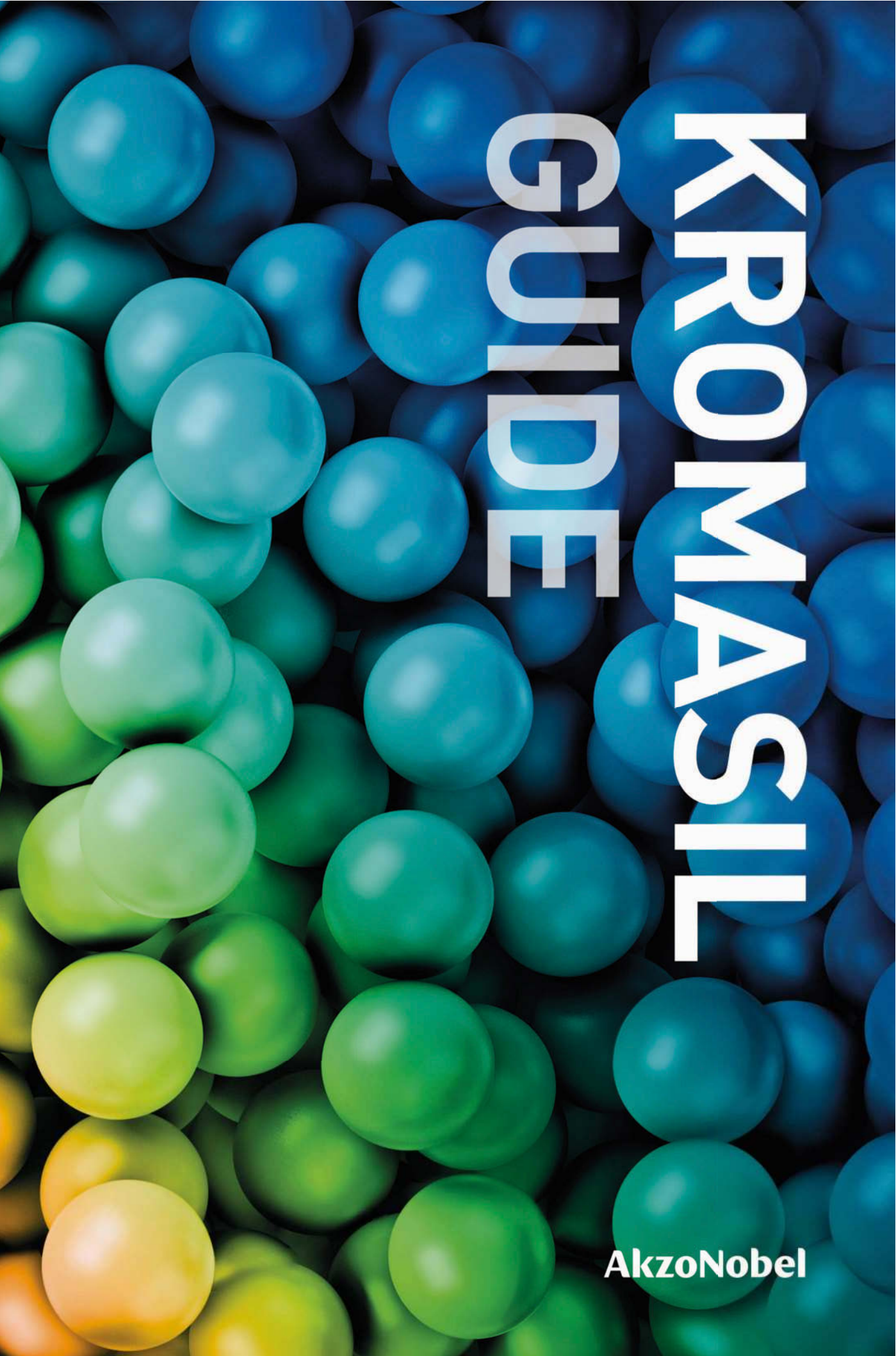
KROMASIL
GUIDE
AkzoNobel

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KROMASIL®

AkzoNobel offers Kromasil high-performance chromatographic media based on state-of-the-art spherical silica for analytical and industrial HPLC, SFC and SMB applications. Products are available in slurry-packed columns and in bulk to fulfill laboratory and production requirements.

When the first Kromasil silica-based packing materials were introduced in 1988, they greatly improved the effectiveness of liquid chromatography. What made the new packing material so unique was the combination of high pore volume and surface area, together with excellent chemical and mechanical stability.

Today, AkzoNobel continues to be the world-class innovator delivering also new platforms in both slurry-packed columns as well as bulk material, pushing the technological boundaries to meet user requirements.

AkzoNobel produces Kromasil in Bohus, Sweden. The production plant is an ISO 9001 facility with a manufacturing permit for 25 tons of material per year.

About Kromasil®

Kromasil is a high performance chromatographic media based on state-of-the-art spherical silica for UHPLC, HPLC and SFC analysis as well as production scale HPLC, SFC and SMB applications. Excellent chemical and mechanical stability result in reliability, consistency and reproducibility and thereby peace of mind for those working in chromatography.

Chromatographic analysis and purifications are ubiquitous in the pharmaceutical, natural products and API manufacturing sectors. As Kromasil is shipped in a wide range of particle sizes and formats, organizations have recognized the value of using the Kromasil brand across entire project cycles from R&D with slurry-packed columns to production with the corresponding bulk product for cost-effective solutions.

Kromasil is produced by AkzoNobel. With more than 25 years experience of stationary phase of manufacturing and packing expertise, AkzoNobel delivers performance products to customers worldwide in the pharmaceutical, food and beverage, clinical and environmental industries.

AkzoNobel has its Kromasil production plant in Bohus Sweden. The manufacturing facility is fully back integrated with probably the largest capacity for producing high quality spherical chromatographic materials in the world. Furthermore, the plant is certified according to ISO 9001 and has a manufacturing permit for 25 tons of material. All products are developed in-house and manufactured to be the perfect choice from analytical to process scale chromatography.

Analysis

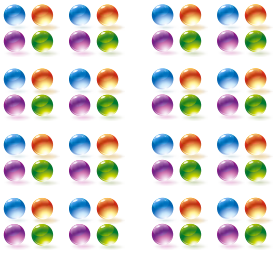
Scientists use UHPLC, HPLC and SFC columns for the separation and identification of substances in the laboratory. Challenge the selectivity of Kromasil for the most sensitive analysis.

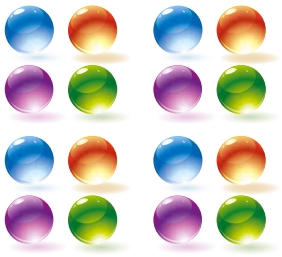
Development

When users need to quickly purify main compounds and remove impurities for further studies in the development of pharmaceuticals and natural products, Kromasil can help achieve isolation goals with ease and efficiency.

Pilot scale and production

Companies using preparative HPLC, SFC and SMB for high efficiency purification in a pilot and up to industrial-scale production can rely on Kromasil as it is available in ton quantities to meet process demands.





Discovery

Research & Development

Method validation

Characterization

Quality control

UHPLC/HPLC/SFC
Analytical columns

2.1-4.6 mm ID
1.8-5 µm particle size

Development

Impurity isolation

Small scale campaigns

Kilo labs

HPLC/SFC
Semiprep columns

10-50 mm ID
5-10 µm particle size

Production

Pilot plants

Manufacturing

HPLC/SFC/SMB
Bulk

10-25 µm particle size

THE KROMASIL PRODUCT PLATFORMS

Kromasil is a brand of totally spherical silica particles for high performance chromatography usage. Kromasil products are available as bare silica and with various surface modifications for normal phase, reversed phase, chiral and supercritical fluid chromatography applications.

KROMASIL
Classic

Platform based on first-in-class silica material. Designed for the whole range from analytical through development to production scale in normal and reversed phase.

KROMASIL
Eternity

Platform based on AkzoNobel's state-of-the-art grafting technology. Designed for reversed-phase separations in potentially harsh conditions.

KROMASIL
Chiral

Platform based on AkzoNobel in-house developed silica matrix coated with a functionalized amylose or cellulose selector. Designed for analytical and industrial chiral chromatography.

KROMASIL
SFC

Platform specific for SFC applications. Designed for users focused on green technologies.

Kromasil®
Classic™

KROMASIL
Classic

Beyond expectations

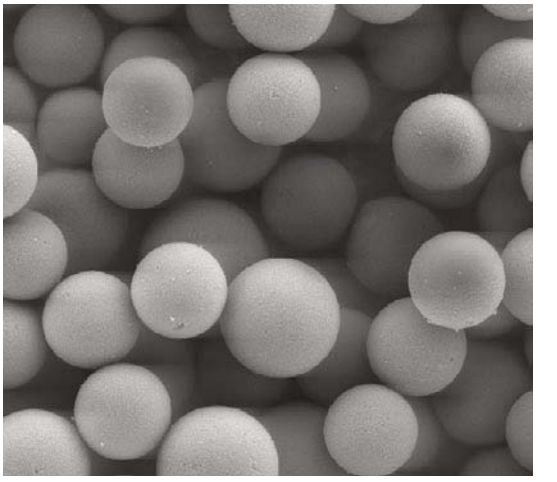
The perfectly shaped silica

The Kromasil Classic platform is based on perfectly spherical silica-based materials to improve efficiency and decrease costs in laboratory analysis and purification steps.

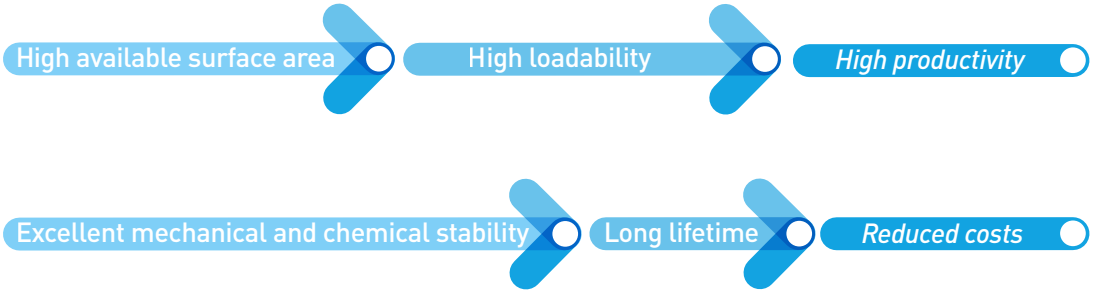
Separates most substances

Kromasil's combination of high pore volume and surface area, together with excellent mechanical and chemical stability, is unmatched for the separation of a wide variety of substances from small molecules to peptides and proteins. The pore structure is ideal for high loadability and long-term durability, making a difference in packing and performance that users have come to appreciate over time. This acceptance is valid across the wide spectrum of the Kromasil offering, from small particles packed in analytical 2.1 mm columns to larger particles packed in wide diameter columns for purifications using dynamic axial compression (DAC) equipment.

This FE-SEM image of Kromasil 100 Å 3.5 µm particles is an illustration the consistent quality manufacturing of Kromasil stationary phase.



Summary of benefits for the Classic platform



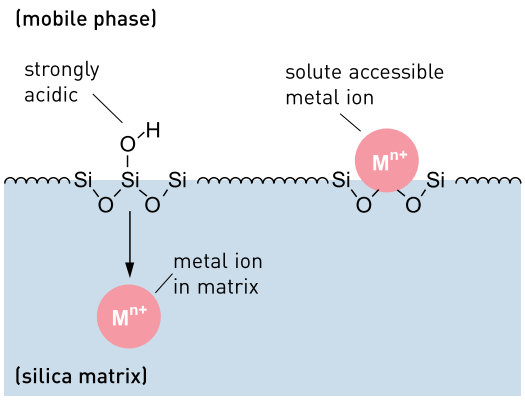
Surface properties

The Kromasil surface is topographically smooth and completely free from micro cavities. The surface silanol groups are evenly distributed and relatively neutral in their nature. These factors, combined with the high reproducibility of the Kromasil silica surface, are the foundation for a reproducible bonding process and derivatized product.

Metal impurities

Strongly bound metal ions present in the silica bulk and in the surface layers are in most cases an outcome of the silica manufacturing process. These metal ion species should be distinguished from adsorbed metal ion species, introduced in the final product due to use of metal ion containing solvents, chemicals etc.

It is often possible to remove adsorbed metal ion species during a regeneration process in contrast to the "built-in", strongly bound, metal ions, which are part of the final product. It is well known that strongly electronegative metal ions (e.g. bivalent iron and trivalent aluminum) in the silica matrix have the ability to enhance the acidity of silanols in their close proximity.



Increased acidity of silanols provides a higher possibility for ion-exchange interactions at any given pH. Moreover, metal ions present in the silica surface layer are able to interact directly with analytes that have Lewis-base properties.

The effect of metal ions in the silica matrix and in the silica surface layer.

The direct metal-analyte interaction is most pronounced for chelating substances, but it also affects the chromatographic behavior of acids, alcohols, and amines.

Kromasil uses a proprietary manufacturing process. The metal content in all reagents and raw materials is minimized due to a rigorous quality control procedure. The table shows information regarding the metal content in three typical batches.

	Batch no.			
Metal	15705	15046	17365	17892
Na	2.8	4.2	6.3	6.1
Al	<1	<1	<1	<1
Fe	1.1	<1	1.2	<1

Metal content in ppm in four batches of Kromasil. The metal content is measured by ICP-SFMS.

Derivatization of Kromasil silica

Even if many stationary phases are launched every year, the C18 phase is still the most popular phase on the analytical market. Extensive quality controls on every raw material together with several in process controls (IPC) throughout the Kromasil manufacturing process ensure a reproducible final quality of the derivatized phases of AkzoNobel.

The perfectly shaped silica (cont.)

Surface coverage

To ensure high chemical stability and excellent chromatographic performance, Kromasil is produced with an optimized bonding step for surface coverage. Kromasil RP products are manufactured by using monofunctional silanes. This together with the Kromasil silica gives outstanding batch-to-batch reproducibility and high chemical stability.

Hydrophobicity

The hydrophobicity of an RP-phase is related to the silica matrix, the silane used for modification, the surface coverage, and the surface distribution of functionalities. Generally, Kromasil RP-phases are considered to have high surface hydrophobicity.

This high hydrophobicity has two major advantages:

1. High surface hydrophobicity provides good separating power. The retention of analytes can then be adjusted by the mobile phase conditions, upon need.
2. High surface hydrophobicity provides good long-lasting performance, i.e. high chemical stability.

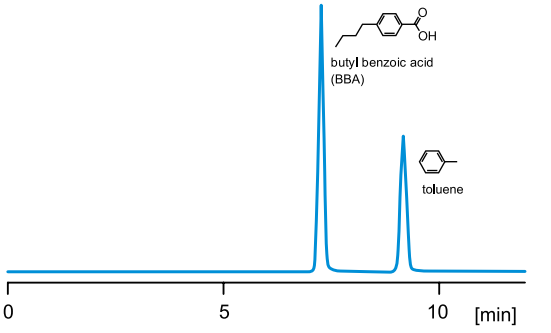
Endcapping

Endcapping is used to minimize undesired interactions between residual silanols and analytes. In the manufacturing process of Kromasil, a proprietary highly efficient technique is used to reduce these silanols.

Symmetrical peaks when using Kromasil

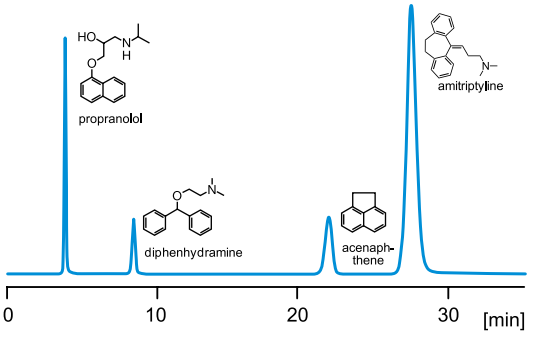
It is well known that residual silanol groups lead to severe peak tailing due to undesired interactions between the analyte and the stationary phase. Kromasil RP-phases show excellent peak shape for both acidic and basic compounds.

Separation of butyl benzoic acid and toluene



Conditions
Column: Kromasil 100-5-C18 4.6 x 250 mm
Part number: M05CLA25
Mobile phase: acetonitrile / 25 mM potassium phosphate, pH 3.2 (65/35)
Sample: Butyl benzoic acid and toluene
Flow rate: 1.0 ml/min
Temperature: 20°C
Detection: UV 254 nm

Separation of propranolol, diphenhydramine, acenaphthene and amitriptyline.



Conditions
Column: Kromasil 100-5-C18 4.6 x 250 mm
Part number: M05CLA25
Mobile phase: methanol / 20 mM potassium phosphate, pH 7.0 (65/35)
Sample: propranolol, diphenhydramine, acenaphthene, amitriptyline
Flow rate: 1.4 ml/min.
Temperature: 20°C
Detection: UV @ 240 nm

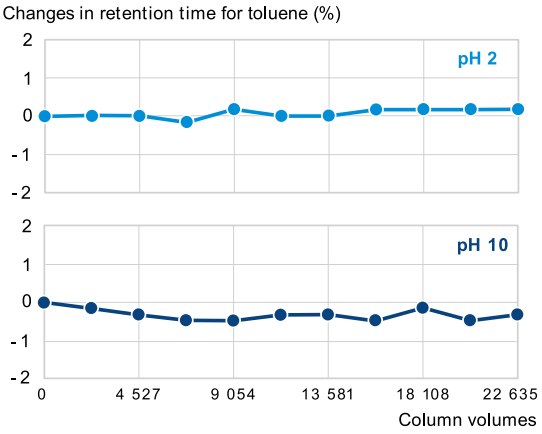
Chemical stability

Kromasil is well known for its high performance in both analytical and preparative chromatography. Mechanical and chemical stability are the cornerstones of Kromasil, as stability determines the lifetime of columns in analysis as well as the stationary phase in purification. In general, at a low pH, bonded phases can be hydrolyzed, resulting in a less hydrophobic surface. At a higher pH, the silica matrix itself can be dissolved, which means loss of both of both the silica and bonded phase.

Working with silica-based materials outside their optimum pH conditions can result in changed retention times and poor peak shape. However, for Kromasil it has been shown that the product responds well to long-term exposure to pH 2 and pH 10.

Kromasil Classic products are available packed in columns, from 2.1 mm ID up to 50 mm ID, and as bulk, from gram quantities up to several metric tons.

Long-term chemical stability – test under different pH conditions for a period of more than 22 000 column volumes.



Conditions
Column: Kromasil 100-5-C18 3.0 x 50 mm
Part number: M05CLC05
Mobile phase pH 2: acetonitrile / water / triflouroacetic acid (TFA) (50/50/0.1)
Mobile phase pH 10: acetonitrile / water / triethyl amine (TEA) (50/50/0.25)
Flow rate: 1.0 ml/min.
Temperature: 20°C
Column volumes: 22 635

With the Kromasil Classic range of products, users can run normal phase, reversed phase, hydrophilic interaction liquid chromatography, as well as supercritical fluid separations and purifications. The Kromasil Classic platform is available in the following particle sizes: 1.8, 2.5, 3.5, 5, 7, 10, 13 and 16 µm (larger particles can also be produced). Kromasil has narrow particle size distribution for high efficiency, low pressure drop, and best total economy in chromatographic analyses and purifications. Surface chemistries include SIL (bare silica), C4, C8, C18, Phenyl, NH2, Diol, and CN.

Within the Kromasil Classic platform, AkzoNobel offers three families of products based on pore sizes: 60, 100 and 300 Å.

Pharmaceutical and natural products project stages to launch using Kromasil

Stages	Discovery	Method validation, QC	Purification	Production
Product format	columns	columns	columns/bulk media	bulk media
Scale	UHPLC/HPLC	UHPLC/HPLC	semipreparative HPLC	preparative HPLC
Column i.d. [mm]	2.1 - 4.6	2.1 - 4.6	10 - 50	⩾ 50
Particle size [µm]	1.8 - 5	1.8 - 5	5 - 10	⩾ 10

Kromasil 60 Å

For separation of small molecules from analytical to process scale

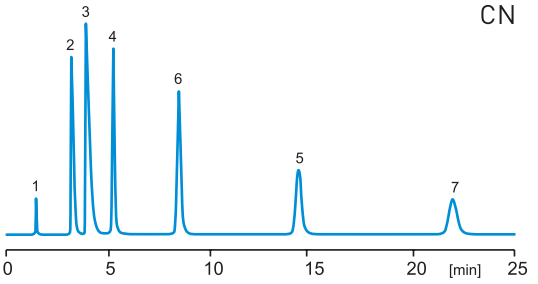
The Kromasil Classic 60 Å family of products is the choice for small, organic molecules when a large, accessible surface area is key for separating peaks in analysis. It also has the added properties of loadability and capacity required for purification.

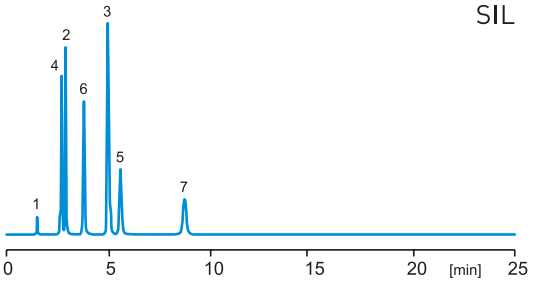
Derivatized stationary phase materials based on Kromasil 60 Å silica are developed and manufactured to give high reproducibility and chemical stability. Scientists can benefit from this range of products for applications within normal phase, reversed phase, HILIC and SFC.

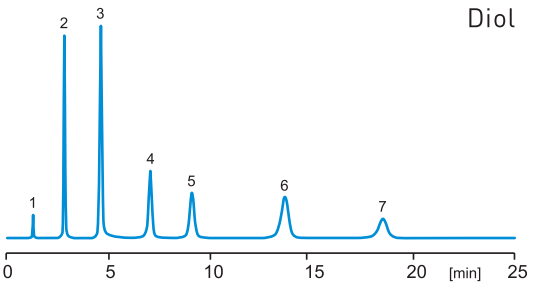
Exploit selectivity differences with Kromasil

With the wide range of derivatizations available in Kromasil, users can test sets of columns to determine which is best for a given sample. The following three chromatograms illustrate the differences in selectivity and resolution highlighted by the exposure of the same mixture of compounds to Kromasil Diol, Silica and Cyano columns.

There is an increased interest within the pharmaceutical industry for polar compounds. Traditionally, it has been a challenge to separate polar compounds such as organic acids, nucleobases, and water soluble vitamins on standard reversed phase columns such as C18. For this reason, within Kromasil Classic 60 Å, Kromasil HILIC-D has been developed for optimal selectivity of polar compounds. This phase is also 100% MS compatible, which works well for laboratories using LC/MS technologies.







Conditions

Stationary phase: Kromasil 60 Å, 5 µm, suface chemistry as in figure

Column size: 4.6 x 250 mm

Part numbers: (Diol) S05DIA25, (CN) S05CNA25, (SIL) S05SIA25

Mobile phase: heptane / 2-propanol (85/15)

Flow rate: 2 ml/min.

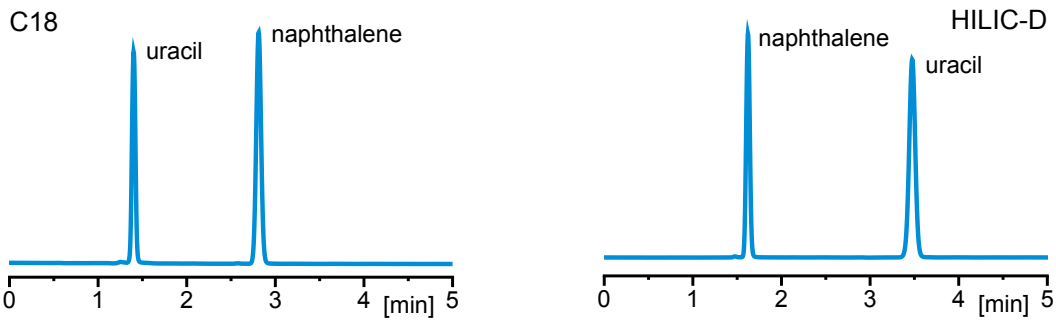
Temperature: 20°C

Detection: 224 nm

Sample: 1 = tri-tert-butylbenzene, 2 = 2-ethoxyaniline, 3 = aniline, 4 = catechol, 5 = 2,4-dinitroaniline, 6 = hydroquinone, 7 = 4-nitroaniline

Kromasil is also recognized for its loading capacity and its benefits in the purification of compounds. The chromatogram below shows the loading of Oxirane onto a 4.6 mm ID column, traditionally regarded as a column for analysis. However, this column format allows the user to perform these types of experiments to verify the loading capability of the stationary phase and then seamlessly scale up for the final purification needs.

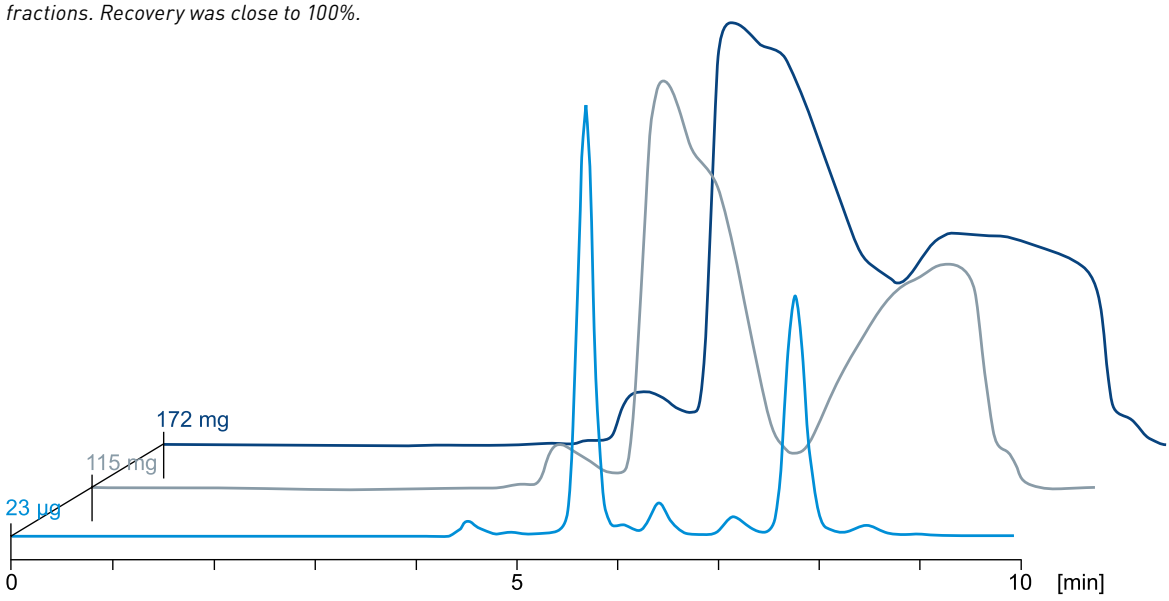
Chromatographic results with C18 and HILIC-D. Retention times vary due to the interactions between the substance structures and the differences in principles of reversed-phase and hydrophilic interaction chromatography. Further, with this particular mixture, selectivity reversal is achieved.



Conditions
Columns: Kromasil 100-5-C18 4.6 x 150 mm
Kromasil 60-5-HILIC-D 4.6 x 150 mm
Part numbers: M05CLA15 and S05HDA15, respectively
Mobile Phase: acetonitrile / water (90/10)

Flow rate: 1 ml/min
Temperature: ambient
Detection: UV @ 254 nm

Kromasil CN (cyano) was used for the large-scale separation of a diastereomeric oxirane derivative, where the chromatograms show the scale-up experiments in analytical scale. Even at a loading corresponding to 172 mg loading in analytical scale, i.e. 86 mg crude/g of packing, 98–99% pure diastereomers could be obtained in the two collected fractions. Recovery was close to 100%.



Conditions
Columns: Kromasil 60-10-CN 4.6 × 250 mm
Part number: S10CNA25

Flow rate: 1.16 ml/min
Solute: Oxirane

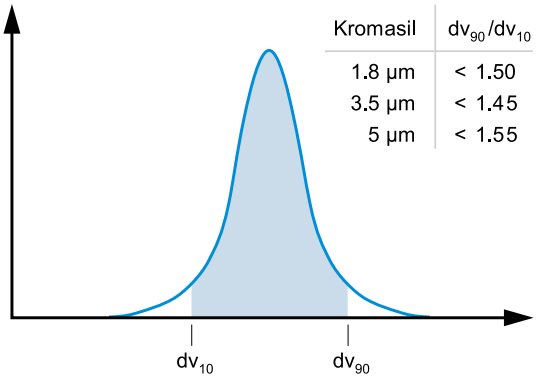
Kromasil 100 Å

For small molecules and peptides

The well-known Kromasil Classic 100 Å family of products is used to separate and purify molecules of up to about 10 000 Da. In fact, drug candidates for the pharmaceutical, natural products and API industries are separated and purified using Kromasil Classic 100 Å columns and bulk material.

Derivatized products based on Kromasil 100 Å silica are developed and manufactured at AkzoNobel to achieve high reproducibility and chemical stability. The narrow and consistent particle size distribution of Kromasil 100 Å silica and its derivatizations lead to chromatographic columns with outstanding efficiency and bed stability.

Particle size distribution showing the dv_{90}/dv_{10} ratio.



A narrow particle size distribution allows the user to avoid high backpressure due to low bed porosity. To define and secure a narrow particle size distribution, all Kromasil products have to pass stringent quality control specifications of dv_{90}/dv_{10} ratio. This specification is quite demanding on the manufacturing process, and provides a superior product compared to others in the marketplace today which only have a specification of dv_{90}/dv_{40}.

Kromasil Classic 100 Å products are supplied for the analysis of mixtures, isolation of the main compound and impurity characterization as well as large-scale manufacturing. Slurry-packed columns are shipped in a variety of particle sizes and column formats. The same applies to bulk stationary phases.

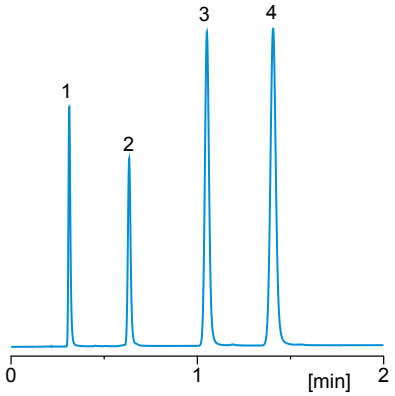
Kromasil in small particle sizes for UHPLC and HPLC

Kromasil is available in a variety of standard particle sizes from 1.8 to 16 µm (larger particles are available upon request). All particle sizes are based on the same Kromasil silica technology. Therefore, scientists can now employ the same quality products as their counterparts across the organization, making it easier, faster and more cost-effective for a drug to reach market.

Kromasil UHPLC columns with 1.8 µm particles are specifically targeted for fast chromatography to screen samples under UHPLC conditions. In this case, the chromatographic results show a separation in slightly more than a minute with significant baseline resolution.

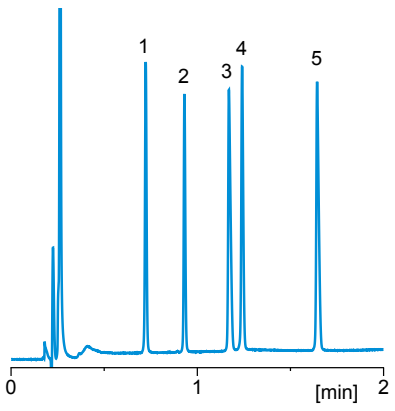
The Kromasil 2.5 µm columns are intended for laboratory flexibility, maintaining exceptional performance. These columns are packed for UHPLC conditions giving users the option to run Kromasil 2.5 µm particle-based columns under UHPLC or HPLC conditions. Scientists can choose the scale that works best in their laboratory environment, and develop and adapt methods for fast turnaround under HPLC conditions or go one step further to UHPLC methods. As with all Kromasil particle sizes, these Kromasil 2.5 µm particles are based on very narrow specification ranges, resulting in columns with excellent performance and backed by the well-known Kromasil column-to-column reproducibility.

Kromasil allows easy transfer of methods developed on 2.5 µm particles to other departments, such as method validation and quality control. Kromasil 2.5 µm columns can also be a good start in open access screening by synthetic or medicinal chemists in the step before purification of key compounds of interest.



Conditions
Column: Kromasil 100-1.8-C18 2.1 x 50 mm
Part number: MF1CLD05
Mobile phase: acetonitrile / water (65/35)
Sample: 1 = dimethyl phthalate, 2 = toluene, 3 = biphenyl, 4 = phenanthrene
Flow rate: 0.6 ml/min
Temperature: 35°C
Detection: UV @ 254 nm

Separation within 2 minutes



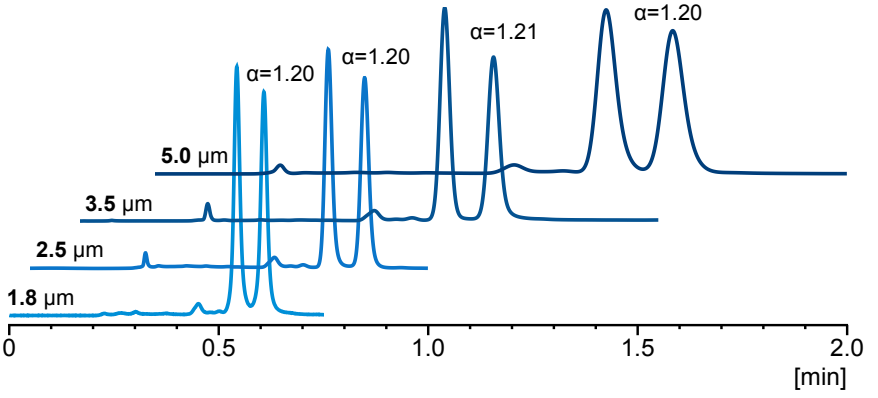
Conditions
Column: Kromasil 100-2.5-C18 4.6 x 50 mm
Part number: MH2CLA05
Sample: 1 = sotalol, 2 = nadolol, 3 = timolol, 4 = metoprolol, 5 = alprenolol
Mobile Phase A: 0.1% TFA in acetonitrile
Mobile Phase B: 0.1% TFA in water
Gradient: 0 min: 5%, 2.7 min: 70% acetonitrile
Flow rate: 3.0 ml/min
Temperature: 50°C
Detection: UV @ 230 nm

Kromasil 100 Å (cont.)

Seamless scalability

Considering a project starts in R&D, scientists can develop a Kromasil based UHPLC method in the early stages, validate the corresponding conditions of analysis and transfer the method to HPLC scale for other departments. Being able to use the same type of stationary phase throughout discovery, development and production is a unique opportunity for chromatographic users not only due to the extent of the Kromasil phases, but also the quality and reproducibility of the materials, which is second to none.

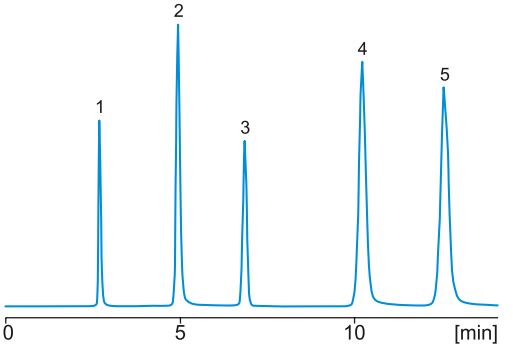
Same selectivity in a fraction of the time



Conditions
Columns: Kromasil 100-1.8-C4 2.1 x 50 mm and Kromasil 100-dp-C4 4.6 x 50 mm for dp from 2.5 to 5 µm
Part numbers: MF1CSD05, MH2CSA05, MH3CSA05 and M05CSA05
Substances: Vitamin E & D
Mobile phase: acetonitrile
Flow rate: 5.0 µm: 1.0 ml/min, 3.5 µm: 1.5 ml/min, 2.5 µm: 2.0 ml/min, 1.8 µm: 0.6 ml/min
Temperature: 20°C
Detection: UV @ 215 nm

Kromasil for HPLC

Kromasil Classic HPLC columns based on 5 µm particle technology are the workhorse in analytical laboratories.

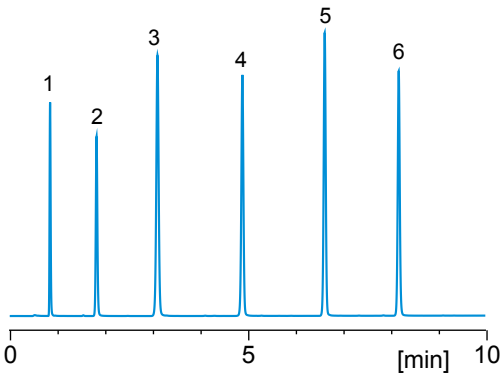


Conditions
Column: Kromasil 100-5-C18 4.6 × 250 mm
Part number: M05CLA25
Eluent: methanol / potassium phosphate, 25 mM, pH 6.0 (80/20)
Flow rate: 1 ml/min
Temperature: ambient
Detection: UV @ 215 nm
Substances: 1 = phenylpropanolamine
2 = nortriptyline
3 = toluene
4 = imipramine
5 = amitriptyline

QC test, tricyclic antidepressants

Lately, 3.5 µm particle columns are also becoming the standard for many laboratories in several sectors within pharmaceutical, food and beverage, natural products, clinical and industrial applications.

Pesticides



Conditions
Column: Kromasil 100-3.5-C18 4.6 × 150 mm
Part number: MH3CLA15
Eluent: acetonitrile/water
Gradient: 0 - 1.5 min: 40%, 10 min: 90% acetonitrile

Flow rate: 1.5 ml/min
Temperature: 30°C
Detection: UV 254 nm

Substances: 1 = uracil
2 = fenuron,
3 = monuron
4 = diuron,
5 = linuron
6 = neburon

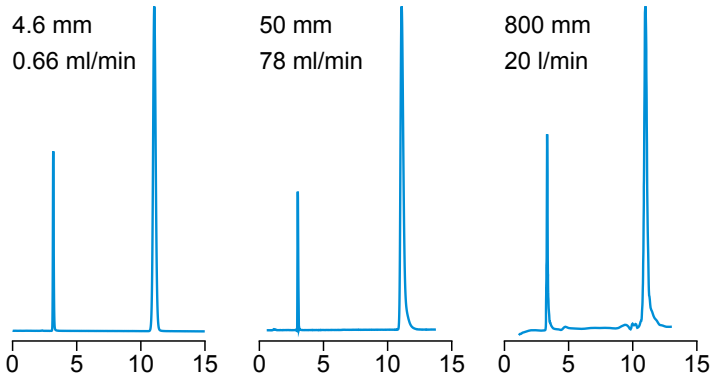
A disruptive technology in purification

Independent of the chromatographer's need for isolation and purification, Kromasil delivers both slurry-packed columns for development and pilot laboratory isolation and bulk material for larger purifications.

One of the main distinguishing aspects of Kromasil is that it is possible to use the same quality product whatever the scale required. This comprises the isolation and purification of compounds and their impurities for carrying out material characterization, pilot runs for campaigns in the pharmaceutical industry and full production purification including the latest polishing steps for delivery to patients.

The following examples illustrate the consistency of Kromasil across column dimensions.

Scalability



All Kromasil pre-packed columns are delivered with a minimum performance guarantee of at least 40 000 pl/m for 10 µm particles. For larger diameters DAC columns are recommended. The performance obtained in analytical columns can be maintained all the way up to very large industrial scale DAC columns, and in the example an 80 cm ID DAC column is proven to show analytical performance. The scale-up factor from the analytical column in this case is 30 000 times.

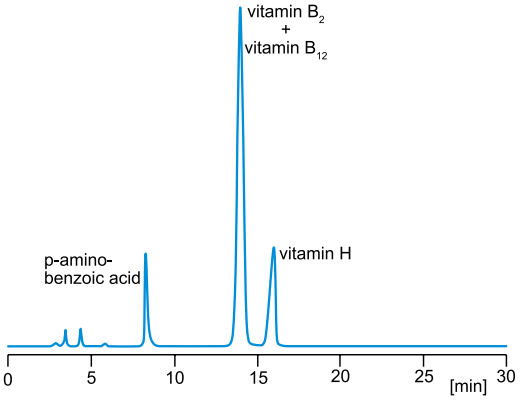
Conditions
Stationary phase: Kromasil 100-10-C18
Part number: M10CLblk
Column size: length: 250 mm, diameter as stated in figures
Sample: uracil and toluene

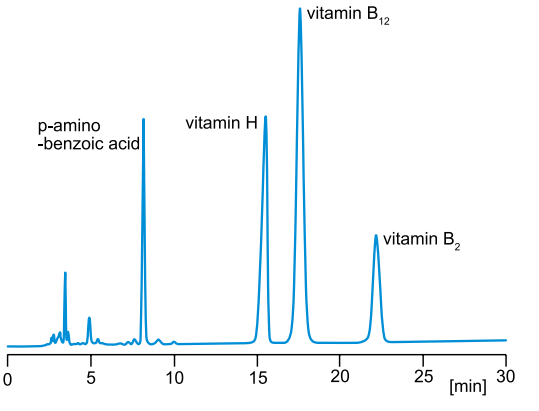
Mobile phase: acetonitrile / water (30/70)
Linear velocity: 0.66 mm/s (equivalent flow rate as stated in figures)
Detection: UV 254 nm

Kromasil 100 Å (cont.)

Consistency from batch to batch

Another important aspect in preparative chromatography is the stationary phase batch-to-batch consistency. A vast number of tests are performed in the quality assurance and control of Kromasil. In the adjoining figure, batch-to-batch reproducibility of Kromasil, measured as selectivity and retention factor over time, is shown for particle sizes from 7 µm to 16 µm.

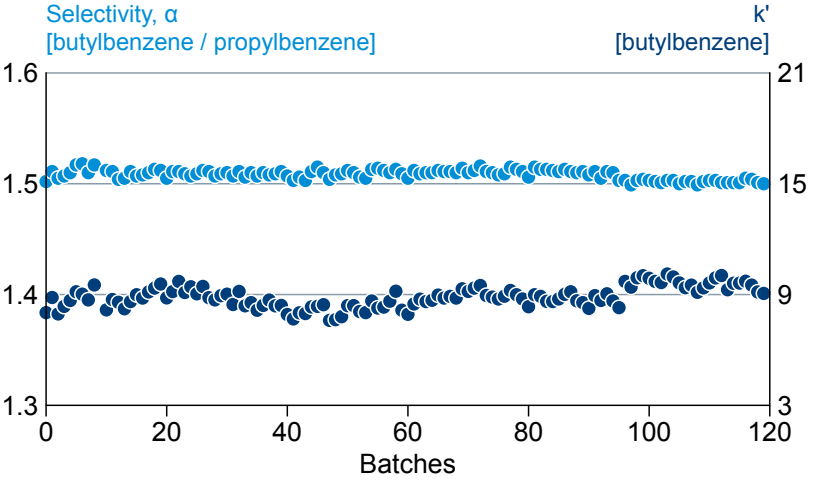




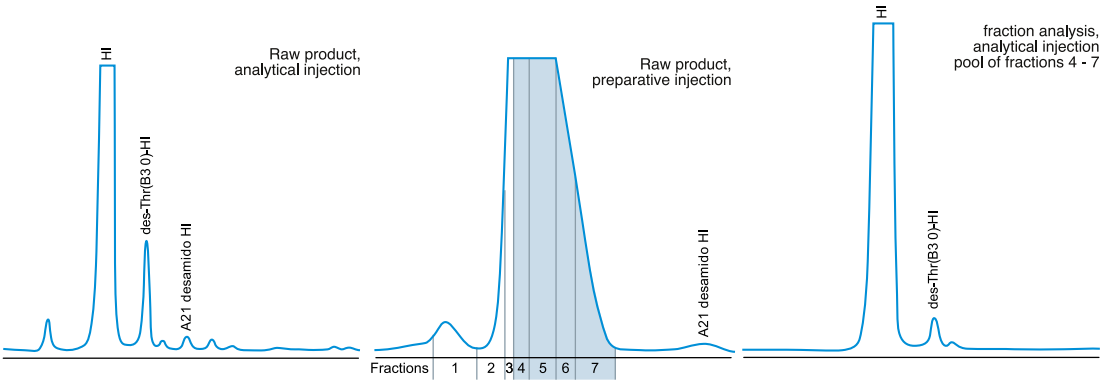
Conditions

Columns: Kromasil 100-5-C18 4.6 x 250 mm
Kromasil 100-5-Phenyl 4.6 x 250 mm
Part numbers: M05CLA25 and M05PHA25 respectively
Mobile phase: acetonitrile / 20 mM ammonium phosphate (12/88)
Flow rate: 1 ml/min
Temperature: 20°C
Detection: 254 nm

In cases where there is a need to use a completely wettable phase, or when the compounds in the sample have aromatic structures requiring unique selectivity for π-π interactions between the phenyl bonded phase and the solute, Kromasil Phenyl phase can be used. Kromasil Phenyl is derivatized using a mono-functional silane, followed by an extensive endcapping. The result is a stationary phase with high stability, high reproducibility, and symmetrical peaks for basic compounds.



Example of scalability with insulin



Conditions

Raw product purity: 90%

Conditions, analytical injection:
Column: Kromasil 100-3.5-C4 4.6 x 120 mm
Part number: MH3CSB12
Mobile phase: acetonitrile / 0.05 M sodium phosphate, 0.1 M sodium chlorate, pH 2.5
Gradient: 0 min: 30%, 55 min: 36% acetonitrile
Flow rate: 1.0 ml/min

Conditions, preparative injection:
Packing material: Kromasil 100-10-C8
DAC Column: 50 x 250 mm
Loading: 6 g/l column volume
Flow rate: 60 ml/min

Detector: UV @ 214 nm

The need for a strong material explained

Mechanical strength is required to withstand mechanical stress in an analytical or purification column. A silica packing is also often exposed to high mechanical stress when unpacked and packed again in production. Frequent packing and unpacking requires very stable packing material where no fines can be created.

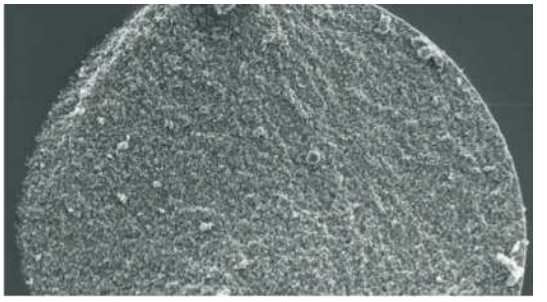
The formation of fines in any part of the process leads to increasing backpressure. Eventually the pressure limit for the system is reached, and the column has to be repacked with new material. The Kromasil particles are essentially perfectly spherical. In addition, the pore shape and structure are more regular than other materials. The result is mechanical strength that allows extremely high piston pressure in columns.

Many Kromasil customers perform cleaning-in-place (CIP) using highly alkaline conditions to remove adsorbed polypeptide impurities, especially in insulin purification. Such conditions will quickly break down less stable materials mechanically. But with Kromasil, you can apply CIP over and over again.

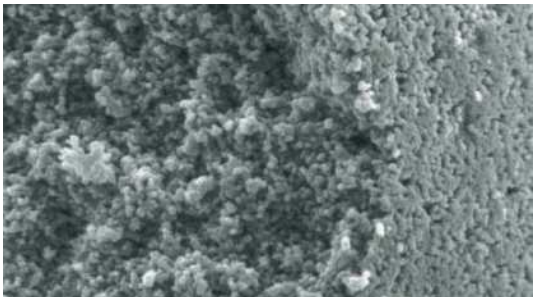
Kromasil 300 Å

Protein and biomolecule separations from analytical to process scale

The Kromasil Classic 300 Å family of products is designed to be the perfect choice for proteins and biomolecules larger than 8–10 kDa. This 300 Å material has a narrow pore size distribution that ensures good mass transfer for larger molecules, resulting in narrow peaks and no size-exclusion effects. The figures below show FE-SEM studies of Kromasil 300 Å, indicating a very regular pore structure, with no voids or dense clusters.

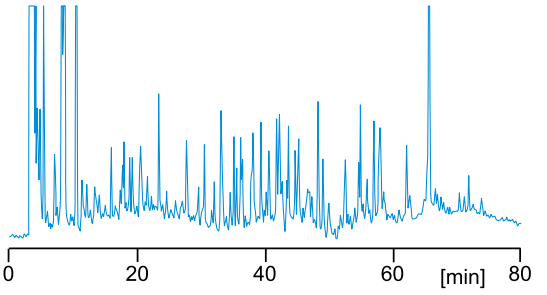


FE-SEM picture of a cut through a Kromasil 300 Å particle at 5 000 x magnification.



FE-SEM picture of a cut through a Kromasil 300 Å particle at 35 000 x magnification, showing both the outer surface and the fracture through the particle.

Tryptic digest of bovine serum albumin (BSA)



A common test for RP packings designed for the separation of biological materials is to run a tryptic digest of BSA. The digest contains fragments of various sizes, and the separation of these into individual peaks is good evidence of the power of resolution.

Conditions
Columns: Kromasil 300-5-C4 4.6 x 250 mm
Part number: L05CSA25
Mobile phase A: acetonitrile / water / TFA (4/96/0.085)
Mobile phase B: acetonitrile / water / TFA (90/10/0.1)

Gradient: 0 min: 4%, 5 min: 4%, 80 min: 40% acetonitrile
Flow rate: 1.0 ml/min
Temperature: 22 °C
Detection: UV @ 215 nm

Product characteristics

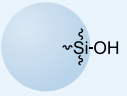
Kromasil 60 Å

Particle size distribution (Coulter Multisizer):
dv_{90}/dv_{10}: 10, 13, 16 µm <1.70
7 µm <1.60
5 µm <1.55

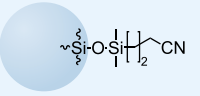
Chemical purity (AAS or ICP): Na <10 ppm, Al < 5 ppm, Fe < 5 ppm

Specific surface area (multi-point BET): 540 m^2/g
Pore volume (N_2-adsorption): 1.2 ml/g
Pore size (N_2-adsorption): 80 Å
Pore size distribution (N_2-adsorption): 80% ± 15 Å
(97% of the surface is accessible for toluene, which indicates low amounts of inaccessible micro pores.)

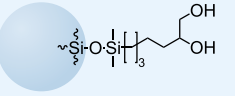
SIL
Bare silica
USP: L3
Packed density: 0.45 g/ml



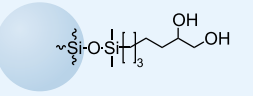
CN
Cyano
USP: L10
Coverage: 3.8 µmol/m^2
Element content: 12% C and 3.8% N
Packed density: 0.48 g/ml



Diol
USP: L20
Coverage: 3.5 µmol/m^2
Element content: 10% C
Packed density: 0.53 g/ml



HILIC-D
Diol
USP: L20
Coverage: 3.5 µmol/m^2
Element content: 10% C
Packed density: 0.53 g/ml



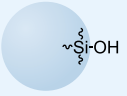
Kromasil 100 Å

Particle size distribution (Coulter Multisizer):
dv_{90}/dv_{10}: 10, 13, 16 µm <1.70
7 µm <1.60
5 µm <1.55
3.5 µm <1.45
2.5 µm <1.40
1.8 µm <1.50

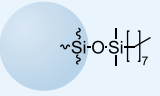
Chemical purity (AAS or ICP): Na <10 ppm, Al < 5 ppm, Fe < 5 ppm
Packed density: 0.50 g/ml

Specific surface area (multi-point BET): 320 m^2/g
Pore volume (N_2-adsorption): 0.9 ml/g
Pore size (N_2-adsorption): 110 Å
Pore size distribution (N_2-adsorption): 80% ± 25 Å
(97% of the surface is accessible for toluene, which indicates low amounts of inaccessible micro pores.)

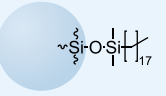
SIL
Bare silica
USP: L3
Packed density: 0.50 g/ml



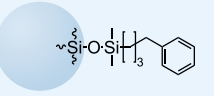
C8
Octyl
USP: L7
Coverage: 3.7 µmol/m^2
Element content: 12% C
Packed density: 0.60 g/ml



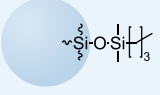
C18
Octadecyl
USP: L1
Coverage: 3.5 µmol/m^2
Element content: 20% C
Packed density: 0.66 g/ml



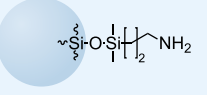
Phenyl
Butyl phenyl
USP: L11
Coverage: 3.7 µmol/m^2
Element content: 14% C
Packed density: 0.59 g/ml



C4
Butyl
USP: L26
Coverage: 3.8 µmol/m^2
Element content: 8% C
Packed density: 0.57 g/ml



NH2
Amino
USP: L8
Coverage: 4.5 µmol/m^2
Element content: 1.7% N
Packed density: 0.53 g/ml



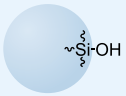
Kromasil 300 Å

Particle size distribution (Coulter Multisizer):
dv_{90}/dv_{10}: 10, 13, 16 µm <1.70
5 µm <1.55

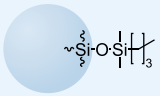
Chemical purity (AAS or ICP): Na <10 ppm, Al < 5 ppm, Fe < 5 ppm

Specific surface area (multi-point BET): 110 m^2/g
Pore volume (N_2-adsorption): 0.9 ml/g
Pore size (N_2-adsorption): 300 Å
Pore size distribution (N_2-adsorption): 80% ± 25 Å
(97% of the surface is accessible for toluene, which indicates low amounts of inaccessible micro pores.)

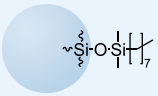
SIL
Bare silica
USP: L3
Packed density: 0.47 g/ml



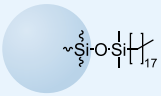
C4
Butyl
USP: L26
Coverage: 3.9 µmol/m^2
Element content: 2.9% C
Packed density: 0.48 g/ml



C8
Octyl
USP: L7
Coverage: 3.8 µmol/m^2
Element content: 4.7% C
Packed density: 0.50 g/ml



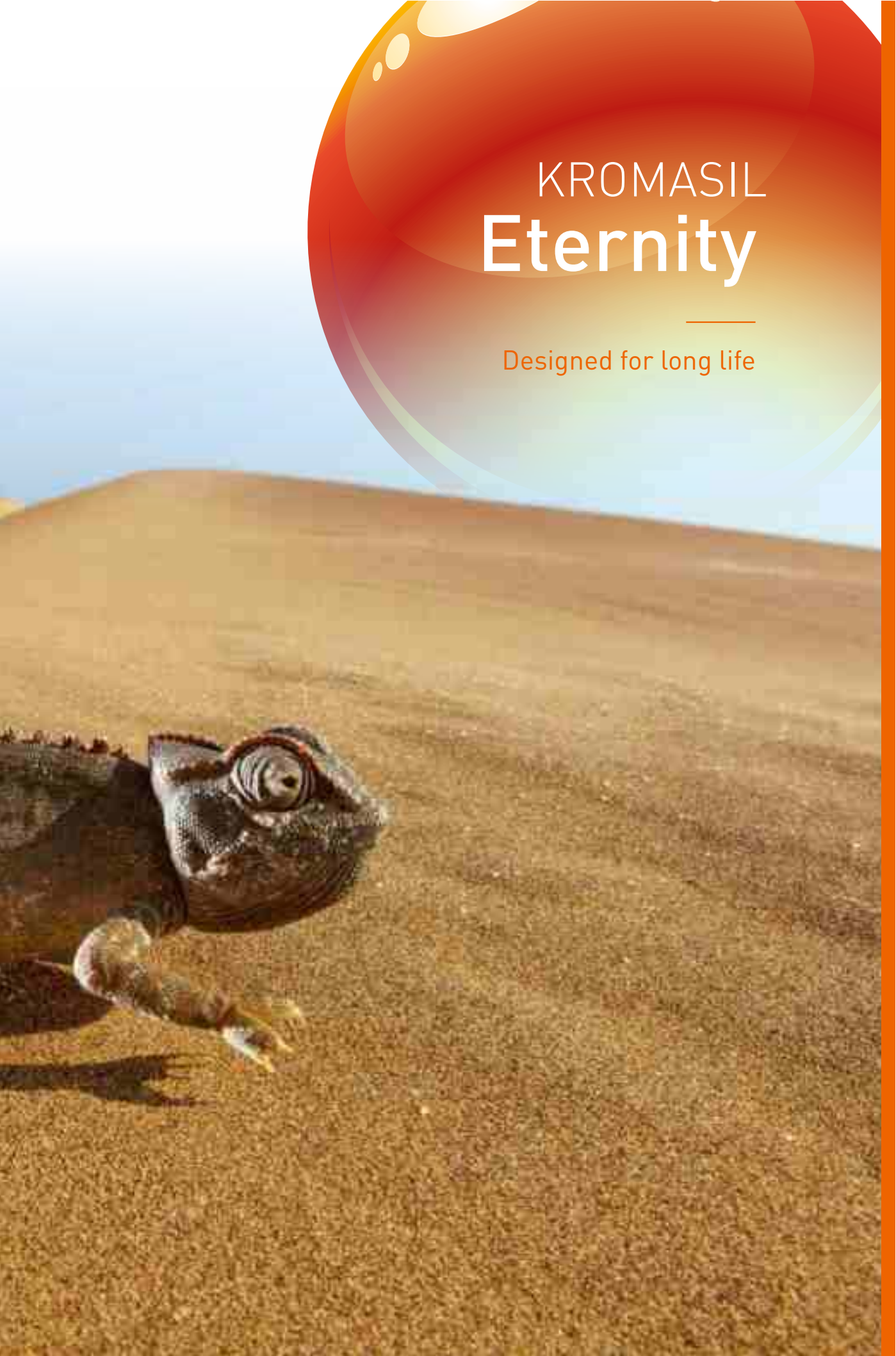
C18
Octadecyl
USP: L1
Coverage: 3.7 µmol/m^2
Element content: 8.7% C
Packed density: 0.52 g/ml



Kromasil®
Eternity™

KROMASIL
Eternity

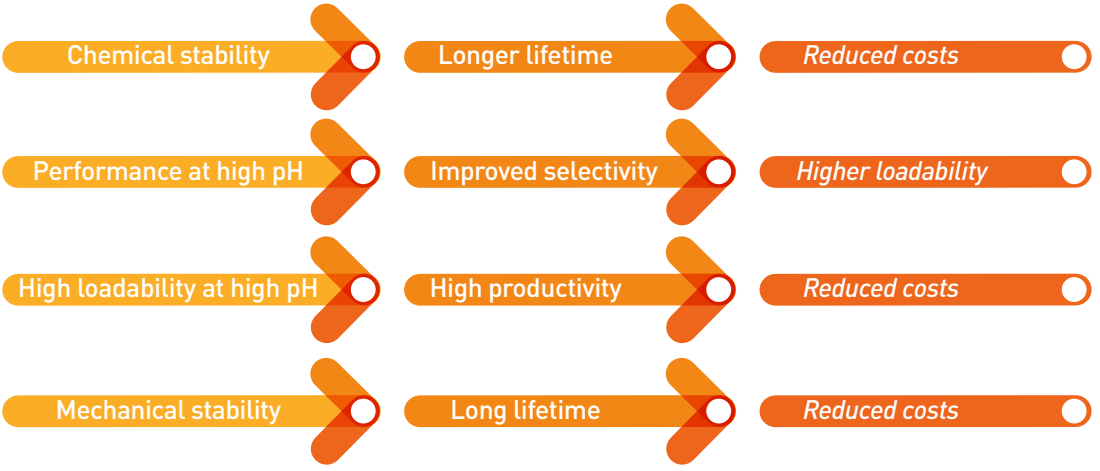
Designed for long life



Easy handling of tough demands

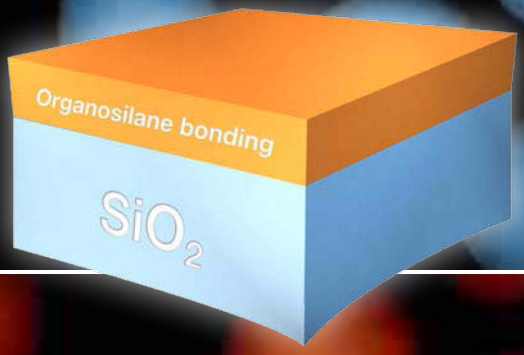
For regular silica-based stationary phases, exposure to extreme pH (especially basic) will have a negative impact on the chemical stability and therefore column lifetime. However, the silica/organosilane surface of the Kromasil Eternity platform offers a chemical stability that will secure a long-lasting stationary phase, even under tough pH conditions and higher temperatures.

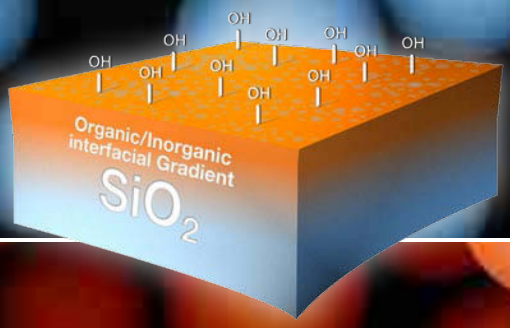
Summary of benefits for the Eternity platform



The silica matrix

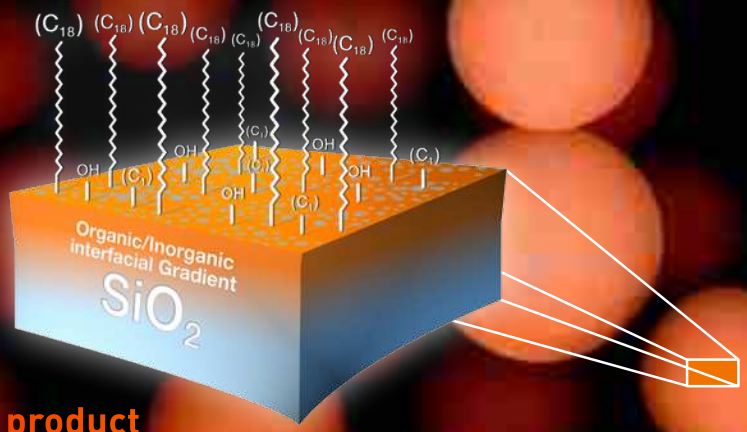
The Eternity platform is based on the Kromasil 100 Å silica matrix, well known for high mechanical stability, and a well-defined pore structure.





The organosilane interfacial gradient

The silica matrix is bonded using a patent-pending technology. An organosilane is immobilized on the silica, and, under certain proprietary conditions merged into an organic/inorganic interfacial gradient. The pores are virtually returned to their original size, resulting in a surface exhibiting both organic and inorganic moieties. This process step has been fine-tuned to give Kromasil EternityXT its extreme chemical stability, extending the pH range and packing lifetime.



The finished product

Finally the product is functionalized with various surface chemistries (C18 in illustration), followed by a proprietary endcapping process.

Excellent performance even at high pH values

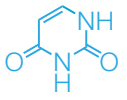
With the wide pH window, the Eternity platform gives users more flexibility to optimize selectivity and loading capacity compared to regular silica materials.

Optimizing resolution

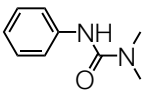
Substances with ionizable groups will exhibit significantly different retention times depending on their degree of ionization. Hence, by changing the pH, selectivity between substances can be altered so that resolution is optimized for a given separation.

In many cases, pharmaceuticals are basic. They are ionized at low or neutral pH, resulting in low retention, poor loadability and broad peaks. Being able to run at high pH means compounds become more retained with narrower peaks, revealing higher chances for better resolution and loadability.

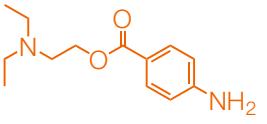
1 = uracil



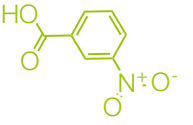
3 = fenuron



2 = procaine



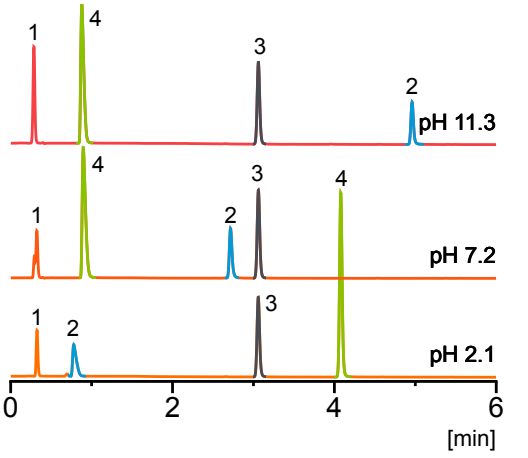
4 = 3-nitrobenzoic acid



Running at high pH

Basic pharmaceuticals become neutral at high pH and exhibit significantly sharper analytical peaks and higher loadability. Higher loadability means higher productivity, leading to a much more economical purification process. With EternityXT, large-scale separations can be run for an extended time, even at levels as high as pH 12.

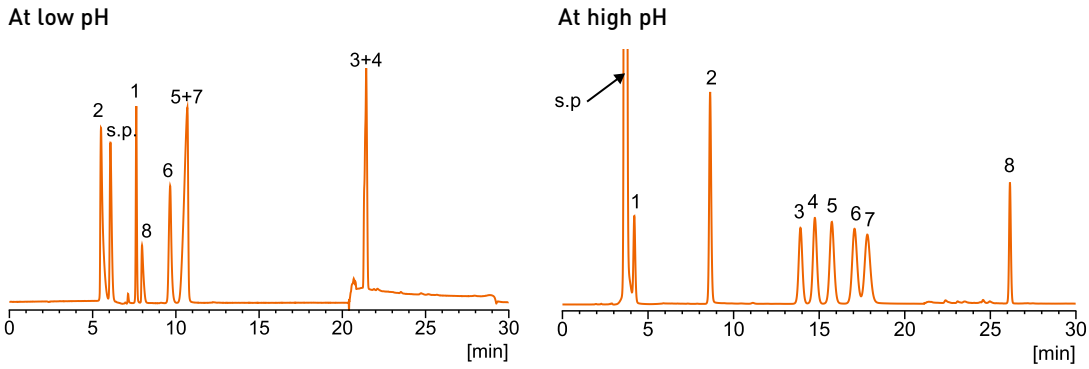
Choose selectivity by tuning pH



Conditions
Column: Kromasil EternityXT-2.5-C18 4.6 x 50 mm
Part number: XH2CLA05
Mobile phase: acetonitrile / 20 mM sodium phosphate pH 2.1, 7.2 and 11.3
Gradient 0-0.5 min: 10%, 5.5 min: 50% acetonitrile
Flow rate: 1.5 ml/min
Temperatur: 25°C
Detection: UV@254 nm

Substances: 1: uracil
2: procaine
3: fenuron
4: 3-nitrobenzoic acid

Improved resolution at high pH



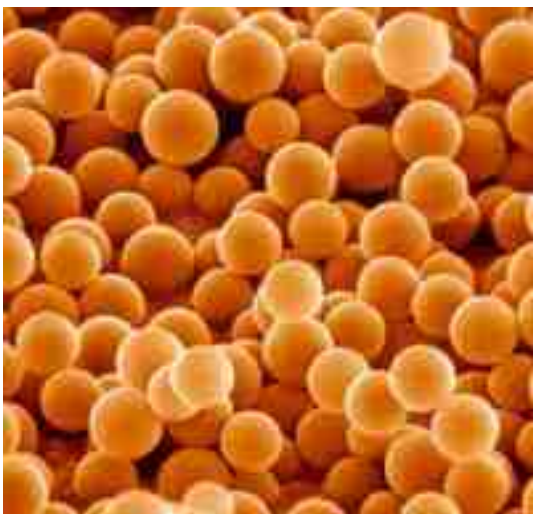
Conditions
Column: Kromasil EternityXT 10-C18, 4.6 x 250 mm
Part number: X10CLA25
Gradient: 0 min: 20%, 2 min: 29.5%, 16 min: 29.5%, 26 min: 90% acetonitrile
Flow rate: 1 ml/min
Temperature: ambient
Detection: UV @ 254 nm

Substances: 1: caffeine
2: aniline
3: 2-nitroaniline
4: 2.4-dinitroaniline
s.p.: solvent peak (acetone)
5: 2-etoxyaniline
6: 3.5-dimethylaniline
7: 3-ethylaniline
8: N,N-diethylaniline

At low pH
Mobile phase: acetonitrile / 10 mM potassium phosphate, pH 2.5

At high pH
Mobile phase: acetonitrile / 10 mM potassium phosphate, pH 10.5

The adjoining chromatograms showing separation of anilines illustrate the significant advantage of being able to use almost the entire pH range for developing a separation method. The low pH (pH = 2.5) chromatogram shows a non-favorable situation, with coelution of two pairs of peaks. However, at high pH (pH = 10.5), a chromatogram with well separated peaks can easily be obtained.



Stronger than ever

Kromasil EternityXT is based on the Kromasil 100 Å silica matrix, with exeptional mechanical stability as a result of the almost perfect spherical shape, combined with a proprietary process to further strengthen the matrix. In EternityXT, the new organic/inorganic platform reinforces the structure to an even higher level.

Columns for the lab

Kromasil Eternity HPLC columns come with particles down to 2.5 µm. EternityXT extends down to 1.8 µm to fit any UHPLC instrument for better efficiency and flexibility in the laboratory. Both can be used for reversed-phase separations and purifications that could demand harsh conditions, fast turnaround, easy method transfer and seamless scale-up from R&D to production.

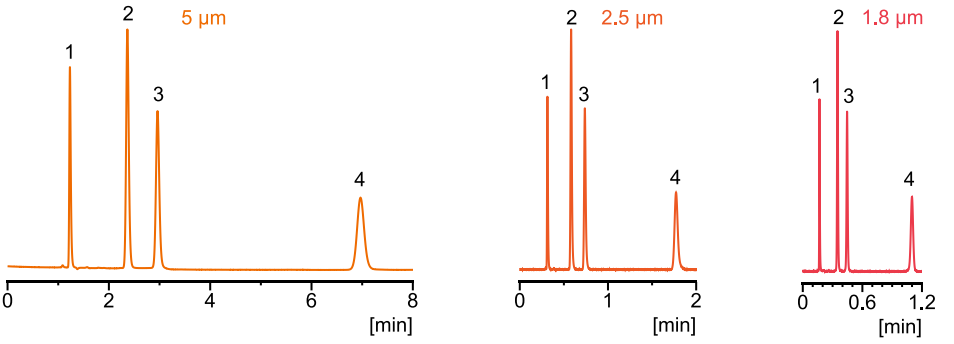
Work fast across the board

With columns built on the Eternity platform, users can now easily develop and validate UHPLC methods for synthetic and natural products, even under tough pH conditions. Method transfer to HPLC for characterization and quality control can be made seamlessly and, if required, scaled up directly for isolation and purification. Our extensive assortment of slurry-packed columns, combined with the wide range of particle sizes from 1.8 µm to 10 µm for the Eternity platform, help businesses improve productivity by using one stationary phase type across the entire company.

High efficiency with small particles

When scientists need to get results fast and within an extended pH range, EternityXT columns can help achieve the desired laboratory efficiency.

With EternityXT columns you can maintain separation power across all dimensions and particle sizes. Here is an illustration of faster result turnaround with maintained resolution when using shorter columns with smaller particles.



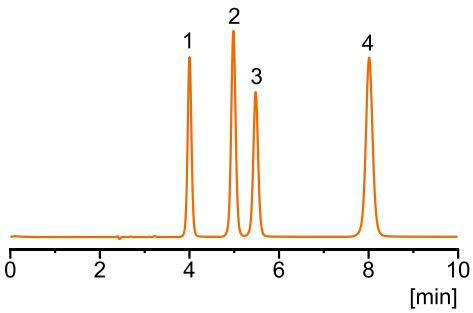
Conditions

Part numbers: X05CLA15, XH2CLAH7 and XF1CLA05, respectively
Stationary phase: Kromasil EternityXT, C18, particle sizes as in figures
Column size: 4.6 x 150 mm, 4.6 x 75 mm, 4.6 x 50 mm (respectively)
Mobile phase: acetonitrile / water/formic acid [25/75/0.1]
Substances: 1: uracil, 2: sulfathiazole, 3: sulfamerazin, 4: sulfamethoxazole
Flow rate: 1 ml/min, 2 ml/min, 2.8 ml/min (respectively)
Temperature: 25°C
Detection: UV @ 254 nm

Alternative separations

While C18 columns are the most commonly used for reversed-phase chromatography, PhenylHexyl is an alternative phase chemistry that provides additional interaction opportunities, especially when the analytes of interest contain an aromatic ring. Available for both Eternity and EternityXT.

Separation of xanthines on Kromasil EternityXT PhenylHexyl.



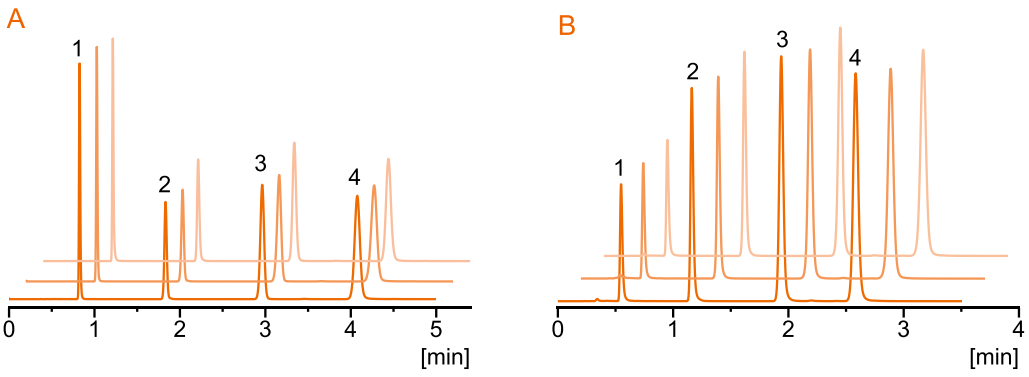
Conditions
Part number: X05PXA25
Column: Kromasil EternityXT, 5 µm, PhenylHexyl, 4.6 x 250 mm
Mobile phase: acetonitrile / water/formic acid [40/60/0.1]
Substances: 1: theobromine, 2: 1.7-dimethylxanthine, 3: theophylline, 4: caffeine

Flow rate: 1 ml/min
Temperature: 30°C
Detection: UV @ 254 nm

Consistent results between columns and batches

Since AkzoNobel controls the entire manufacturing process of the Eternity platform, from the initial production steps of the stationary phase to the finished packed columns, batch-to-batch as well as column-to-column reproducibility is assured.

Comparisions of three columns showing column-to-column (A) and batch-to-batch (B) reproducibility.



Conditions
Part numbers: XH2CLA10 and XH2CLD10
Column: Kromasil EternityXT, 2.5 µm, C18, A: 4.6 x 100 mm, B: 2.1 x 100 mm
Mobile phase: acetonitrile / water: A: [70/30], B: [65/35]
Substances: 1: dimethyl phthalate, 2: toluene, 3: biphenyl, 4: phenanthrene

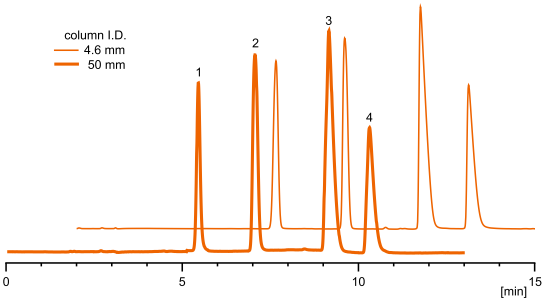
Flow rate: A: 1.7 ml/min, B: 0.65 ml/min
Temperature: A: 25°C, B: 35°C
Detection: UV @ 254 nm

Columns for the lab (cont.)

Scale-up with ease

As it is fairly straightforward to scale HPLC up or down, having the reproducible Eternity platform phases available on a broad range of particle and column sizes gives the user the key tools to carry out method scaling efficiently.

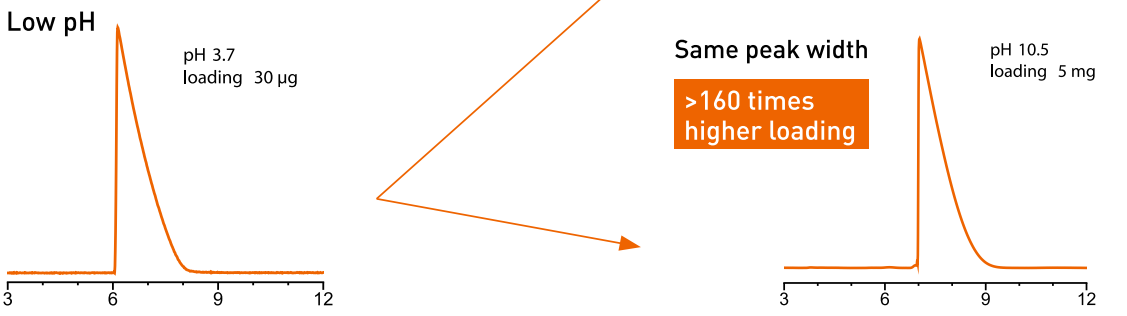
The separation of β-blockers illustrates the possibility to scale up your separation developed in analytical scale to larger scale chromatography, essentially without any loss of performance. Use 4.6 mm ID or 10 mm ID columns for the method development, and use the data obtained for predicting the performance in larger scale. With dynamic axial columns (DAC) it is possible to reproduce the performance obtained in analytical columns even in very large scale.



Conditions
Part number: X10CLA25
Column: Kromasil EternityXT 10-C18 4.6 x 250 mm
Mobile phase: acetonitrile / 10 mM ammonium hydrogen carbonate, pH 10.5
Substances: 1: sotalol, 2: nadolol, 3: pindolol, 4: metoprolol
Gradient: 0 min: 10%, 10 min: 90% acetonitrile
Flow rate: 1 ml/min
Temperature: ambient
Detection: UV @ 230 nm

Loadability increases at high pH

The loadability increase that can be obtained at high pH for basic compounds is illustrated in the adjoining chromatograms, where diphenhydramine is run at pH = 3.7 and 10.5, respectively. At low pH, the molecule is ionized, leading to a large band broadening even at very low loadings. The same loading at high pH (upper right chromatogram) produces a sharp peak without any tendency to broaden as a function of concentration overload. To obtain the same band broadening at high pH, the loading has to be increased more than 160 times. Hence, loading capacity is increased by a factor >160!



Conditions
Column: Kromasil EternityXT-10-C18, 4.6 x 250mm
Part number: X10CLA25
Flow rate: 1 ml/min
Detection: UV @ 254 nm

Low pH, low loading
Loading: 30 µg diphenhydramine
Mobile phase:
acetonitrile / 25 mM ammonium format, pH 3.7 (35/65)

High pH, low loading
Loading: 30 µg diphenhydramine
Mobile phase:
acetonitrile / 25 mM ammonium hydrogen carbonate, pH 10.5 (70/30)

High pH, high loading
Loading: 5 mg diphenhydramine
Mobile phase:
acetonitrile / 25 mM ammonium hydrogen carbonate, pH 10.5 (70/30)

State-of-the-art stability

Traditional silica-based reversed phase materials very often have an upper limit for use at neutral to slightly basic pH. At higher pH levels, the silica matrix starts to dissolve. With Kromasil Classic RP phases this limit has been moved up to pH 9.5, and in some cases, even higher. With the Eternity platform, the boundaries are moved beyond what could be expected from the strongest silica matrix.

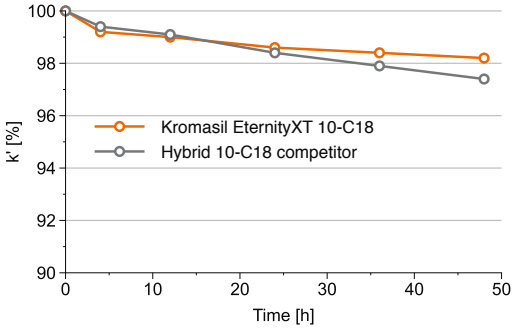
Up to pH 12

The first generation of Eternity C18 set a new standard for column lifetime expectations for hybrid materials. With EternityXT C18, users get the flexibility to develop methods for quick UHPLC analysis as well as isolation and large-scale purification between pH 1-12, for long-term use.

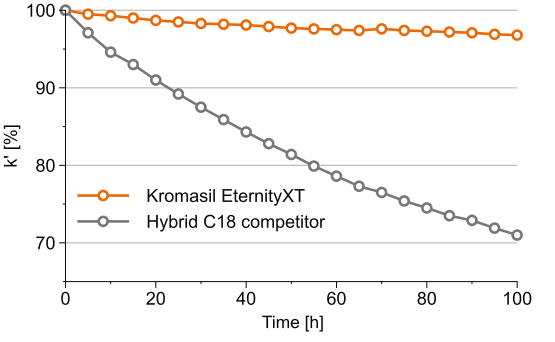
Long-term chemical stability

In the adjoining figures the long-term chemical stability at low and high pH is shown. Low pH conditions simulate a very long-term use by applying an elevated temperature and a highly aqueous mobile phase. The hybrid materials still show excellent stability, with very low shift in k' over time. High pH conditions also include highly aqueous buffer and elevated temperature. It has been shown that carbonate buffer is especially aggressive when used with silica-based packing materials, but it has little effect on the retention factor for EternityXT, due to the very dense C18 derivatization and the EternityXT gradient, protecting the silica matrix.

Low pH



High pH



Conditions
Column size: 4.6 x 250 mm

Acidic hydrolysis
Mobile phase: methanol / water/trifluoroacetic acid (5/95/0.1), pH ≈ 1.9
Flow rate: 0.2 ml/min
Temperature: 80°C

Basic hydrolysis
Mobile phase: acetonitrile / 10 mM ammonium carbonate, pH 10.5 (10/90)
Flow rate: 0.2 ml/min
Temperature: 60°C

Chromatographic test conditions
Test compound: phenanthrene
Mobile phase: acetonitrile / water (70/30)
Flow rate: 1 ml/min
Detection: UV @ 254 nm

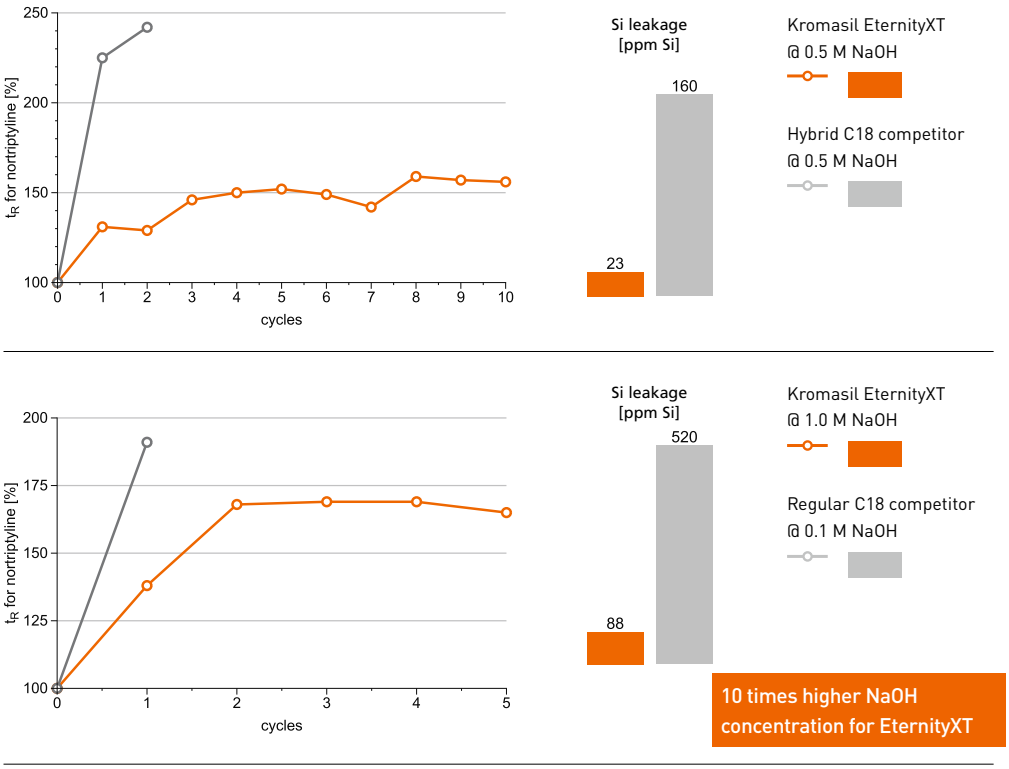
Flexibility at your fingertips

The main proportion of all synthetic pharmaceutical APIs are basic in nature, and will exhibit an increased loadability, and hence productivity, at a high pH. Basic peptides, oligos and PNAs will also benefit from high pH separation methods. In addition, it is possible to sanitize or regenerate Kromasil EternityXT in-column (cleaning in place, or CIP) even using 1 M NaOH when necessary. 1 M NaOH is a standard in biochromatography for polymeric resins.

With Kromasil EternityXT, users have the flexibility to develop analytical and separation methods for virtually the entire pH range, and to sanitize or regenerate the column using conditions previously reserved only for polymeric resins. This gives scientists the best of both worlds: highest performance and excellent stability at high pH.

Chemical stability – CIP conditions

In purification of polypeptides and proteins it is common to use high pH CIP processes (cleaning-in-place) to remove irreversibly adsorbed depositions on the packing material. The figures show retention time change after a number of CIP cycles, and the leakage of silicon during the process. For 0.5 M NaOH it can be seen that the leading hybrid C18 competitor exhibits a much lower stability compared to EternityXT, both in terms of retention time change and leakage of silicon. At 1.0 M NaOH, i.e. standard cleaning conditions for polymeric materials, EternityXT still shows very high chemical stability, while a regular C18 competitor is quickly impaired already at ten times lower hydroxide concentration, i.e. 0.1 M NaOH.

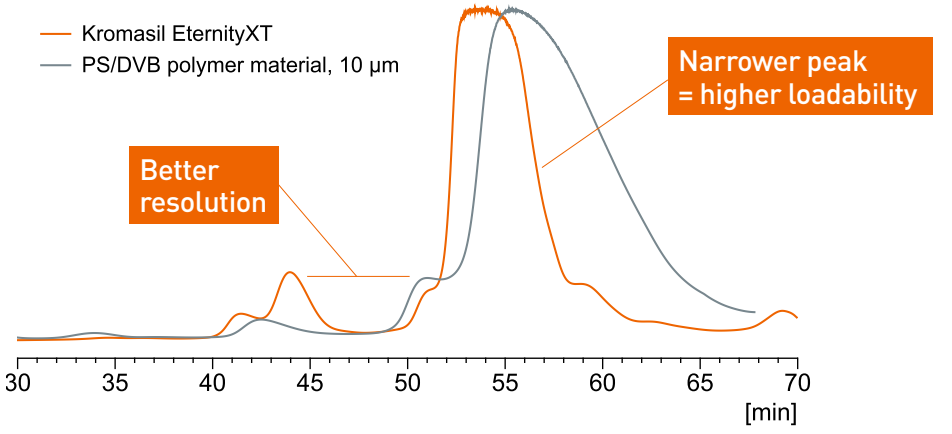


Conditions
Column size: 4.6 x 250 mm
Mobile phase: 10 column volumes of NaOH solution / ethanol (50/50)
Flow rate: 1 ml/min, for 10 column volumes (contact time 41.5 min)
Temperature: ambient
Test compound: nortriptyline at pH 7.0

State-of-the-art stability (cont.)

Chromatographic performance – EternityXT vs polymeric packing

It is well known that polystyrene/divinylbenzene (PS/DVB)-based packing materials exhibit very high chemical stability at high pH, allowing cleaning steps involving for example 1 M NaOH. However, the material can unfortunately not compete with silica-based packing materials in terms of chromatographic performance. The graph shows a typical comparison between a silica- and a polymer-based packing material: EternityXT and the market leader for PS/DVB-based packings, where identical conditions have been used. The chromatogram shows a preparative separation of insulin, where it can be seen that the silica-based material, EternityXT, has markedly sharper peaks, with roughly only 50% of the band broadening seen on the PS/DVB-based material. Both analytical efficiency and loading capacity is significantly better for EternityXT. With Kromasil EternityXT it is possible to obtain the high separation power associated with silica-based materials, and at the same time experience very high chemical stability at high pH, as can be seen in the figures.



Conditions

Column size: 4.6 x 250 mm
Temperature: 25°C
Mobile phase: ethanol / ammonium acetate 0.2 M

Flow rate: 0.7 ml/min
Detection: UV @ 280 nm
Gradient: for EternityXT, 0 min: 30%, 60 min: 38% ethanol
for PS/DVB, 0 min: 34%, 60 min: 42% ethanol

Withstands pressure time and time again

Kromasil Classic changed the world of large-scale and industrial-scale chromatography by combining a high available surface area with great mechanical stability. Kromasil EternityXT builds upon this legacy and further enhances the performance of preparative chromatography.

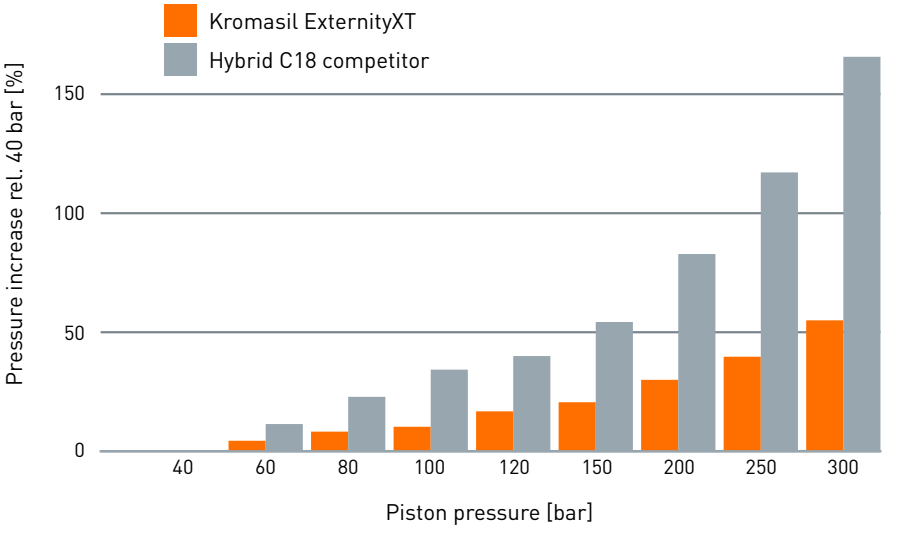
High loading capacity

Kromasil Classic is a packing material with very high loading capacity, and hence high productivity, as it can withstand the high mechanical stress the packing is exposed to in a dynamic axial compression (DAC) column. Kromasil EternityXT is a preparative packing material with exceptional physical and chemical properties. It takes mechanical stability to the next level by exhibiting even higher mechanical stability, with the same high available surface area, and hence loading capacity.

Based on the Kromasil 100 Å silica matrix, Kromasil EternityXT has exceptional mechanical stability as a result of the spherical shape and a proprietary process that further strengthens the matrix. In EternityXT, the new organic/inorganic platform reinforces the structure to an even higher level.

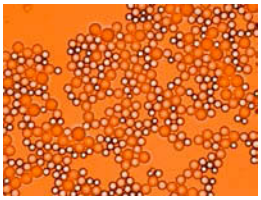
Pressure over packed bed during mechanical stability test

To simulate a repeated packing procedure without emptying the column, a test method with a successive increase of piston pressure was applied. The back pressure increase is a measure of the degree of densification and degradation of the material after repeated packings.

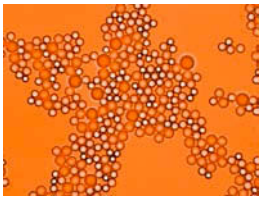


Test conditions
The test material is packed in a 50 mm ID DAC column, and the pressure is increased stepwise, from 40 bar up to 300 bar. The backpressure is monitored during the process using ethanol as the mobile phase. The backpressure monitored during the pressure increase cycle is shown in the diagram.

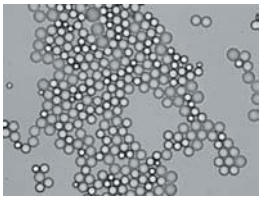
EternityXT before



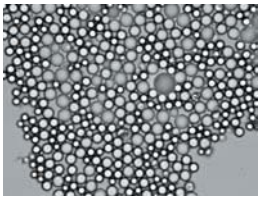
EternityXT after



Competitor before



Competitor after



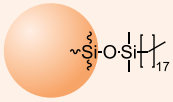
Key characteristics

In addition to the physical and chemical properties of Eternity and EternityXT, it is important to know some other facts. Manufacturing starts with the silica raw material and runs all the way through to the finished packing material. Controlling the total manufacturing process means the highest quality of the final product is guaranteed. All Kromasil products are manufactured in an ISO 9001 certified facility.

Product characteristics

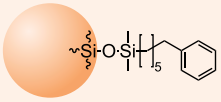
C18

	Eternity	EternityXT
ligand	octadecyl silane	
USP	L1	
pore size	100 Å	
particle size	2.5 and 5 µm	1.8, 2.5, 5 and 10 µm
surface area	330 m^2/g	
carbon load	14%	17%
endcapping	proprietary	
pH range	2-12	1-12



PhenylHexyl

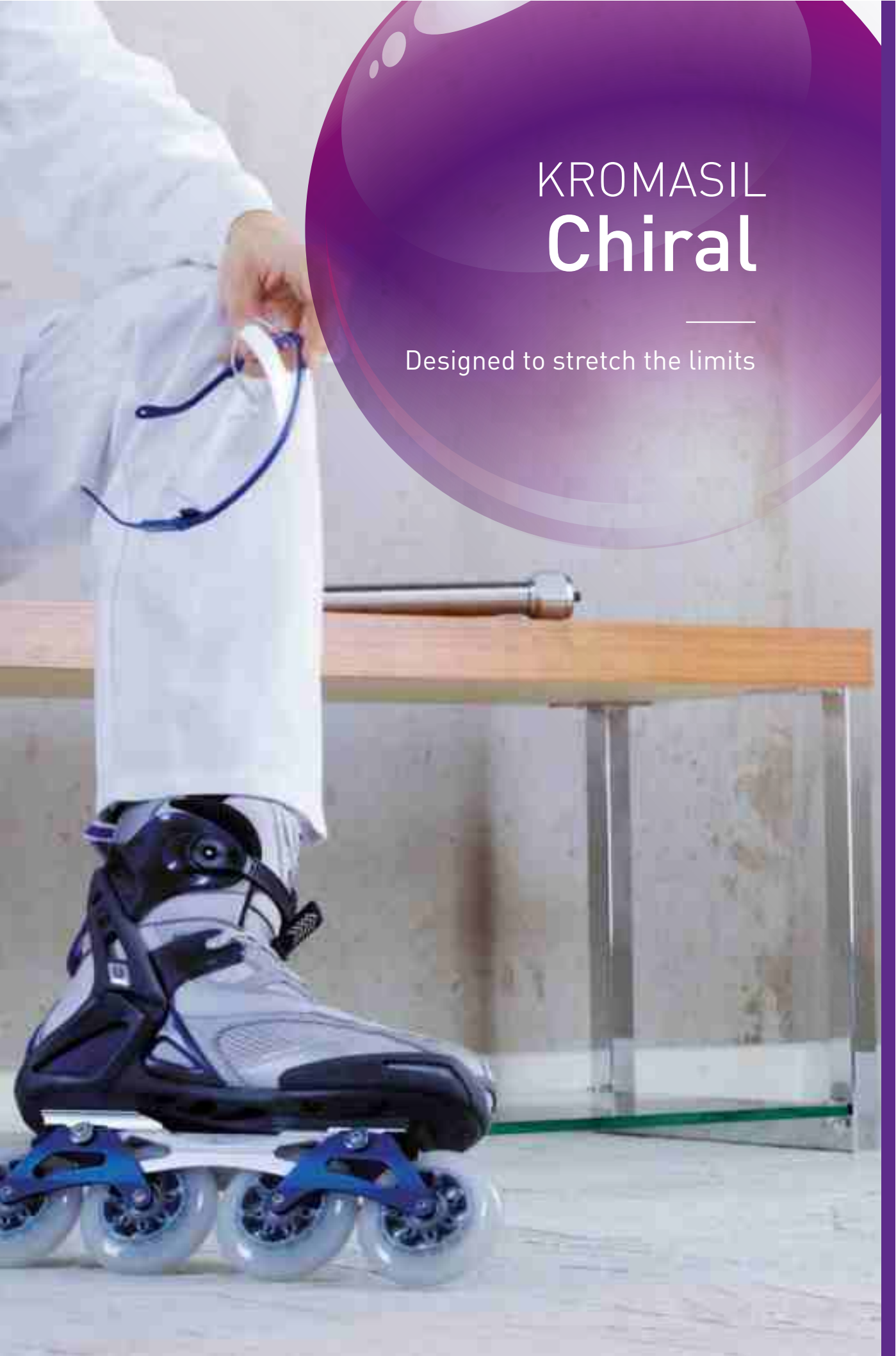
	Eternity	EternityXT
ligand	6-phenylhexyl	
USP	L11	
pore size	100 Å	
particle size	2.5 and 5 µm	1.8, 2.5 and 5 µm
surface area	330 m^2/g	
carbon load	12%	15%
endcapping	proprietary	
pH range	2-12	



Availability

Please check the tables with part numbers in the availability part of this guide.


Kromasil®
Chiral



KROMASIL
Chiral

Designed to stretch the limits

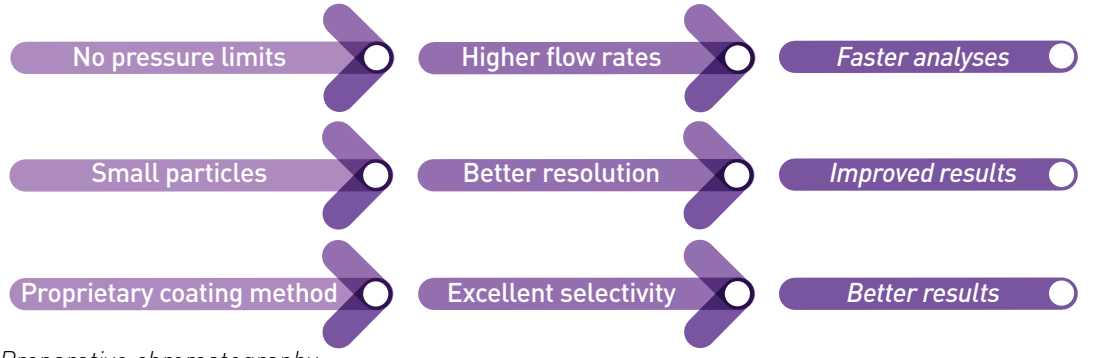
High-performing chiral phases

Polysaccharide-based Kromasil AmyCoat and CelluCoat stretch the limits for chiral chromatography. The silica is based on a proprietary matrix and coated with a functionalized amylose or cellulose selector.

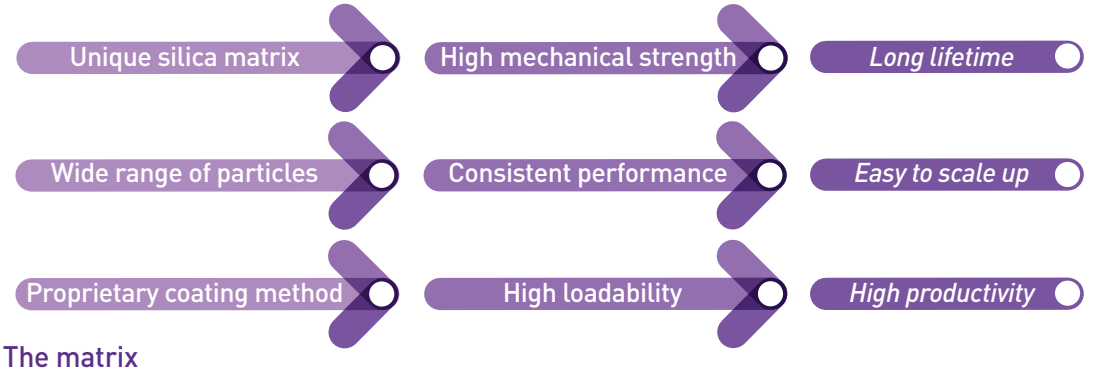
Kromasil AmyCoat and CelluCoat give high resolution, excellent selectivity and stable performance when switching between compatible mobile phases. Users do not have to worry about pressure limits, as both Kromasil AmyCoat and CelluCoat can withstand flow rates equivalent to pressures of up to 400 bar – i.e. the limit for most standard HPLC systems.

Summary of benefits for the Chiral platform

Analytical chromatography

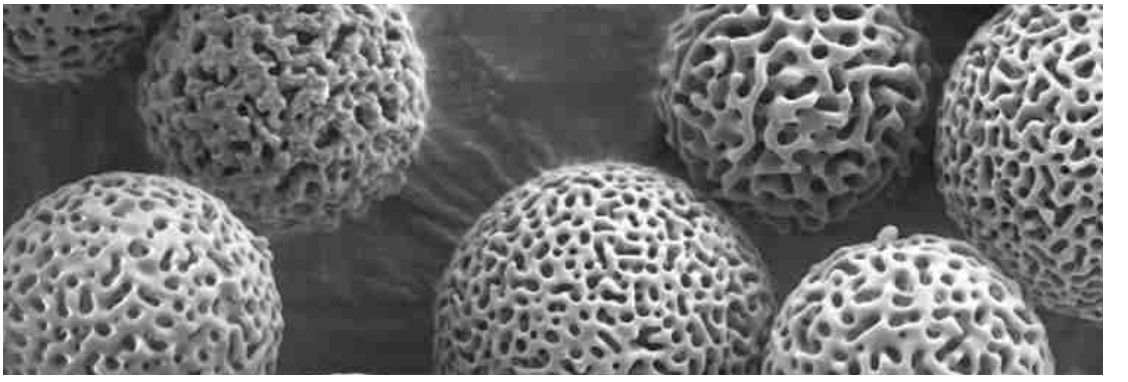


Preparative chromatography



The matrix

Kromasil Chiral is based on super-wide pore silica particles in sizes 3, 5, 10 and 25 µm.



Fast and easy method development

To speed up and simplify method development, AkzoNobel has removed some of the restrictions for coated polysaccharide phases. In analytical scale chromatography, 3 µm particles and the absence of pressure limits allow fast chromatography with good separation results.

Good results

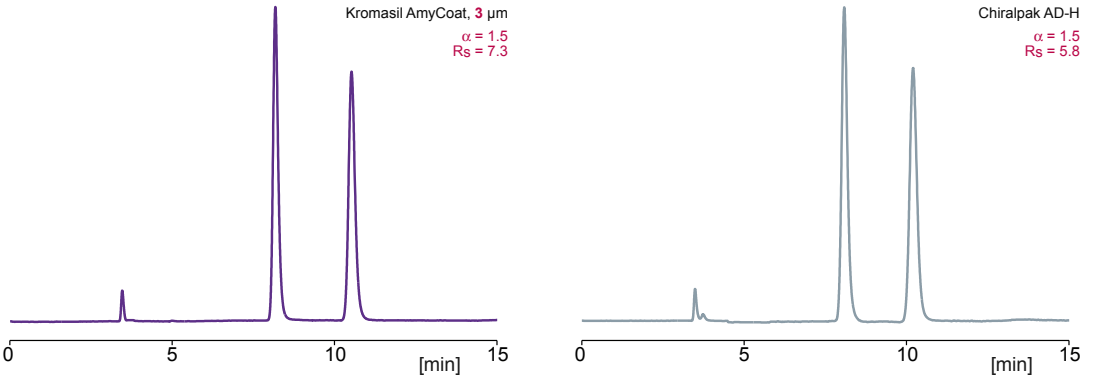
Kromasil AmyCoat and CelluCoat show excellent enantioselectivity for many racemates. In the application section of this guide, there are many chiral applications showing the performance levels scientists can expect.

By having access to 3 µm particles, higher plate count and resolution can be expected for analytical chromatography. Combined with excellent selectivity, this facilitates the separation of enantiomers.

Saving time

With Kromasil AmyCoat and CelluCoat, users get better results faster. Thanks to the absence of pressure limits, analytical chromatography can be run at very high flow rates and thereby save time.

Selectivity and resolution comparison –Kromasil AmyCoat 3 µm and Chiralpak AD-H (5 µm)

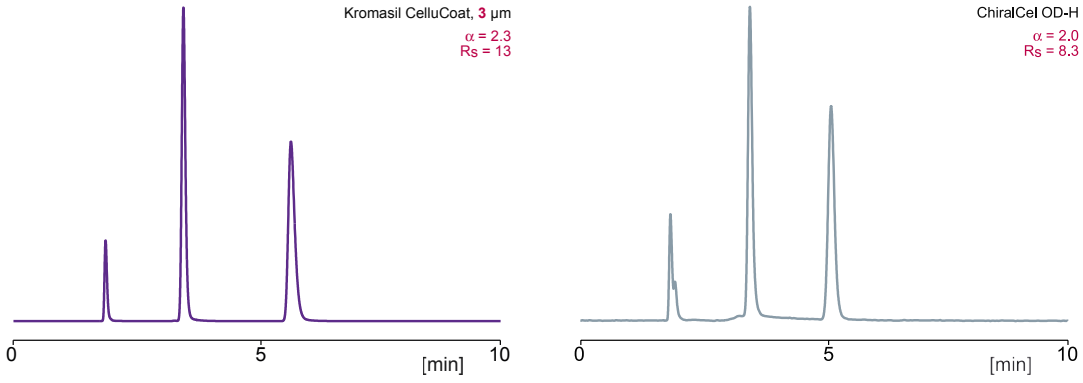


Conditions
Solute: Carbinoxamine
Mobile phase: Heptane / 2-Propanol / DEA (90/10/0.1)
Column size: 4.6 × 150 mm
Flow rate: 0.5 ml/min
Temperature: 22°C
Detection: UV 226 nm

	α		R_s	
	AmyCoat 3 µm	Chiralpak AD-H*	AmyCoat 3 µm	Chiralpak AD-H*
Ambucetamide	1.4	1.4	4.8	4.2
Carbinoxamine	1.5	1.5	7.3	5.8
Ketoprofen	1.4	1.3	4.6	4.3
Naproxen	1.2	1.2	3.4	3.1
Oxamniquine	1.2	1.2	3.3	3.1
Proglumide	2.7	2.8	11.8	9.0
Sulindac	1.3	1.3	4.8	3.9

*(5 µm)

Selectivity and resolution comparison –Kromasil CelluCoat 3 µm and Chiralcel OD-H (5 µm)

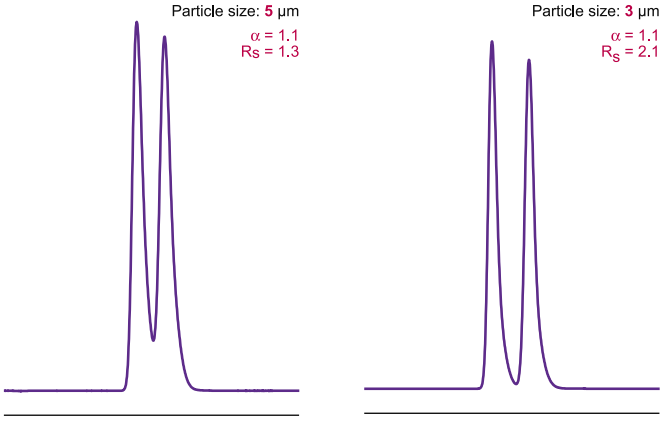


Conditions
Solute: trans-Stilbene oxide
Mobile phase: Heptane / 2-Propanol (90/10)
Column size: 4.6 x 150 mm
Flow rate: 1 ml/min
Temperature: 25°C
Detection: UV 229 nm

	α		R_s	
	CelluCoat 3 µm	Chiralcel OD-H*	CelluCoat 3 µm	Chiralcel OD-H*
Trans-Stilbene oxide	2.3	2.0	13.2	8.3
Benzoin	1.5	1.5	8.6	5.7
TFAE	2.9	2.9	14.7	11
Tröger's base	1.4	1.4	3.7	2.7
Oxprenolol	5.6	5.5	18.1	15.1
Naproxen	1.2	1.2	2.9	2.2
Proglumide	2.0	2.0	7.6	3.2

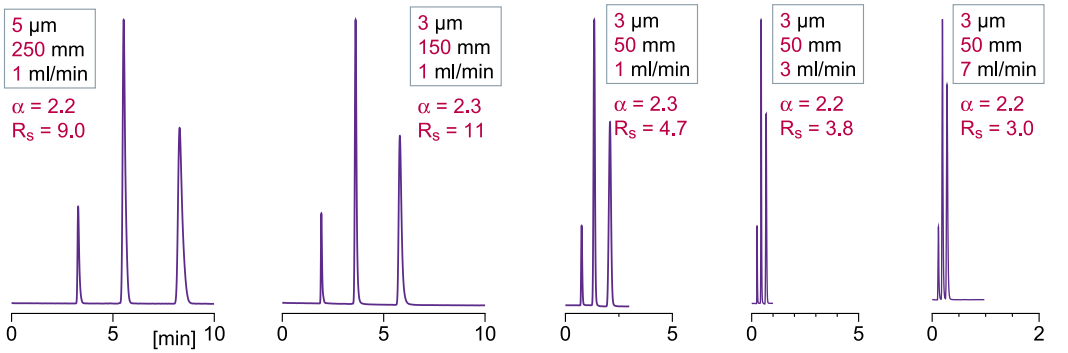
*(5 µm)

Difference in resolution–Kromasil AmyCoat 3 µm vs. 5 µm



Conditions
Columns: Kromasil *dp* AmyCoat 4.6 x 150 mm (*dp* = 5 and 3 µm, respectively)
Part number: C05ACA15 and C03ACA15
Solute: trans-2-phenyl-1-cyclohexanol
Mobile phase: heptane/2-propanol (95/5)
Flow rate: 1 ml/min
Temperature: 25°C
Detection: UV 220 nm

Fast analytical chromatography



Conditions

Columns: Kromasil *dp* CelluCoat 4.6 x *length* mm*
Part numbers: C05CCA25, C03CCA15 and C03CCA05

Solute: trans-stilbene oxide
Mobile phase: heptane/2-propanol (90/10)
Temperature: 25 °C
Detection: UV 229 nm

* where *dp* is 3 or 5 µm, and *length* is 50, 150 or 250 mm, as displayed respectively in figures

Makes everyday work so much easier

Kromasil AmyCoat and CelluCoat allow the user to perform method development without interference from restrictive parameters such as pressure limits, equilibration times and long-term performance.

The economy of chiral chromatography

The lack of restrictions on various parameters makes method development particularly user-friendly. One well-known restriction for coated polysaccharide phases is the general pressure limit over the bed. Kromasil AmyCoat and CelluCoat withstand flow rates equivalent to pressures of up to 400 bar—which is about the limit for a standard HPLC system itself. This allows users to run chiral chromatography very fast.

Stable performance

When it comes to stability, Kromasil AmyCoat and CelluCoat are compatible with normal, polar organic and reversed mobile phases. Switching between compatible normal to polar organic mobile phases does not lead to any reduction in performance and there is no need for solvent dedicated columns.

Short equilibration times

Column equilibration is a time-consuming activity when running chiral chromatography. In general, long equilibration times are most pronounced when switching mobile phases containing basic additives to acidic additives or the other way around. The test with a Kromasil CelluCoat 3 µm column switching between two compatible mobile phases shows how short the needed equilibration times actually are.

No memory effects

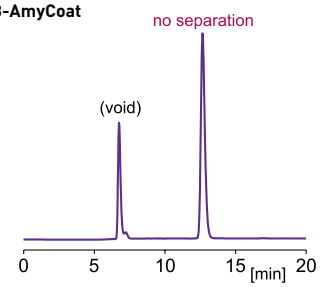
These two tests illustrate short equilibration times and additive switches for Kromasil AmyCoat and CelluCoat with absolutely no sign of memory effects.

Reverse phase compatibility

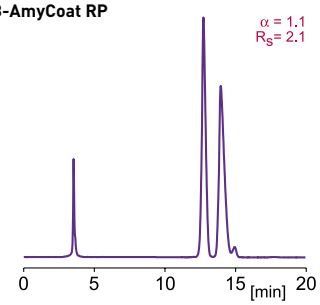
Many chiral separations are run under normal phase conditions. Sometimes, though, reversed-phase conditions are required to achieve separation. While it is possible to convert Kromasil AmyCoat or CelluCoat columns to run under RP-mode, it might be quicker and more efficient to use a column initially conditioned for RP-mode: Kromasil AmyCoat RP and CelluCoat RP.

Extend your action range

Kromasil 3-AmyCoat



Kromasil 3-AmyCoat RP



Conditions

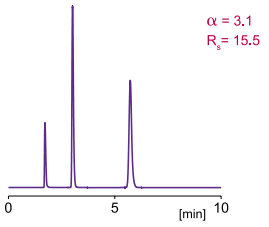
NP column: Kromasil 3-AmyCoat 4.6 x 150 mm
RP column: Kromasil 3-AmyCoat RP 4.6 x 150 mm
Part numbers: C03ACA15 and C03ARA15, respectively
NP mobile phase: heptane / 2-propanol (90/10)
RP mobile phase: acetonitrile / water (40/60)
Solute: 2-phenyl-2-butanol
Flow rates: 0.25 ml/min and 0.5 ml/min, respectively
Temperature: 22 °C
Detection: UV @ 210 nm and 254 nm, respectively

Stable performance – No pressure limits – Freedom to switch solvents

Identical result — **Identical result**

Before

Solute: trans-Stilbene oxide

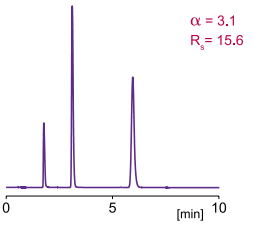


Test sequence

Mobile phase	Flow rate [ml/min]	Run time [h]	Total back-pressure [bar]
1. Heptane/2-Propanol (90/10)	4.3	2	345
2. 2-Propanol	0.7	2	260
3. Acetonitrile	1	2	58
4. Ethanol	1	2	188
5. Heptane/2-Propanol (90/10)	1	2	72

After

Solute: trans-Stilbene oxide



Conditions

Column: Kromasil 3-AmyCoat 4.6 × 150 mm
Part number: C03ACA15

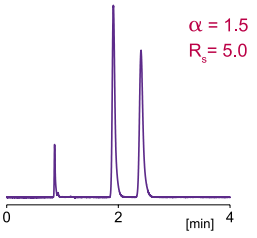
Mobile phase: heptane / 2-propanol (90/10)
Flow rate: 1 ml/min

Temperature: 25 °C
Detection: UV 229 nm

Short equilibration times – Freedom to switch additives

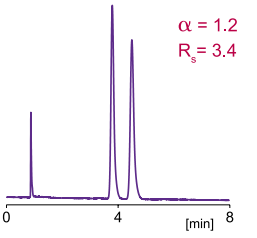
Identical result — **Identical result**

Mobile phase 1
Solute: Carbinoxamine
Detection: UV 228 nm



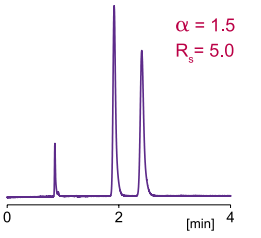
Equilibration
Mobile phase 2
Duration: 18 min

Mobile phase 2
Solute: Ketoprofen
Detection: UV 250 nm



Equilibration
Mobile phase 1
Duration: 12 min

Mobile phase 1
Solute: Carbinoxamine
Detection: UV 228 nm



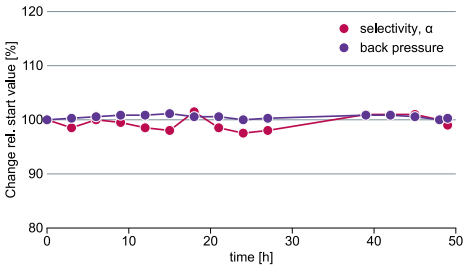
Conditions

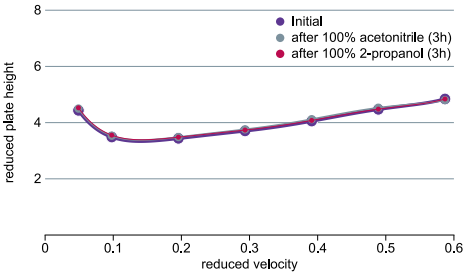
Column: Kromasil 3-AmyCoat 4.6 x 150 mm
Part number: C03ACA15

Mobile phase 1:
heptane / 2-propanol/DEA (90/10/0.1)
Mobile phase 2:
heptane / 2-propanol/TFA (90/10/0.1)

Sample 1/2: carbinoxamine / ketoprofen
Flow rate: 2 ml/min
Temperature: 25 °C
Detection 1/2: UV @ 228 nm / UV @ 250 nm

Stable performance – No pressure limits – Freedom to switch solvents

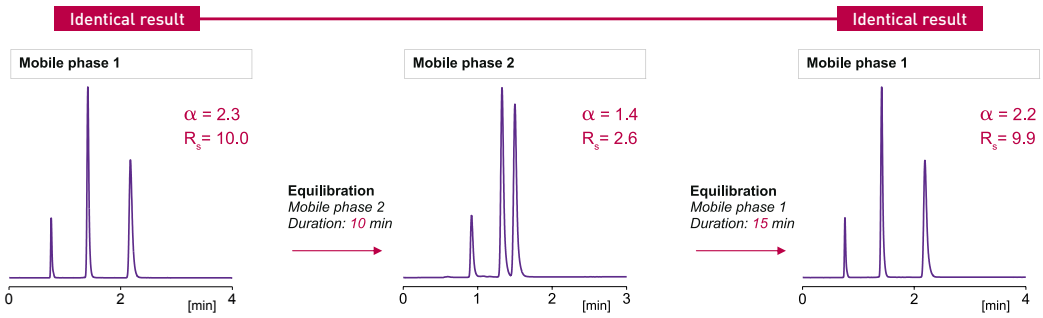




Conditions
Column: Kromasil 3-CelluCoat 4.6 x 50 mm
Part number: C03CCA05
Mobile phase: heptane/2-propanol (90/10)
Solute: trans-stilbene oxide
Flow rate: 7 ml/min
Temperature: 25 °C

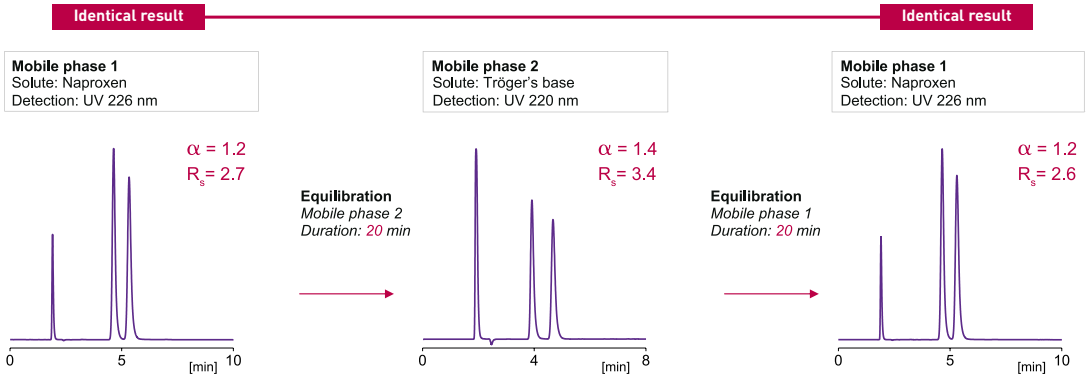
Conditions
Column: Kromasil 5-CelluCoat 4.6 x 250 mm
Part number: C05CCA25
Mobile phase: heptane / 2-propanol (90/10)
Solute: trans-stilbene oxide
Flow rates: 0.1-1.2 ml/min
Temperature: 25 °C

Short equilibration times – Freedom to switch solvents



Conditions
Column: Kromasil 3-CelluCoat 4.6 x 150 mm
Part number: C03CCA25
Mobile phase 1: heptane / 2-propanol (90/10)
Mobile phase 2: ethanol
Solute: trans-stilbene oxide
Flow rate: 2 ml/min
Temperature: 25 °C
Detection: UV 229 nm
Equilibration 1 with mobile phase 2: 10 min
Equilibration 2 with mobile phase 1: 15 min

Short equilibration times – Freedom to switch additives



Conditions
Column: Kromasil 3-CelluCoat 4.6 x 150 mm
Part number: C03CCA15

Mobile phase 1:
heptane / 2-propanol/TFA (90/10/0.1)
Mobile phase 2:
heptane / 2-propanol/DEA (90/10/0.1)

Sample 1/2: naproxene / Tröger's base
Flow rate: 1 ml/min
Temperature: 25 °C
Detection 1/2: UV @ 226 nm / UV @ 220 nm

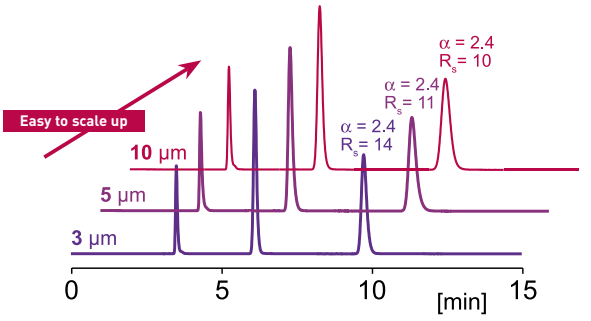
Works all the way

Kromasil products are well known for their ability to work along the whole spectrum from analytical to industrial scale chromatography. Kromasil AmyCoat and CelluCoat are no exception.

Simplifies method development

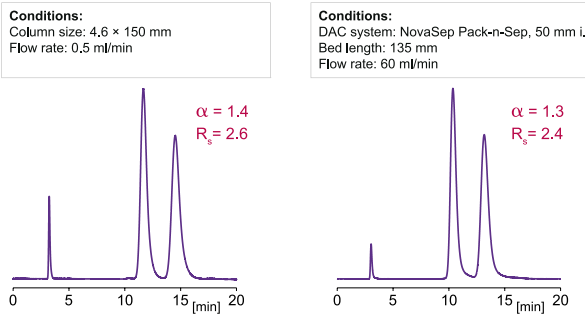
With particle sizes from 3 µm to 25 µm giving identical selectivity, Kromasil AmyCoat and CelluCoat make it easy to scale up while retaining excellent performance. As for all Kromasil products, the user can perform the required method development in analytical scale columns and then scale up to a larger column. For example, 3 µm particles in an analytical scale column can be scaled to a larger column packed with 10 µm particles. If the initial goal is to scale up the process, an analytical column packed with 10 µm particles can be used right from the start.

Easy to scale up



Conditions
Columns: Kromasil *dp* CelluCoat, 4.6 × 150 mm, where *dp* = 3, 5 and 10 µm, respectively
Part numbers: C03CCA15, C05CCA15 and C10CCA15
Mobile phase: heptane/2-propanol (90/10)
Solute: trans-stilbene oxide
Flow rate: 0.5 ml/min
Temperature: 25 °C
Detection: UV @ 229 nm

Kromasil AmyCoat

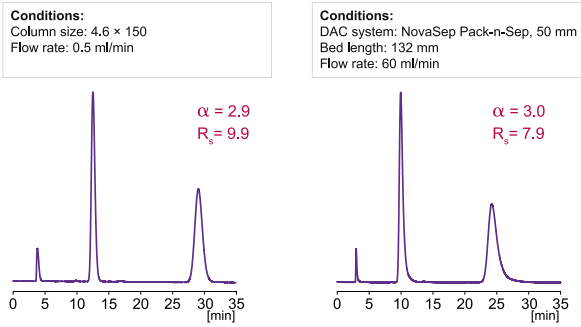


Conditions
Stationary phase: Kromasil AmyCoat, 10 µm
Mobile phase: heptane/2-propanol (90/10)
Solute: trifluoro-anthrylethanol
Temperature: 20 °C
Detection: UV @ 254 nm

Analytical conditions
Column size: 4.6 × 150 mm
Part number: C10ACA15
Flow rate: 0.5 ml/min

Prep conditions
DAC system: NovaSep Pack-n-Sep, 50 mm i.d.
Bed length: 135 mm
Flow rate: 60 ml/min

Kromasil CelluCoat



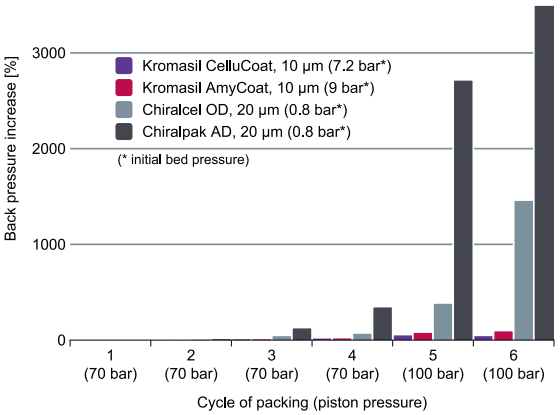
Conditions
Stationary phase: Kromasil CelluCoat, 10 µm
Mobile phase: heptane/2-propanol (90/10)
Solute: trifluoro-anthrylethanol
Temperature: 20 °C
Detection: UV @ 254 nm

Analytical conditions
Column size: 4.6 × 150 mm
Part number C10CCA15
Flow rate: 0.5 ml/min

Prep conditions
DAC system: NovaSep Pack-n-Sep, 50 mm i.d.
Bed length: 132 mm
Flow rate: 60 ml/min

Mechanically strong

Mechanical strength is an important product lifetime parameter. Kromasil AmyCoat and CelluCoat have mechanically strong spherical silica, which withstands repeated cycles of packing. The test was designed to exert greater than normal mechanical stress on the chiral stationary phases, and is performed at a packing pressure above the maximum 50 bar recommended by the manufacturer of Chiralcel OD and Chiralpak AD.



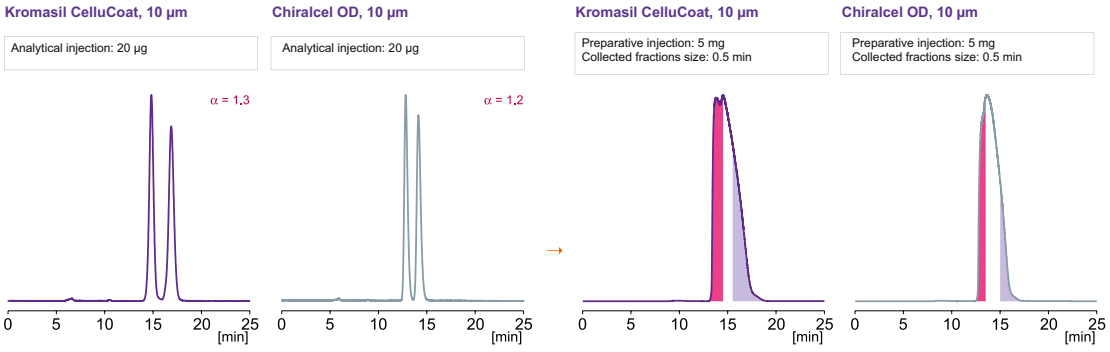
The relative backpressure increase is a measure of the degree of degradation of the material after repeated packings. Actual particle size for Chiralcel and Chiralpak is about three times larger than that for Kromasil, which explains the difference in initial backpressure (backpressure is inversely proportional to the square of the particle size).

Fully back-integrated

AkzoNobel manufactures the super wide pore silica for Kromasil polysaccharide products and performs all subsequent steps leading to the final product. All products are fully traceable.

Every manufacturing step is ensured through AkzoNobel's detailed quality system, and the final product is never released until it has passed a rigorous quality control test sequence.

See the application part of this guide for examples of preparative applications of Kromasil AmyCoat and CelluCoat.



Purity and Yield from fraction analysis:

	Enantiomer 1		Enantiomer 2	
	Purity [%]	Yield [%]	Purity [%]	Yield [%]
Kromasil CelluCoat	91.2	73.3	94.4	50.1
Daicel Chiralcel OD	91.4	46.7	96.6	24.9

Conditions

Columns: Kromasil 10-CelloCoat 4.6 x 250 mm and Daicel Chiralcel OD (10 µm) 4.6 x 250 mm, respectively

Mobile phase: heptane / 2-propanol/TFA (90/10/0.1)

Sample: Naproxen

Flow rate: 0.5 ml/min

Temperature: 25 °C

Analytical conditions

Sample load: 20 µg

Preparative conditions

Sample load: 5 mg

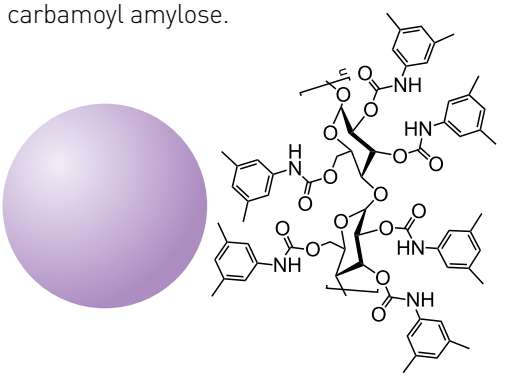
fraction size: 0.5 min

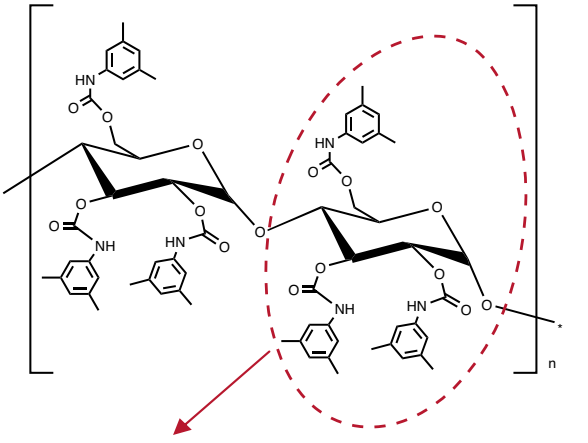
Product characteristics

Chiral selector

Kromasil AmyCoat and AmyCoat RP

The coated selector is tris-(3.5-dimethylphenyl) carbamoyl amylose.

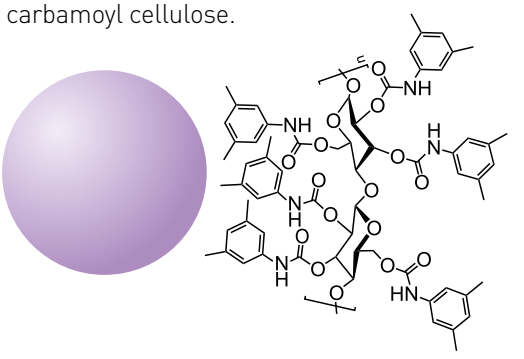


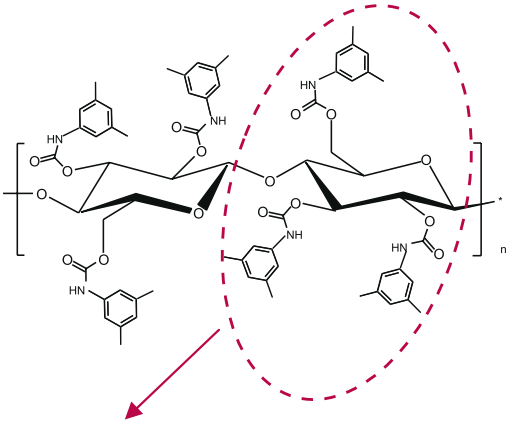


tris-(3.5-dimethylphenyl)carbamoyl amylose

Kromasil CelluCoat and CelluCoat RP

The coated selector is tris (3.5-dimethylphenyl) carbamoyl cellulose.





tris-(3.5-dimethylphenyl)carbamoyl cellulose

Compatible mobile phases

Kromasil AmyCoat and CelluCoat

alkane/2-propanol	100/0 to 0/100
alkane/ethanol	100/0 to 0/100
alkane/methanol	100/0 to 0/100
alkane/MTBE	100/0 to 50/50
ethanol/methanol	100/0 to 0/100
(SFC) CO_2/alcohol	100/0 to 50/50

Kromasil AmyCoat only

acetonitrile/methanol	0/100 to 15/85 85/15 to 100/0
acetonitrile/2-propanol	100/0 to 0/100
ethanol/MTBE	100/0 to 70/30

Kromasil CelluCoat only

acetonitrile/methanol	85/15 to 100/0
ethanol/MTBE	100/0 to 50/50

Kromasil AmyCoat RP and CelluCoat RP

Aqueous solution	Organic modifiers	Organic part	Temperature
acetic acid, 0.1%	*For all listed aqueous solutions:* acetonitrile, methanol, ethanol, 2-propanol	10-100 %	5-40°C
potassium phosphate buffer 0-0.5 M, pH 2.0-8.0 (i.e. 50 mM at pH 2.0, 20 mM at pH 8.0)		10-85%	pH < 7: 5-40°C pH > 7: 5-25°C
phosphoric acid, aq. sol. at pH 2.0		as above	as above
sodium hexafluorophosphate aq. sol. (i.e. 100 mM at pH 2.0, 50 mM at pH 5.0)		as above	as above
sodium borate buffer 0-0.2 M, pH 7.5-9.0 (i.e. 20 mM at pH 9.0)		as above	5-25°C
water		10-100 %	5-40°C

Availability

Please check the tables with part numbers in the availability part of this guide.

Kromasil®
SFC

KROMASIL
SFC

Designed for green technology

Columns for efficient SFC

Through the years, Kromasil has become the first choice for SFC separations for reliability and reproducibility. Kromasil SFC is built upon this legacy.

The natural choice

Briefly, carbon dioxide is the main component of the SFC mobile carrier, which can be accompanied by small percentages of modifiers such as methanol. The use of mostly carbon dioxide is seen as an environmentally sound approach. It is also a way to reduce operating costs in the laboratory as the cost of carbon dioxide is significantly lower than acetonitrile or methanol.

In addition, due to the physics involved, SFC is a tool for quick sample turnaround. This is especially true when moving to drug development and production, where the user can minimize eluent evaporation time in the fractions collected, increasing overall productivity in the laboratory and manufacturing.

Based on Kromasil silica particles, the Kromasil superficial fluid chromatography (SFC) platform is a set of columns that meets the increased interest for green technologies and sustainable solutions in the laboratory.

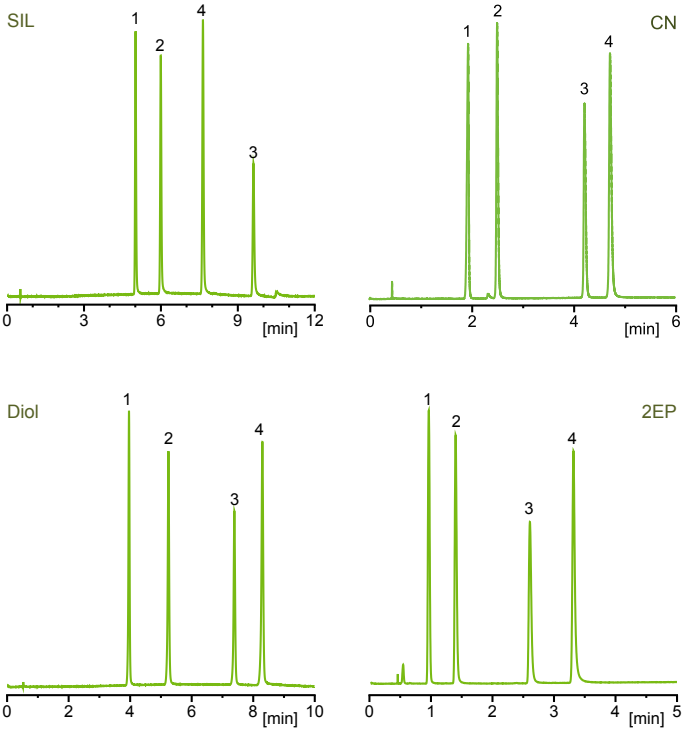
Analytical SFC columns

Based on 100 Å pore size and 2.5 µm particles, Kromasil SFC gives users fast separations. The columns are tailor-made for research, discovery and routine analysis.

Many options

Kromasil SFC columns are delivered in cyano, diol, silica, and 2-ethylpyridine chemistries for the laboratory scientist to separate and analyze a wide range of substances, from non-polar to strongly polar compounds.

The stationary phase quartet



Separation of -blockers

By using this standard set of Kromasil SFC columns, the user can efficiently screen the material that works best for a given sample.

Conditions

Stationary phase: Kromasil SFC, 2.5 µm phase chemistry as in figure
Part numbers: FH2SIC15, FH2CNC15, FH2DIC15, FH2EPC15
Column size: 3.0 x 150 mm
Eluent: CO_2 / methanol + 20 mM ammonia
Gradient: 0 min: 5%, 10 min: 30% methanol
Flow rate: 2 ml/min

Substances: 1 = alprenolol
2 = propranolol
3 = acebutolol
4 = pindolol

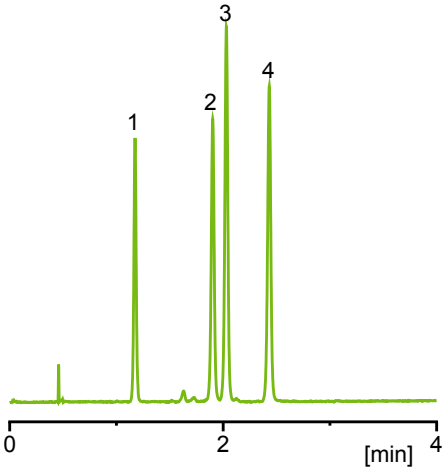
Temperature: 40°C
Outlet pressure: 120 bar
Detection: ES-MS and UV @ 220 nm

Fast separations

Medium and high throughput laboratories working with green technology and seeking to improve turnaround time can take advantage of the separation power of the Kromasil SFC 2.5 µm family of columns.

Separation of steroids

With the chromatographic power of Kromasil SFC cyano phase users can easily achieve baseline resolution within 2.5 minutes of a generic linear gradient.



Conditions
Stationary phase: Kromasil SFC, 2.5 µm, CN, 3.0 x 150 mm
Part number: FH2CNC15
Eluent: CO_2 / methanol
Gradient: 0 min: 5%, 10 min: 30% methanol
Flow rate: 2 ml/min

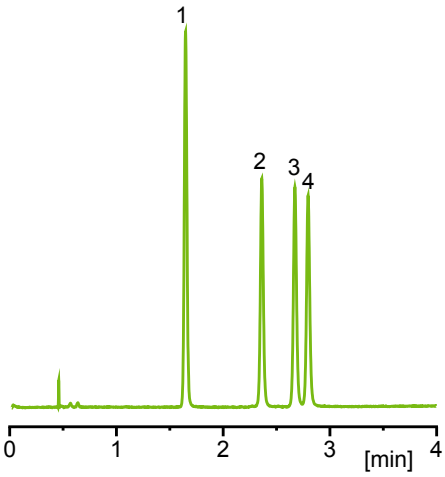
Substances: 1 = deoxycorticosterone
2 = corticosterone
3 = cortisone
4 = hydrocortisone

Temperature: 40°C
Outlet pressure: 120 bar
Detection: ES-MS and UV @ 220 nm

Selectivity for SFC

Separation of anti-inflammatory drugs

With its endcapping and aromatic properties, Kromasil SFC with 2-ethylpyridine offers a unique separation power that makes it standout from the rest.



Conditions
Column: Kromasil SFC, 2.5 µm, 2EP, 3.0 x 150 mm
Part numbers: FH2EPC15
Eluent: CO_2 / methanol
Gradient: 0 min: 5%, 10 min: 30% methanol
Flow rate: 2 ml/min

Substances: 1 = ibuprofen
2 = fenoprofen
3 = flurbiprofen
4 = ketoprofen

Temperature: 40°C
Outlet pressure: 120 bar
Detection: ES-MS and UV @ 220 nm

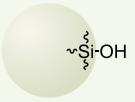
Note: Application results and chromatograms in this SFC section are courtesy of AstraZeneca, Mölndal, Sweden.

Product characteristics

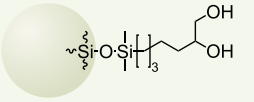
Characteristics

Kromasil SFC is based on a porous silica particle with 100 Å pore size and 2.5 µm particle size.

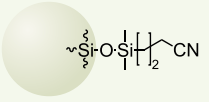
SIL: Bare silica



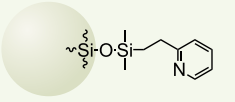
Diol: Diol
Coverage: 3.4 µmol/m²



CN: Cyano
Coverage: 4.0 µmol/m²



2EP: 2-ethylpyridine
Coverage: 3.8 µmol/m²



Availability

Please check the tables with part numbers in the availability of this guide.


db

THE KROMASIL PRODUCT AVAILABILITY

Product codes for Kromasil bulk media and columns are given in the tables of this chapter. Listed are items that are believed to be the most interesting to users. Other column combinations not listed here may be available or packed upon request. Contact AkzoNobel offices or the local distributor for enquiries.

Ordering Kromasil products

Contact info

AkzoNobel Pulp and Performance Chemicals
Separation Products, SE-445 80 Bohus, Sweden.
Tel +46 31 58 70 00,
Fax +46 31 58 77 27

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22F, Eco City, No. 1788 West Nanjing Road, Jingan District Shanghai 200040, P. R. China
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Availability tables

Kromasil bulk media for HPLC, SFC and SMB

Availability for Kromasil bulk media

		Particle size, [µm]									
Family	**Phase**	**1.8**	**2.5**	**3**	**3.5**	**5**	**7**	**10**	**13**	**16**	**25**
60 Å	SIL					S05SIblk	S07SIblk	S10SIblk	S13SIblk	S16SIblk	
60 Å	CN					●		S10CNblk		S16CNblk	
60 Å	Diol					●		S10DIblk			
60 Å	HILIC-D					●		S10HDblk			
100 Å	SIL	MF1SIblk	MH2SIblk		MH3SIblk	M05SIblk	M07SIblk	M10SIblk	M13SIblk	M16SIblk	
100 Å	C1					●					
100 Å	C4	●	●		●	●	M07CSblk	M10CSblk	M13CSblk	M16CSblk	
100 Å	C8	●	●		●	●	M07CMblk	M10CMblk	M13CMblk	M16CMblk	
100 Å	C18	●	●		●	●	M07CLblk	M10CLblk	M13CLblk	M16CLblk	
100 Å	NH2				●	●	M07NHblk	M10NHblk	M13NHblk	M16NHblk	
100 Å	Phenyl					●		M10PHblk		M16PHblk	
300 Å	SIL					L05SIblk		L10SIblk		L16SIblk	
300 Å	C4					●		L10CSblk		L16CSblk	
300 Å	C8					●		L10CMblk		L16CMblk	
300 Å	C18					●		L10CLblk		L16CLblk	
Eternity	C18		●			●					
Eternity	PhenylHexyl		●			●					
EternityXT	C18	●	●			●		X10CLblk			
EternityXT	PhenylHexyl	●	●			●					
Chiral	AmyCoat			●		●		C10ACblk			C25ACblk
Chiral	AmyCoat RP			●		●					
Chiral	CelluCoat			●		●		C10CCblk			C25CCblk
Chiral	CelluCoat RP			●		●					
SFC	CN		●								
SFC	Diol		●								
SFC	2EP		●								
SFC	SIL		FH2SIblk								

● : analytical product, only available in slurry-packed columns

Kromasil Classic columns for UHPLC and HPLC

Kromasil Classic, 2.1 mm i.d. columns

			column size, i.d. × length [mm]			
Family	**Phase**	**particle size [µm]**	**2.1 × 33**	**2.1 × 50**	**2.1 × 100**	**2.1 × 150**
60Å	**SIL**	**5**		S05SID05	S05SID10	S05SID15
60Å	**CN**	**5**		S05CND05	S05CND10	S05CND15
60Å	**Diol**	**5**		S05DID05	S05DID10	S05DID15
60Å	**HILIC-D**	**5**		S05HDD05	S05HDD10	S05HDD15
100Å	**SIL**	**3.5**		MH3SID05	MH3SID10	MH3SID15
100Å	**SIL**	**5**		M05SID05	M05SID10	M05SID15
100Å	**C4**	**1.8**		MF1CSD05	MF1CSD10	
100Å	**C4**	**2.5**		MH2CSD05	MH2CSD10	
100Å	**C4**	**3.5**		MH3CSD05	MH3CSD10	MH3CSD15
100Å	**C4**	**5**		M05CSD05	M05CSD10	M05CSD15
100Å	**C8**	**1.8**		MF1CMD05	MF1CMD10	
100Å	**C8**	**2.5**		MH2CMD05	MH2CMD10	
100Å	**C8**	**3.5**		MH3CMD05	MH3CMD10	MH3CMD15
100Å	**C8**	**5**		M05CMD05	M05CMD10	M05CMD15
100Å	**C18**	**1.8**		MF1CLD05	MF1CLD10	
100Å	**C18**	**2.5**		MH2CLD05	MH2CLD10	
100Å	**C18**	**3.5**		MH3CLD05	MH3CLD10	MH3CLD15
100Å	**C18**	**5**		M05CLD05	M05CLD10	M05CLD15
100Å	**NH2**	**3.5**		MH3NHD05	MH3NHD10	MH3NHD15
100Å	**NH2**	**5**		M05NHD05	M05NHD10	M05NHD15
100Å	**Phenyl**	**5**		M05PHD05	M05PHD10	M05PHD15
300Å	**SIL**	**5**	L05SIDT3	L05SID05	L05SID10	L05SID15
300Å	**C4**	**5**		L05CSD05	L05CSD10	L05CSD15
300Å	**C8**	**5**		L05CMD05	L05CMD10	L05CMD15
300Å	**C18**	**5**		L05CLD05	L05CLD10	L05CLD15

Kromasil Classic, 3.0 mm i.d. columns

			column size, i.d. × length [mm]				
Family	**Phase**	**particle size [µm]**	**3.0 × 50**	**3.0 × 100**	**3.0 × 125**	**3.0 × 150**	**3.0 × 250**
60Å	**SIL**	**5**	S05SIC05	S05SIC10		S05SIC15	
60Å	**CN**	**5**	S05CNC05	S05CNC10		S05CNC15	
60Å	**Diol**	**5**	S05DIC05	S05DIC10		S05DIC15	
60Å	**HILIC-D**	**5**	S05HDC05	S05HDC10		S05HDC15	
100Å	**SIL**	**3.5**	MH3SIC05	MH3SIC10		MH3SIC15	
100Å	**SIL**	**5**	M05SIC05	M05SIC10		M05SIC15	
100Å	**C4**	**1.8**	MF1CSC05	MF1CSC10			
100Å	**C4**	**2.5**	MH2CSC05	MH2CSC10			
100Å	**C4**	**3.5**	MH3CSC05	MH3CSC10		MH3CSC15	
100Å	**C4**	**5**	M05CSC05	M05CSC10		M05CSC15	
100Å	**C8**	**1.8**	MF1CMC05	MF1CMC10			
100Å	**C8**	**2.5**	MH2CMC05	MH2CMC10			
100Å	**C8**	**3.5**	MH3CMC05	MH3CMC10		MH3CMC15	
100Å	**C8**	**5**	M05CMC05	M05CMC10		M05CMC15	
100Å	**C18**	**1.8**	MF1CLC05	MF1CLC10			
100Å	**C18**	**2.5**	MH2CLC05	MH2CLC10			
100Å	**C18**	**3.5**	MH3CLC05	MH3CLC10	MH3CLC1F	MH3CLC15	MH3CLC25
100Å	**C18**	**5**	M05CLC05	M05CLC10	M05CLC1F	M05CLC15	M05CLC25
100Å	**NH2**	**3.5**	MH3NHC05	MH3NHC10		MH3NHC15	
100Å	**NH2**	**5**	M05NHC05	M05NHC10		M05NHC15	
100Å	**Phenyl**	**5**	M05PHC05	M05PHC10		M05PHC15	
300Å	**SIL**	**5**	L05SIC05	L05SIC10		L05SIC15	
300Å	**C4**	**5**	L05CSC05	L05CSC10		L05CSC15	
300Å	**C8**	**5**	L05CMC05	L05CMC10		L05CMC15	
300Å	**C18**	**5**	L05CLC05	L05CLC10		L05CLC15	

Kromasil Classic, 3.9 mm i.d. columns

			column size, i.d. × length [mm]		
Family	**Phase**	**particle size [µm]**	**3.9 × 150**	**3.9 × 250**	**3.9 × 300**
60Å	**CN**	**10**		S10CNJ25	
100Å	**C18**	**10**	M10CLJ15	M10CLJ25	M10CLJ30

Kromasil 60 Å, 4.0 mm i.d. columns

			column size, i.d. × length [mm]			
Family	**Phase**	**particle size [µm]**	**4.0 × 50**	**4.0 × 100**	**4.0 × 150**	**4.0 × 250**
60Å	**SIL**	**5**	S05SIB05	S05SIB10	S05SIB15	S05SIB25
60Å	**SIL**	**7**	S07SIB05	S07SIB10	S07SIB15	S07SIB25
60Å	**SIL**	**10**	S10SIB05	S10SIB10	S10SIB15	S10SIB25
60Å	**SIL**	**13**	S13SIB05	S13SIB10	S13SIB15	S13SIB25
60Å	**SIL**	**16**	S16SIB05	S16SIB10	S16SIB15	S16SIB25
60Å	**CN**	**5**	S05CNB05	S05CNB10	S05CNB15	S05CNB25
60Å	**CN**	**10**	S10CNB05	S10CNB10	S10CNB15	S10CNB25
60Å	**CN**	**16**	S16CNB05	S16CNB10	S16CNB15	S16CNB25
60Å	**Diol**	**5**	S05DIB05	S05DIB10	S05DIB15	S05DIB25
60Å	**Diol**	**10**	S10DIB05	S10DIB10	S10DIB15	S10DIB25
60Å	**HILIC-D**	**5**	S05HDB05	S05HDB10	S05HDB15	S05HDB25
60Å	**HILIC-D**	**10**	S10HDB05	S10HDB10	S10HDB15	S10HDB25

Kromasil 100 Å, 4.0 mm i.d. columns

			column size, i.d. × length [mm]		
Family	**Phase**	**particle size [µm]**	**4.0 × 125**	**4.0 × 200**	**4.0 × 300**
100Å	**C8**	**5**	M05CMB1F		
100Å	**C8**	**10**			M10CMB30
100Å	**C18**	**5**	M05CLB1F	M05CLB20	M05CLB30
100Å	**C18**	**10**			M10CLB30

Kromasil 100 Å, 4.0 mm i.d. columns

			column size, i.d. × length [mm]			
Family	**Phase**	**particle size [µm]**	**4.0 × 50**	**4.0 × 100**	**4.0 × 150**	**4.0 × 250**
100Å	**SIL**	**3.5**	MH3SIB05	MH3SIB10	MH3SIB15	MH3SIB25
100Å	**SIL**	**5**	M05SIB05	M05SIB10	M05SIB15	M05SIB25
100Å	**SIL**	**7**	M07SIB05	M07SIB10	M07SIB15	M07SIB25
100Å	**SIL**	**10**	M10SIB05	M10SIB10	M10SIB15	M10SIB25
100Å	**SIL**	**13**	M13SIB05	M13SIB10	M13SIB15	M13SIB25
100Å	**SIL**	**16**	M16SIB05	M16SIB10	M16SIB15	M16SIB25
100Å	**C4**	**3.5**	MH3CSB05	MH3CSB10	MH3CSB15	MH3CSB25
100Å	**C4**	**5**	M05CSB05	M05CSB10	M05CSB15	M05CSB25
100Å	**C4**	**7**	M07CSB05	M07CSB10	M07CSB15	M07CSB25
100Å	**C4**	**10**	M10CSB05	M10CSB10	M10CSB15	M10CSB25
100Å	**C4**	**13**	M13CSB05	M13CSB10	M13CSB15	M13CSB25
100Å	**C4**	**16**	M16CSB05	M16CSB10	M16CSB15	M16CSB25
100Å	**C8**	**3.5**	MH3CMB05	MH3CMB10	MH3CMB15	MH3CMB25
100Å	**C8**	**5**	M05CMB05	M05CMB10	M05CMB15	M05CMB25
100Å	**C8**	**7**	M07CMB05	M07CMB10	M07CMB15	M07CMB25
100Å	**C8**	**10**	M10CMB05	M10CMB10	M10CMB15	M10CMB25
100Å	**C8**	**13**	M13CMB05	M13CMB10	M13CMB15	M13CMB25
100Å	**C8**	**16**	M16CMB05	M16CMB10	M16CMB15	M16CMB25
100Å	**C18**	**3.5**	MH3CLB05	MH3CLB10	MH3CLB15	MH3CLB25
100Å	**C18**	**5**	M05CLB05	M05CLB10	M05CLB15	M05CLB25
100Å	**C18**	**7**	M07CLB05	M07CLB10	M07CLB15	M07CLB25
100Å	**C18**	**10**	M10CLB05	M10CLB10	M10CLB15	M10CLB25
100Å	**C18**	**13**	M13CLB05	M13CLB10	M13CLB15	M13CLB25
100Å	**C18**	**16**	M16CLB05	M16CLB10	M16CLB15	M16CLB25
100Å	**NH2**	**3.5**	MH3NHB05	MH3NHB10	MH3NHB15	MH3NHB25
100Å	**NH2**	**5**	M05NHB05	M05NHB10	M05NHB15	M05NHB25
100Å	**NH2**	**7**	M07NHB05	M07NHB10	M07NHB15	M07NHB25
100Å	**NH2**	**10**	M10NHB05	M10NHB10	M10NHB15	M10NHB25
100Å	**NH2**	**13**	M13NHB05	M13NHB10	M13NHB15	M13NHB25
100Å	**NH2**	**16**	M16NHB05	M16NHB10	M16NHB15	M16NHB25
100Å	**Phenyl**	**5**	M05PHB05	M05PHB10	M05PHB15	M05PHB25
100Å	**Phenyl**	**10**	M10PHB05	M10PHB10	M10PHB15	M10PHB25
100Å	**Phenyl**	**16**	M16PHB05	M16PHB10	M16PHB15	M16PHB25

Kromasil 300 Å, 4.0 mm i.d. columns

			column size, i.d. × length [mm]			
Family	**Phase**	**particle size [µm]**	**4.0 × 50**	**4.0 × 100**	**4.0 × 150**	**4.0 × 250**
300Å	**SIL**	**5**	L05SIB05	L05SIB10	L05SIB15	L05SIB25
300Å	**SIL**	**10**	L10SIB05	L10SIB10	L10SIB15	L10SIB25
300Å	**SIL**	**16**	L16SIB05	L16SIB10	L16SIB15	L16SIB25
300Å	**C4**	**5**	L05CSB05	L05CSB10	L05CSB15	L05CSB25
300Å	**C4**	**10**	L10CSB05	L10CSB10	L10CSB15	L10CSB25
300Å	**C4**	**16**	L16CSB05	L16CSB10	L16CSB15	L16CSB25
300Å	**C8**	**5**	L05CMB05	L05CMB10	L05CMB15	L05CMB25
300Å	**C8**	**10**	L10CMB05	L10CMB10	L10CMB15	L10CMB25
300Å	**C8**	**16**	L16CMB05	L16CMB10	L16CMB15	L16CMB25
300Å	**C18**	**5**	L05CLB05	L05CLB10	L05CLB15	L05CLB25
300Å	**C18**	**10**	L10CLB05	L10CLB10	L10CLB15	L10CLB25
300Å	**C18**	**16**	L16CLB05	L16CLB10	L16CLB15	L16CLB25

Kromasil 60 Å, 4.6 mm i.d. columns

			column size, i.d. × length [mm]			
Family	**Phase**	**particle size [µm]**	**4.6 × 50**	**4.6 × 100**	**4.6 × 150**	**4.6 × 250**
60Å	**SIL**	**5**	S05SIA05	S05SIA10	S05SIA15	S05SIA25
60Å	**SIL**	**7**	S07SIA05	S07SIA10	S07SIA15	S07SIA25
60Å	**SIL**	**10**	S10SIA05	S10SIA10	S10SIA15	S10SIA25
60Å	**SIL**	**13**	S13SIA05	S13SIA10	S13SIA15	S13SIA25
60Å	**SIL**	**16**	S16SIA05	S16SIA10	S16SIA15	S16SIA25
60Å	**CN**	**5**	S05CNA05	S05CNA10	S05CNA15	S05CNA25
60Å	**CN**	**10**	S10CNA05	S10CNA10	S10CNA15	S10CNA25
60Å	**CN**	**16**	S16CNA05	S16CNA10	S16CNA15	S16CNA25
60Å	**Diol**	**5**	S05DIA05	S05DIA10	S05DIA15	S05DIA25
60Å	**Diol**	**10**	S10DIA05	S10DIA10	S10DIA15	S10DIA25
60Å	**HILIC-D**	**5**	S05HDA05	S05HDA10	S05HDA15	S05HDA25
60Å	**HILIC-D**	**10**	S10HDA05	S10HDA10	S10HDA15	S10HDA25

Kromasil 100 Å, 4.6 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm]			
			4.6 × 50	4.6 × 100	4.6 × 150	4.6 × 250
100Å	SIL	3.5	MH3SIA05	MH3SIA10	MH3SIA15	MH3SIA25
100Å	SIL	5	M05SIA05	M05SIA10	M05SIA15	M05SIA25
100Å	SIL	7	M07SIA05	M07SIA10	M07SIA15	M07SIA25
100Å	SIL	10	M10SIA05	M10SIA10	M10SIA15	M10SIA25
100Å	SIL	13	M13SIA05	M13SIA10	M13SIA15	M13SIA25
100Å	SIL	16	M16SIA05	M16SIA10	M16SIA15	M16SIA25
100Å	C1	5				M05C1A25
100Å	C4	2.5	MH2CSA05	MH2CSA10		
100Å	C4	3.5	MH3CSA05	MH3CSA10	MH3CSA15	MH3CSA25
100Å	C4	5	M05CSA05	M05CSA10	M05CSA15	M05CSA25
100Å	C4	7	M07CSA05	M07CSA10	M07CSA15	M07CSA25
100Å	C4	10	M10CSA05	M10CSA10	M10CSA15	M10CSA25
100Å	C4	13	M13CSA05	M13CSA10	M13CSA15	M13CSA25
100Å	C4	16	M16CSA05	M16CSA10	M16CSA15	M16CSA25
100Å	C8	2.5	MH2CMA05	MH2CMA10		
100Å	C8	3.5	MH3CMA05	MH3CMA10	MH3CMA15	MH3CMA25
100Å	C8	5	M05CMA05	M05CMA10	M05CMA15	M05CMA25
100Å	C8	7	M07CMA05	M07CMA10	M07CMA15	M07CMA25
100Å	C8	10	M10CMA05	M10CMA10	M10CMA15	M10CMA25
100Å	C8	13	M13CMA05	M13CMA10	M13CMA15	M13CMA25
100Å	C8	16	M16CMA05	M16CMA10	M16CMA15	M16CMA25
100Å	C18	2.5	MH2CLA05	MH2CLA10		
100Å	C18	3.5	MH3CLA05	MH3CLA10	MH3CLA15	MH3CLA25
100Å	C18	5	M05CLA05	M05CLA10	M05CLA15	M05CLA25
100Å	C18	7	M07CLA05	M07CLA10	M07CLA15	M07CLA25
100Å	C18	10	M10CLA05	M10CLA10	M10CLA15	M10CLA25
100Å	C18	13	M13CLA05	M13CLA10	M13CLA15	M13CLA25
100Å	C18	16	M16CLA05	M16CLA10	M16CLA15	M16CLA25
100Å	NH2	3.5	MH3NHA05	MH3NHA10	MH3NHA15	MH3NHA25
100Å	NH2	5	M05NHA05	M05NHA10	M05NHA15	M05NHA25
100Å	NH2	7	M07NHA05	M07NHA10	M07NHA15	M07NHA25
100Å	NH2	10	M10NHA05	M10NHA10	M10NHA15	M10NHA25
100Å	NH2	13	M13NHA05	M13NHA10	M13NHA15	M13NHA25
100Å	NH2	16	M16NHA05	M16NHA10	M16NHA15	M16NHA25
100Å	Phenyl	5	M05PHA05	M05PHA10	M05PHA15	M05PHA25
100Å	Phenyl	10	M10PHA05	M10PHA10	M10PHA15	M10PHA25
100Å	Phenyl	16	M16PHA05	M16PHA10	M16PHA15	M16PHA25

Kromasil 100 Å, 4.6 mm i.d. columns

			column size, i.d. × length [mm]				
Family	**Phase**	**particle size [µm]**	**4.6 × 30**	**4.6 × 33**	**4.6 × 125**	**4.6 × 200**	**4.6 × 300**
100Å	**SIL**	**3.5**			MH3SIA1F	MH3SIA20	
100Å	**C4**	**3.5**			MH3CSA1F	MH3CSA20	
100Å	**C8**	**3.5**			MH3CMA1F	MH3CMA20	
100Å	**C8**	**10**				M10CMA20	M10CMA30
100Å	**C18**	**3.5**			MH3CLA1F	MH3CLA20	
100Å	**C18**	**5**	M05CLA03	M05CLAT3			
100Å	**C18**	**10**				M10CLA20	M10CLA30
100Å	**NH2**	**3.5**			MH3NHA1F	MH3NHA20	

Kromasil 300 Å, 4.6 mm i.d. columns

			column size, i.d. × length [mm]			
Family	**Phase**	**particle size [µm]**	**4.6 × 50**	**4.6 × 100**	**4.6 × 150**	**4.6 × 250**
300Å	**SIL**	**5**	L05SIA05	L05SIA10	L05SIA15	L05SIA25
300Å	**SIL**	**10**	L10SIA05	L10SIA10	L10SIA15	L10SIA25
300Å	**SIL**	**16**	L16SIA05	L16SIA10	L16SIA15	L16SIA25
300Å	**C4**	**5**	L05CSA05	L05CSA10	L05CSA15	L05CSA25
300Å	**C4**	**10**	L10CSA05	L10CSA10	L10CSA15	L10CSA25
300Å	**C4**	**16**	L16CSA05	L16CSA10	L16CSA15	L16CSA25
300Å	**C8**	**5**	L05CMA05	L05CMA10	L05CMA15	L05CMA25
300Å	**C8**	**10**	L10CMA05	L10CMA10	L10CMA15	L10CMA25
300Å	**C8**	**16**	L16CMA05	L16CMA10	L16CMA15	L16CMA25
300Å	**C18**	**5**	L05CLA05	L05CLA10	L05CLA15	L05CLA25
300Å	**C18**	**10**	L10CLA05	L10CLA10	L10CLA15	L10CLA25
300Å	**C18**	**16**	L16CLA05	L16CLA10	L16CLA15	L16CLA25


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Kromasil 60 Å, 10 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**10 × 150**	**10 × 250**
60Å	**SIL**	**5**	S05SIP15	S05SIP25
60Å	**SIL**	**7**	S07SIP15	S07SIP25
60Å	**SIL**	**10**	S10SIP15	S10SIP25
60Å	**SIL**	**13**	S13SIP15	S13SIP25
60Å	**SIL**	**16**	S16SIP15	S16SIP25
60Å	**CN**	**5**	S05CNP15	S05CNP25
60Å	**CN**	**10**	S10CNP15	S10CNP25
60Å	**CN**	**16**	S16CNP15	S16CNP25
60Å	**Diol**	**5**	S05DIP15	S05DIP25
60Å	**Diol**	**10**	S10DIP15	S10DIP25
60Å	**HILIC-D**	**5**	S05HDP15	S05HDP25
60Å	**HILIC-D**	**10**	S10HDP15	S10HDP25

Kromasil 60 Å, 21.2 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**21.2 × 150**	**21.2 × 250**
60Å	**SIL**	**5**	S05SIQ15	S05SIQ25
60Å	**SIL**	**7**	S07SIQ15	S07SIQ25
60Å	**SIL**	**10**	S10SIQ15	S10SIQ25
60Å	**SIL**	**13**	S13SIQ15	S13SIQ25
60Å	**SIL**	**16**	S16SIQ15	S16SIQ25
60Å	**CN**	**5**	S05CNQ15	S05CNQ25
60Å	**CN**	**10**	S10CNQ15	S10CNQ25
60Å	**CN**	**16**	S16CNQ15	S16CNQ25
60Å	**Diol**	**5**	S05DIQ15	S05DIQ25
60Å	**Diol**	**10**	S10DIQ15	S10DIQ25
60Å	**HILIC-D**	**5**	S05HDQ15	S05HDQ25
60Å	**HILIC-D**	**10**	S10HDQ15	S10HDQ25

Kromasil 60 Å, 30 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm] 30 × 150	30 × 250
60Å	SIL	5	S05SIR15	S05SIR25
60Å	SIL	7	S07SIR15	S07SIR25
60Å	SIL	10	S10SIR15	S10SIR25
60Å	SIL	13	S13SIR15	S13SIR25
60Å	SIL	16	S16SIR15	S16SIR25
60Å	CN	5	S05CNR15	S05CNR25
60Å	CN	10	S10CNR15	S10CNR25
60Å	CN	16	S16CNR15	S16CNR25
60Å	Diol	5	S05DIR15	S05DIR25
60Å	Diol	10	S10DIR15	S10DIR25
60Å	HILIC-D	5	S05HDR15	S05HDR25
60Å	HILIC-D	10	S10HDR15	S10HDR25

Kromasil 60 Å, 50 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm] 50 × 150	50 × 250
60Å	SIL	7	S07SIT15	S07SIT25
60Å	SIL	10	S10SIT15	S10SIT25
60Å	SIL	13	S13SIT15	S13SIT25
60Å	SIL	16	S16SIT15	S16SIT25
60Å	CN	10	S10CNT15	S10CNT25
60Å	CN	16	S16CNT15	S16CNT25
60Å	Diol	10	S10DIT15	S10DIT25
60Å	HILIC-D	10	S10HDT15	S10HDT25

Kromasil 100 Å, 10 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**10 × 150**	**10 × 250**
100Å	**SIL**	**5**	M05SIP15	M05SIP25
100Å	**SIL**	**7**	M07SIP15	M07SIP25
100Å	**SIL**	**10**	M10SIP15	M10SIP25
100Å	**SIL**	**13**	M13SIP15	M13SIP25
100Å	**SIL**	**16**	M16SIP15	M16SIP25
100Å	**C4**	**5**	M05CSP15	M05CSP25
100Å	**C4**	**7**	M07CSP15	M07CSP25
100Å	**C4**	**10**	M10CSP15	M10CSP25
100Å	**C4**	**13**	M13CSP15	M13CSP25
100Å	**C4**	**16**	M16CSP15	M16CSP25
100Å	**C8**	**5**	M05CMP15	M05CMP25
100Å	**C8**	**7**	M07CMP15	M07CMP25
100Å	**C8**	**10**	M10CMP15	M10CMP25
100Å	**C8**	**13**	M13CMP15	M13CMP25
100Å	**C8**	**16**	M16CMP15	M16CMP25
100Å	**C18**	**5**	M05CLP15	M05CLP25
100Å	**C18**	**7**	M07CLP15	M07CLP25
100Å	**C18**	**10**	M10CLP15	M10CLP25
100Å	**C18**	**13**	M13CLP15	M13CLP25
100Å	**C18**	**16**	M16CLP15	M16CLP25
100Å	**NH2**	**5**	M05NHP15	M05NHP25
100Å	**NH2**	**7**	M07NHP15	M07NHP25
100Å	**NH2**	**10**	M10NHP15	M10NHP25
100Å	**NH2**	**13**	M13NHP15	M13NHP25
100Å	**NH2**	**16**	M16NHP15	M16NHP25
100Å	**Phenyl**	**5**	M05PHP15	M05PHP25
100Å	**Phenyl**	**10**	M10PHP15	M10PHP25
100Å	**Phenyl**	**16**	M16PHP15	M16PHP25

Kromasil 100 Å, 21.2 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**21.2 × 150**	**21.2 × 250**
100Å	**SIL**	**5**	M05SIQ15	M05SIQ25
100Å	**SIL**	**7**	M07SIQ15	M07SIQ25
100Å	**SIL**	**10**	M10SIQ15	M10SIQ25
100Å	**SIL**	**13**	M13SIQ15	M13SIQ25
100Å	**SIL**	**16**	M16SIQ15	M16SIQ25
100Å	**C4**	**5**	M05CSQ15	M05CSQ25
100Å	**C4**	**7**	M07CSQ15	M07CSQ25
100Å	**C4**	**10**	M10CSQ15	M10CSQ25
100Å	**C4**	**13**	M13CSQ15	M13CSQ25
100Å	**C4**	**16**	M16CSQ15	M16CSQ25
100Å	**C8**	**5**	M05CMQ15	M05CMQ25
100Å	**C8**	**7**	M07CMQ15	M07CMQ25
100Å	**C8**	**10**	M10CMQ15	M10CMQ25
100Å	**C8**	**13**	M13CMQ15	M13CMQ25
100Å	**C8**	**16**	M16CMQ15	M16CMQ25
100Å	**C18**	**5**	M05CLQ15	M05CLQ25
100Å	**C18**	**7**	M07CLQ15	M07CLQ25
100Å	**C18**	**10**	M10CLQ15	M10CLQ25
100Å	**C18**	**13**	M13CLQ15	M13CLQ25
100Å	**C18**	**16**	M16CLQ15	M16CLQ25
100Å	**NH2**	**5**	M05NHQ15	M05NHQ25
100Å	**NH2**	**7**	M07NHQ15	M07NHQ25
100Å	**NH2**	**10**	M10NHQ15	M10NHQ25
100Å	**NH2**	**13**	M13NHQ15	M13NHQ25
100Å	**NH2**	**16**	M16NHQ15	M16NHQ25
100Å	**Phenyl**	**5**	M05PHQ15	M05PHQ25
100Å	**Phenyl**	**10**	M10PHQ15	M10PHQ25
100Å	**Phenyl**	**16**	M16PHQ15	M16PHQ25

Kromasil 100 Å, 30 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**30 × 150**	**30 × 250**
100Å	**SIL**	**5**	M05SIR15	M05SIR25
100Å	**SIL**	**7**	M07SIR15	M07SIR25
100Å	**SIL**	**10**	M10SIR15	M10SIR25
100Å	**SIL**	**13**	M13SIR15	M13SIR25
100Å	**SIL**	**16**	M16SIR15	M16SIR25
100Å	**C4**	**5**	M05CSR15	M05CSR25
100Å	**C4**	**7**	M07CSR15	M07CSR25
100Å	**C4**	**10**	M10CSR15	M10CSR25
100Å	**C4**	**13**	M13CSR15	M13CSR25
100Å	**C4**	**16**	M16CSR15	M16CSR25
100Å	**C8**	**5**	M05CMR15	M05CMR25
100Å	**C8**	**7**	M07CMR15	M07CMR25
100Å	**C8**	**10**	M10CMR15	M10CMR25
100Å	**C8**	**13**	M13CMR15	M13CMR25
100Å	**C8**	**16**	M16CMR15	M16CMR25
100Å	**C18**	**5**	M05CLR15	M05CLR25
100Å	**C18**	**7**	M07CLR15	M07CLR25
100Å	**C18**	**10**	M10CLR15	M10CLR25
100Å	**C18**	**13**	M13CLR15	M13CLR25
100Å	**C18**	**16**	M16CLR15	M16CLR25
100Å	**NH2**	**5**	M05NHR15	M05NHR25
100Å	**NH2**	**7**	M07NHR15	M07NHR25
100Å	**NH2**	**10**	M10NHR15	M10NHR25
100Å	**NH2**	**13**	M13NHR15	M13NHR25
100Å	**NH2**	**16**	M16NHR15	M16NHR25
100Å	**Phenyl**	**5**	M05PHR15	M05PHR25
100Å	**Phenyl**	**10**	M10PHR15	M10PHR25
100Å	**Phenyl**	**16**	M16PHR15	M16PHR25

Kromasil 100 Å, 50 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**50 × 150**	**50 × 250**
100Å	**SIL**	**7**	M07SIT15	M07SIT25
100Å	**SIL**	**10**	M10SIT15	M10SIT25
100Å	**SIL**	**13**	M13SIT15	M13SIT25
100Å	**SIL**	**16**	M16SIT15	M16SIT25
100Å	**C4**	**7**	M07CST15	M07CST25
100Å	**C4**	**10**	M10CST15	M10CST25
100Å	**C4**	**13**	M13CST15	M13CST25
100Å	**C4**	**16**	M16CST15	M16CST25
100Å	**C8**	**7**	M07CMT15	M07CMT25
100Å	**C8**	**10**	M10CMT15	M10CMT25
100Å	**C8**	**13**	M13CMT15	M13CMT25
100Å	**C8**	**16**	M16CMT15	M16CMT25
100Å	**C18**	**7**	M07CLT15	M07CLT25
100Å	**C18**	**10**	M10CLT15	M10CLT25
100Å	**C18**	**13**	M13CLT15	M13CLT25
100Å	**C18**	**16**	M16CLT15	M16CLT25
100Å	**NH2**	**7**	M07NHT15	M07NHT25
100Å	**NH2**	**10**	M10NHT15	M10NHT25
100Å	**NH2**	**13**	M13NHT15	M13NHT25
100Å	**NH2**	**16**	M16NHT15	M16NHT25
100Å	**Phenyl**	**10**	M10PHT15	M10PHT25
100Å	**Phenyl**	**16**	M16PHT15	M16PHT25


Kromasil

Kromasil 300 Å, 10 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**10 × 150**	**10 × 250**
300Å	**SIL**	**5**	L05SIP15	L05SIP25
300Å	**SIL**	**10**	L10SIP15	L10SIP25
300Å	**SIL**	**16**	L16SIP15	L16SIP25
300Å	**C4**	**5**	L05CSP15	L05CSP25
300Å	**C4**	**10**	L10CSP15	L10CSP25
300Å	**C4**	**16**	L16CSP15	L16CSP25
300Å	**C8**	**5**	L05CMP15	L05CMP25
300Å	**C8**	**10**	L10CMP15	L10CMP25
300Å	**C8**	**16**	L16CMP15	L16CMP25
300Å	**C18**	**5**	L05CLP15	L05CLP25
300Å	**C18**	**10**	L10CLP15	L10CLP25
300Å	**C18**	**16**	L16CLP15	L16CLP25

Kromasil 300 Å, 21.2 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**21.2 × 150**	**21.2 × 250**
300Å	**SIL**	**5**	L05SIQ15	L05SIQ25
300Å	**SIL**	**10**	L10SIQ15	L10SIQ25
300Å	**SIL**	**16**	L16SIQ15	L16SIQ25
300Å	**C4**	**5**	L05CSQ15	L05CSQ25
300Å	**C4**	**10**	L10CSQ15	L10CSQ25
300Å	**C4**	**16**	L16CSQ15	L16CSQ25
300Å	**C8**	**5**	L05CMQ15	L05CMQ25
300Å	**C8**	**10**	L10CMQ15	L10CMQ25
300Å	**C8**	**16**	L16CMQ15	L16CMQ25
300Å	**C18**	**5**	L05CLQ15	L05CLQ25
300Å	**C18**	**10**	L10CLQ15	L10CLQ25
300Å	**C18**	**16**	L16CLQ15	L16CLQ25

Kromasil 300 Å, 30 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**30 × 150**	**30 × 250**
300Å	**SIL**	**5**	L05SIR15	L05SIR25
300Å	**SIL**	**10**	L10SIR15	L10SIR25
300Å	**SIL**	**16**	L16SIR15	L16SIR25
300Å	**C4**	**5**	L05CSR15	L05CSR25
300Å	**C4**	**10**	L10CSR15	L10CSR25
300Å	**C4**	**16**	L16CSR15	L16CSR25
300Å	**C8**	**5**	L05CMR15	L05CMR25
300Å	**C8**	**10**	L10CMR15	L10CMR25
300Å	**C8**	**16**	L16CMR15	L16CMR25
300Å	**C18**	**5**	L05CLR15	L05CLR25
300Å	**C18**	**10**	L10CLR15	L10CLR25
300Å	**C18**	**16**	L16CLR15	L16CLR25

Kromasil 300 Å, 50 mm i.d. columns

			column size, i.d. × length [mm]	
Family	**Phase**	**particle size [µm]**	**50 × 150**	**50 × 250**
300Å	**SIL**	**10**	L10SIT15	L10SIT25
300Å	**SIL**	**16**	L16SIT15	L16SIT25
300Å	**C4**	**10**	L10CST15	L10CST25
300Å	**C4**	**16**	L16CST15	L16CST25
300Å	**C8**	**10**	L10CMT15	L10CMT25
300Å	**C8**	**16**	L16CMT15	L16CMT25
300Å	**C18**	**10**	L10CLT15	L10CLT25
300Å	**C18**	**16**	L16CLT15	L16CLT25

Kromasil Eternity columns

Kromasil Eternity, 2.1 mm i.d. columns

			column size, i.d. × length [mm]		
Family	**Phase**	**particle size [µm]**	**2.1 × 50**	**2.1 × 100**	**2.1 × 150**
Eternity	**C18**	**2.5**	EH2CLD05	EH2CLD10	
Eternity	**C18**	**5**	E05CLD05		E05CLD15
Eternity	**PhenylHexyl**	**2.5**	EH2PXD05	EH2PXD10	
Eternity	**PhenylHexyl**	**5**	E05PXD05		E05PXD15
EternityXT	**C18**	**1.8**	XF1CLD05	XF1CLD10	
EternityXT	**C18**	**2.5**	XH2CLD05	XH2CLD10	
EternityXT	**C18**	**5**	X05CLD05		X05CLD15
EternityXT	**PhenylHexyl**	**1.8**	XF1PXD05	XF1PXD10	
EternityXT	**PhenylHexyl**	**2.5**	XH2PXD05	XH2PXD10	
EternityXT	**PhenylHexyl**	**5**	X05PXD05		X05PXD15

Kromasil Eternity, 4.6 mm i.d. columns

			column size, i.d. × length [mm]			
Family	**Phase**	**particle size [µm]**	**4.6 × 50**	**4.6 × 100**	**4.6 × 150**	**4.6 × 250**
Eternity	**C18**	**2.5**	EH2CLA05	EH2CLA10		
Eternity	**C18**	**5**	E05CLA05	E05CLA10	E05CLA15	E05CLA25
Eternity	**PhenylHexyl**	**2.5**	EH2PXA05	EH2PXA10		
Eternity	**PhenylHexyl**	**5**	E05PXA05	E05PXA10	E05PXA15	E05PXA25
EternityXT	**C18**	**2.5**	XH2CLA05	XH2CLA10		
EternityXT	**C18**	**5**	X05CLA05	X05CLA10	X05CLA15	X05CLA25
EternityXT	**C18**	**10**				X10CLA25
EternityXT	**PhenylHexyl**	**2.5**	XH2PXA05	XH2PXA10		
EternityXT	**PhenylHexyl**	**5**	X05PXA05	X05PXA10	X05PXA15	X05PXA25

Kromasil Eternity, 10 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm]		
			10 × 100	10 × 150	10 × 250
Eternity	**C18**	**5**	E05CLP10	E05CLP15	E05CLP25
Eternity	**PhenylHexyl**	**5**	E05PXP10	E05PXP15	E05PXP25
EternityXT	**C18**	**5**	X05CLP10	X05CLP15	X05CLP25
EternityXT	**C18**	**10**	X10CLP10	X10CLP15	X10CLP25
EternityXT	**PhenylHexyl**	**5**	X05PXP10	X05PXP15	X05PXP25

Kromasil Eternity, 21.2 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm]		
			21.2 × 100	21.2 × 150	21.2 × 250
Eternity	**C18**	**5**	E05CLQ10	E05CLQ15	E05CLQ25
Eternity	**PhenylHexyl**	**5**	E05PXQ10	E05PXQ15	E05PXQ25
EternityXT	**C18**	**5**	X05CLQ10	X05CLQ15	X05CLQ25
EternityXT	**C18**	**10**	X10CLQ10	X10CLQ15	X10CLQ25
EternityXT	**PhenylHexyl**	**5**	X05PXQ10	X05PXQ15	X05PXQ25

Kromasil Eternity, 30 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm]		
			30 × 100	30 × 150	30 × 250
Eternity	**C18**	**5**	E05CLR10	E05CLR15	E05CLR25
Eternity	**PhenylHexyl**	**5**	E05PXR10	E05PXR15	E05PXR25
EternityXT	**C18**	**10**	X10CLR10	X10CLR15	X10CLR25

Kromasil Chiral columns

Kromasil Chiral, 4.6 mm i.d. columns

			column size, i.d. × length [mm]		
Family	Phase	particle size [µm]	4.6 × 50	4.6 × 150	4.6 × 250
Chiral	AmyCoat	3	C03ACA05	C03ACA15	
Chiral	AmyCoat	5	C05ACA05	C05ACA15	C05ACA25
Chiral	AmyCoat	10	C10ACA05	C10ACA15	C10ACA25
Chiral	AmyCoat	25	C25ACA05	C25ACA15	C25ACA25
Chiral	AmyCoat RP	3	C03ARA05	C03ARA15	
Chiral	AmyCoat RP	5	C05ARA05	C05ARA15	C05ARA25
Chiral	AmyCoat RP	10	C10ARA05	C10ARA15	C10ARA25
Chiral	AmyCoat RP	25	C25ARA05	C25ARA15	C25ARA25
Chiral	CelluCoat	3	C03CCA05	C03CCA15	
Chiral	CelluCoat	5	C05CCA05	C05CCA15	C05CCA25
Chiral	CelluCoat	10	C10CCA05	C10CCA15	C10CCA25
Chiral	CelluCoat	25	C25CCA05	C25CCA15	C25CCA25
Chiral	CelluCoat RP	3	C03CRA05	C03CRA15	
Chiral	CelluCoat RP	5	C05CRA05	C05CRA15	C05CRA25
Chiral	CelluCoat RP	10	C10CRA05	C10CRA15	C10CRA25
Chiral	CelluCoat RP	25	C25CRA05	C25CRA15	C25CRA25

Kromasil Chiral, 10 mm i.d. columns

			column size, i.d. × length [mm]
Family	Phase	particle size [µm]	10 × 250
Chiral	AmyCoat	5	C05ACP25
Chiral	AmyCoat	10	C10ACP25
Chiral	AmyCoat	25	C25ACP25
Chiral	AmyCoat RP	5	C05ARP25
Chiral	AmyCoat RP	10	C10ARP25
Chiral	AmyCoat RP	25	C25ARP25
Chiral	CelluCoat	5	C05CCP25
Chiral	CelluCoat	10	C10CCP25
Chiral	CelluCoat	25	C25CCP25
Chiral	CelluCoat RP	5	C05CRP25
Chiral	CelluCoat RP	10	C10CRP25
Chiral	CelluCoat RP	25	C25CRP25

Kromasil Chiral, 21.2 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm] 21.2 × 150	21.2 × 250
Chiral	**AmyCoat**	**5**	C05ACQ15	C05ACQ25
Chiral	**AmyCoat**	**10**	C10ACQ15	C10ACQ25
Chiral	**AmyCoat**	**25**	C25ACQ15	C25ACQ25
Chiral	**AmyCoat RP**	**5**	C05ARQ15	C05ARQ25
Chiral	**AmyCoat RP**	**10**	C10ARQ15	C10ARQ25
Chiral	**AmyCoat RP**	**25**	C25ARQ15	C25ARQ25
Chiral	**CelluCoat**	**5**	C05CCQ15	C05CCQ25
Chiral	**CelluCoat**	**10**	C10CCQ15	C10CCQ25
Chiral	**CelluCoat**	**25**	C25CCQ15	C25CCQ25
Chiral	**CelluCoat RP**	**5**	C05CRQ15	C05CRQ25
Chiral	**CelluCoat RP**	**10**	C10CRQ15	C10CRQ25
Chiral	**CelluCoat RP**	**25**	C25CRQ15	C25CRQ25

Kromasil Chiral, 30 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm] 30 × 250
Chiral	**AmyCoat**	**5**	C05ACR25
Chiral	**AmyCoat**	**10**	C10ACR25
Chiral	**AmyCoat**	**25**	C25ACR25
Chiral	**AmyCoat RP**	**5**	C05ARR25
Chiral	**AmyCoat RP**	**10**	C10ARR25
Chiral	**AmyCoat RP**	**25**	C25ARR25
Chiral	**CelluCoat**	**5**	C05CCR25
Chiral	**CelluCoat**	**10**	C10CCR25
Chiral	**CelluCoat**	**25**	C25CCR25
Chiral	**CelluCoat RP**	**5**	C05CRR25
Chiral	**CelluCoat RP**	**10**	C10CRR25
Chiral	**CelluCoat RP**	**25**	C25CRR25

Kromasil Chiral, 50 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm] 50 × 250
Chiral	**AmyCoat**	**5**	C05ACT25
Chiral	**AmyCoat**	**10**	C10ACT25
Chiral	**AmyCoat**	**25**	C25ACT25
Chiral	**AmyCoat RP**	**5**	C05ART25
Chiral	**AmyCoat RP**	**10**	C10ART25
Chiral	**AmyCoat RP**	**25**	C25ART25
Chiral	**CelluCoat**	**5**	C05CCT25
Chiral	**CelluCoat**	**10**	C10CCT25
Chiral	**CelluCoat**	**25**	C25CCT25
Chiral	**CelluCoat RP**	**5**	C05CRT25
Chiral	**CelluCoat RP**	**10**	C10CRT25
Chiral	**CelluCoat RP**	**25**	C25CRT25

Kromasil SFC columns

Kromasil SFC, 3.0 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm] 3.0 × 150
SFC	**CN**	**2.5**	FH2CNC15
SFC	**Diol**	**2.5**	FH2DIC15
SFC	**2EP**	**2.5**	FH2EPC15
SFC	**SIL**	**2.5**	FH2SIC15
SFC	**KIT**	**2.5**	FH2FKC15

Kromasil SFC, 4.6 mm i.d. columns

Family	Phase	particle size [µm]	column size, i.d. × length [mm] 4.6 × 150
SFC	**SIL**	**2.5**	FH2SIA15
SFC	**Diol**	**2.5**	FH2DIA15
SFC	**CN**	**2.5**	FH2CNA15
SFC	**2EP**	**2.5**	FH2EPA15

KIT *is a 4 column kit for screening studies with one column of each 4 SFC phases in one box.*