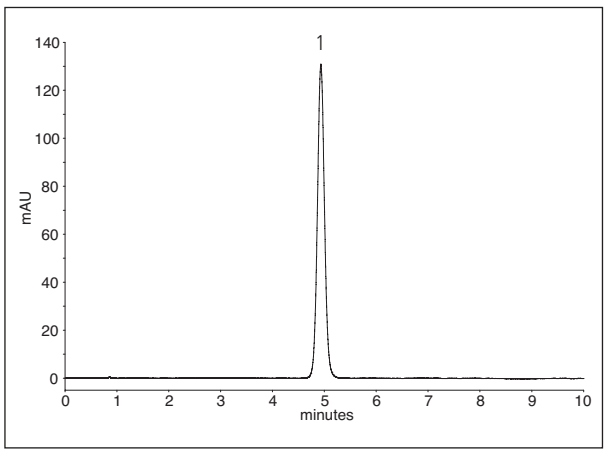
1. Zidovudine

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

Syncronis 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)



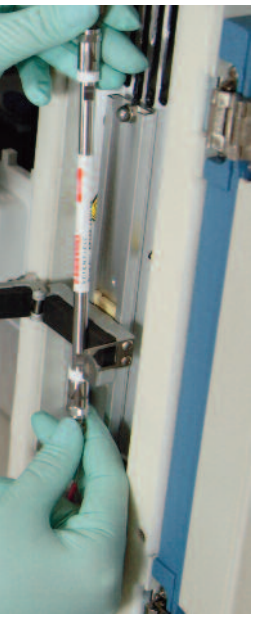
Column: Syncronis C18, 5µm, 100mm x 4.6mm

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

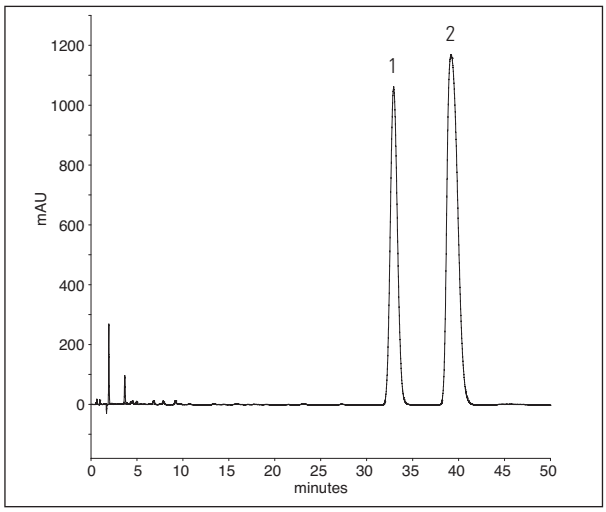
1. Chloramphenicol

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 Syncronis C18



Application: Ibuprofen and Valerophenone (USP)



Column: Syncronis C18, 5µm, 150mm x 4.0mm

Mobile phase:	Water Phosphoric Acid (pH2.5): Acetonitrile (66.3:33.7)
Flow rate:	2.0 mL/min
Temperature:	30°C
Detection:	214 nm
Injection volume:	5 µL

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 mm ID	4 mm ID	4.6 mm ID
Syncronis C18	1.7 µm	30	97102-032130	–	–	–
		50	97102-052130	97102-053030	–	97102-054630
		100	97102-102130	97102-103030	–	–
	5 µm	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
		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 µm	10	97105-012101	97105-013001	97105-014001	–

Thermo Scientific Syncronis C8

Specifications

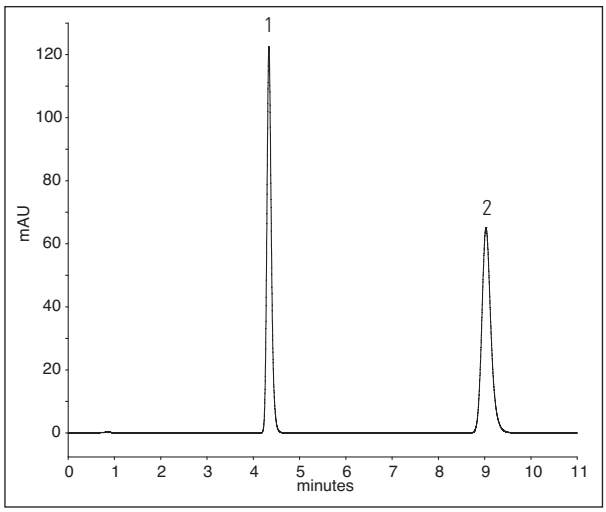
Particle size	1.7 µm, 5 µm	**Carbon load**	10 %
Pore size	100 Å	**Endcapped**	Y
Surface area	320 m²/g	**USP classification**	L7
pH range	2 - 8		

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

Syncronis 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. Syncronis C8 columns can also be used where it is desirable to elute compounds more quickly.

Application: Fenoprofen (USP)



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

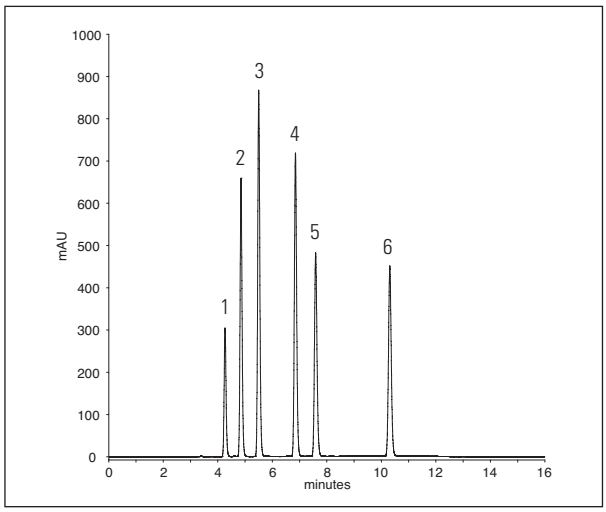
Mobile phase:	Acetonitrile:Water: Phosphoric Acid (50:49.6:0.4)
Flow rate:	2.0 mL/min
Temperature:	30°C
Detection:	272 nm
Injection volume:	20 µL

1. Fenoprofen
2. Gemfibrozil

Parameter	USP Specification	Measured Fenoprofen (5 replicate injections)	Measured Gemfibrizol (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 Syncronis C8

Application: Uron Herbicides



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

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 mm ID	4 mm ID	4.6 mm ID
Syncronis 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
		150	97205-152130	97205-153030	97205-154030	97205-154630
		250	97205-252130	97205-253030	97205-254030	97205-254630
Drop-in guard cartridges (4/pk)	5 µm	10	97205-012101	97205-013001	97205-014001	–

Thermo Scientific Syncronis aQ

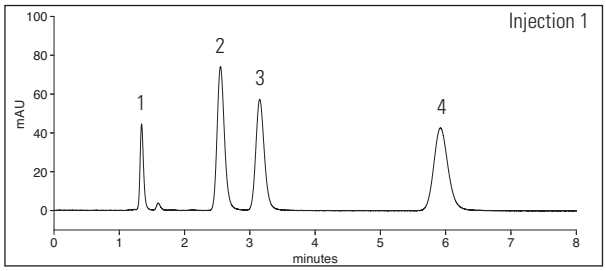
Specifications

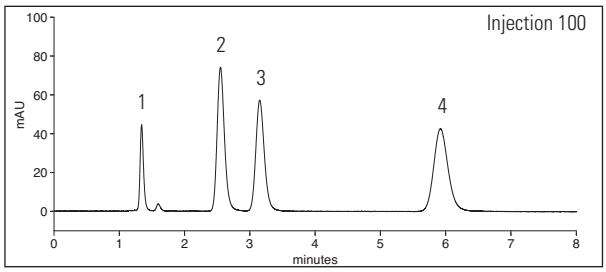
Particle size	1.7 µm, 5 µm	**Carbon load**	19 %
Pore size	100 Å	**Endcapped**	Polar
Surface area	320 m^2/g	**USP classification**	L1
pH range	2 - 8		

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





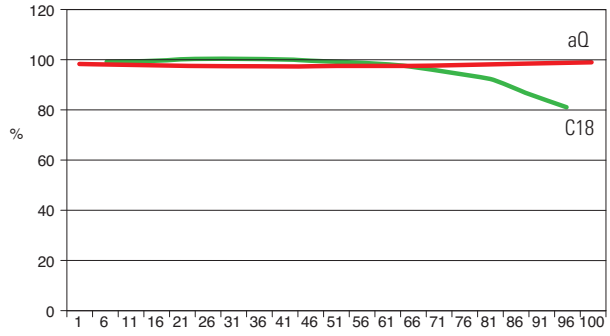
Stability of Syncronis aQ in 100% aqueous mobile phase

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

Mobile phase:	50mM Aqueous K_2HPO_4 (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 Syncronis aQ polar end-capped C18 stationary phase exhibits superior stability towards aqueous mobile phase. Syncronis aQ shows no degradation in performance after 100 injections in a buffered 100% aqueous eluent.

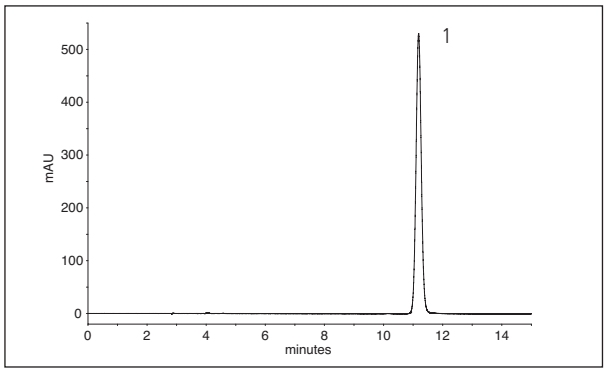


Comparison of relative retention time for 5-AMP on Syncronis aQ and C18 over 100 injections

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.

Thermo Scientific Syncronis aQ

Application: Lamivudine (USP)

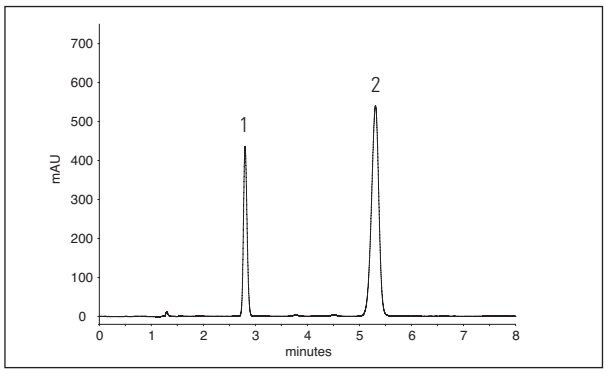


Column: Syncronis aQ, 5µm, 250mm x 4.6mm

Mobile phase:	25 mM, NH_4OAc (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: Syncronis aQ, 5µm, 300mm x 4.0mm

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 mm ID	4 mm ID	4.6 mm ID
Syncronis 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
		150	97305-152130	97305-153030	97305-154030	97305-154630
		250	97305-252130	97305-253030	97305-254030	97305-254630
Drop-in guard cartridges (4/pk)	5 µm	10	97305-012101	97305-013001	97305-014001	–

Thermo Scientific Syncronis Phenyl

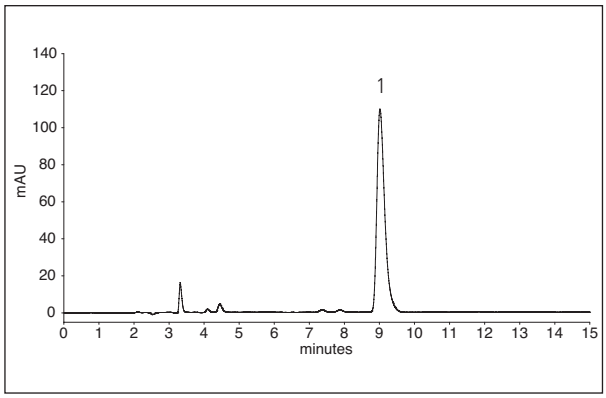
Specifications

Particle size	1.7 µm, 5 µm	**Carbon load**	11 %
Pore size	100 Å	**Endcapped**	Yes
Surface area	320 m^2/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: Syncronis Phenyl, 5µm, 300mm x 4.0mm

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 (0.11mg/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 mm ID	4 mm ID	4.6 mm ID
Syncronis 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
		150	97905-152130	97905-153030	97905-154030	97905-154630
		250	97905-252130	97905-253030	97905-254030	97905-254630
Drop-in guard cartridges (4/pk)	5 µm	10	97905-012101	97905-013001	97905-014001	–

Thermo Scientific Syncronis Amino

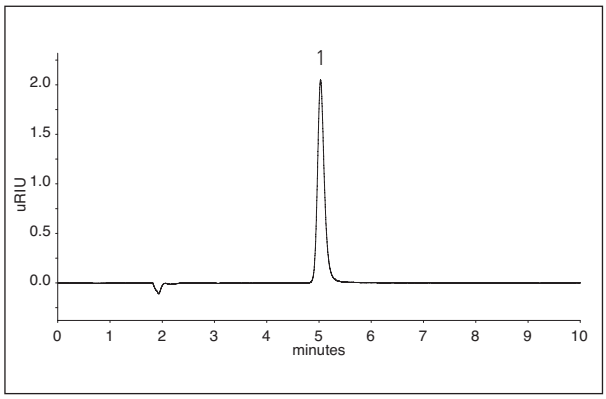
Specifications

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

Key features/benefits

- Outstanding reproducibility for reversed phase, normal phase, ion exhange 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: Syncronis Amino 5µm, 150mm x 4.6mm

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 mm ID	4 mm ID	4.6 mm ID
Syncronis 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 Syncronis Silica

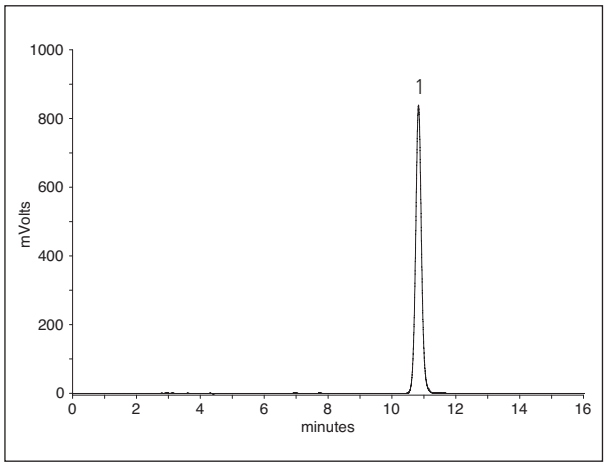
Specifications

Particle size	1.7 µm, 5 µm	**Carbon load**	–
Pore size	100 Å	**Endcapped**	–
Surface area	320 m^2/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: Syncronis Silica, 5µm, 250mm x 4.6mm

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 mm ID	4 mm ID	4.6 mm ID
Syncronis 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 Syncronis HILIC

Specifications

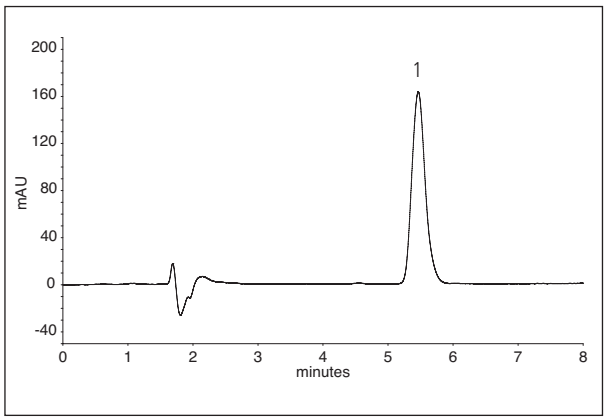
Particle size	5 µm	**Carbon load**	5%
Pore size	100 Å	**Endcapped**	–
Surface area	320 m^2/g	**USP classification**	–
pH range	2 - 8		

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

Syncronis 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. Syncronis HILIC columns offer enhanced retention of polar and hydrophilic analytes.

Application: Allantoin



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

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

Ordering Information

Description	Particle size	Length (mm)	2.1 mm ID	3 mm ID	4 mm ID	4.6 mm ID
Syncronis HILIC	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
		250	97505-252130	97505-253030	97505-254030	97505-254630
Drop-in guard cartridges (4/pk)	5 µm	10	97505-012101	97505-013001	97505-014001	–

1.7 µm Particles for UHPLC Applications

1.7 µm particles give higher efficiency than 3µm or 5µm 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 1.7µm particles give equivalent efficiency to longer columns packed with 5 µm 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-2µm-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/chromatography

System Considerations

With 1.7µm 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 1.7µm 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 2010/2011 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/chromatography** 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. Subscribe today at **www.thermoscientific.com/chromatography**

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AUTHORIZED DISTRIBUTOR

MZ-Analysentechnik GmbH, Barcelona-Allee 17 • D-55129 Mainz
Tel +49 6131 880 96-0, Fax +49 6131 880 96-20
e-mail: info@mz-at.de, www.mz-at.de

For more information, visit the **Chromatography Resource Center** at **www.thermoscientific.com/chromatography**

BRCCSSYNCRONIS 0810

USA and Canada +1 800 332 3331
France +33 (0) 3 88 67 53 20
Germany +49 6103 408 0
Switzerland +41 56 618 41 11
United Kingdom +44 (0) 1928 534 110
Japan +81 45 453 9220
China +86-21-68654588 or +86-10-84193588
India 1800 22 8374 (toll-free)
+91 22 6716 2200
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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