



## Solid Phase Extraction (SPE)

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# Basic principles of SPE



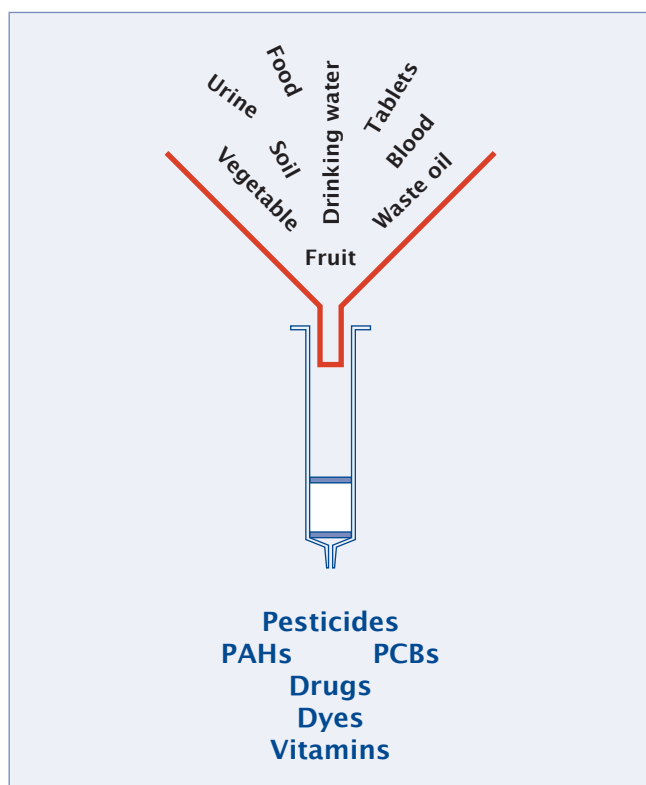
Solid phase extraction (SPE) is a powerful method for sample preparation and is used by most chromatographers today.

More than 20 years ago MACHEREY-NAGEL designed and introduced CHROMABOND® SPE cartridges containing silica-based adsorbents. Since then we developed the widest range of phases and products for SPE based on silica and polymeric materials.

SPE has capabilities in a broad range of applications:

- ◆ environmental analyses
- ◆ pharmaceutical and biochemical analyses
- ◆ organic chemistry
- ◆ food analysis

## Solid Phase Extraction



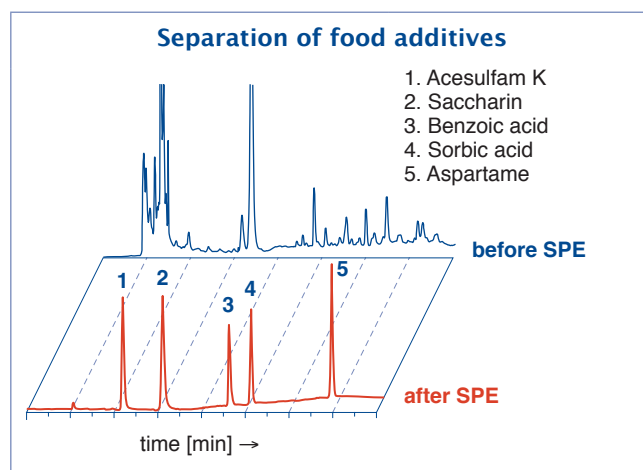
SPE is a form of digital (step-wise) chromatography designed to extract, partition, and / or adsorb one or more components from a liquid phase (sample) onto a stationary phase (adsorbent or resin). An adsorbed substance can be removed from the adsorbent by step-wise increase of elution strength of the eluent (step gradient technique). SPE extends a chromatographic system's lifetime, improves qualitative and quantitative analysis, and the demand placed on an analytical instrument is considerably lessened.

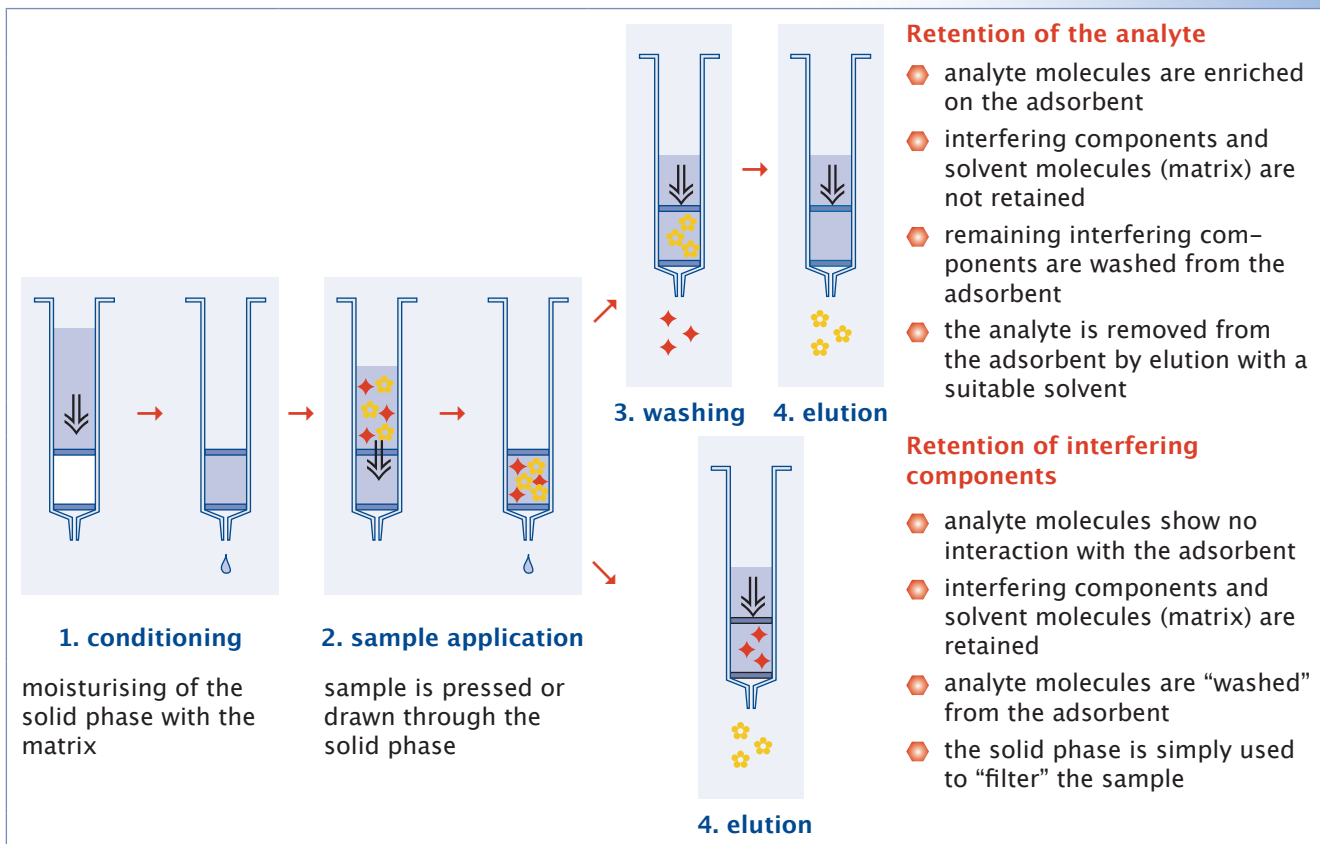
**In general, SPE is used for three important purposes in state-of-the-art analyses:**

- ◆ concentration of the analyte (up to factor 10.000 – increase of chromatographic sensibility / improved limits of detection)
- ◆ removal of interfering compounds (protection of subsequent analyses like HPLC, GC, TLC, UV or IR spectroscopy, ...)
- ◆ changing an analyte's environment to a simpler matrix more suitable for subsequent analyses

**Advantages of SPE compared to classical liquid-liquid extraction:**

- ◆ lower consumption of solvents
- ◆ faster – enormous time savings
- ◆ lower costs per sample
- ◆ potential for automation
- ◆ high consistency in individual sample handling
- ◆ more specific selectivity because of the broad range of adsorbents and different retention mechanisms
- ◆ optimisation of extraction by variation or adjusting of the solid phase and chromatographic conditions





Since analytes can be either adsorbed on the SPE packing material or directly flow through while the interfering substances are retained, two general separation procedures are possible – both cases are shown in the figure above.

## Main steps of the SPE procedure

### 1. Conditioning of the adsorbent

Conditioning of the adsorbent is necessary in order to ensure reproducible interaction with the analyte. Conditioning, also called solvation, results in a wetting of the adsorbent and thus produces an environment, which is suitable for adsorption of the analyte. Nonpolar adsorbents are usually conditioned with 2 – 3 column volumes of a solvent, which is miscible with water (methanol, THF, 2-propanol etc.), followed by the solvent in which the analyte is dissolved (pure matrix, e.g. water, buffer). Polar adsorbents are conditioned with nonpolar solvents.

After the conditioning step the adsorbent bed **must not run dry**, because otherwise solvation is destroyed (de-conditioning).

### 2. Sample application (adsorption)

Sample application can be performed with positive or negative pressure with a flow rate of ~3 ml/min. Sample volumes vary from a few ml up to liters.

### 3. Washing of the adsorbent

Washing of the adsorbent is usually achieved with a special wash solution; however, in some cases it may not be necessary. If the polarity difference between wash solution and eluent is very large, or if both are not miscible, drying of the adsorbent bed after washing is recommended to improve elution and recovery.

### 4. Elution

Elution with a suitable eluent should not be too fast. The elution speed depends on the column or cartridge dimension and the quantity of adsorbent (about 1 ml/min).



# Basic principles of SPE

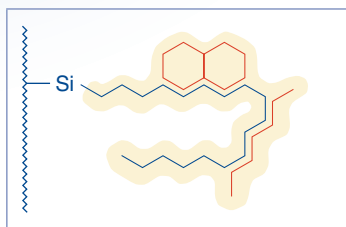
## Molecular interactions in SPE

SPE adsorbents are most commonly categorised by the nature of their primary interaction mechanism with the analyte of interest. The three most common extraction mechanisms used in SPE are reversed phase (RP), normal phase (NP) and ion exchanger.

### Typical extraction mechanisms

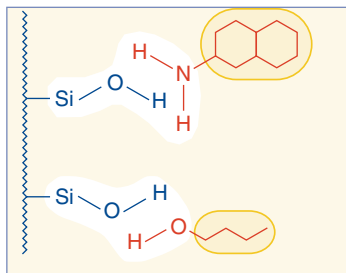
- Reversed Phase Extraction of hydrophobic or polar organic analytes from aqueous matrix
- Normal Phase Extraction of polar analytes from non-polar organic solvents
- Ion Exchanger Extraction of charged analytes from aqueous or non-polar organic samples

### Types of retention mechanisms:



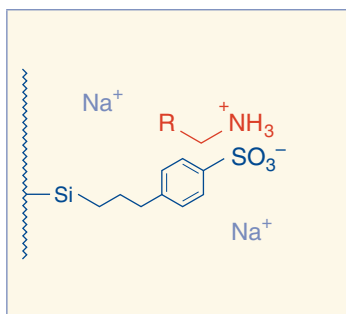
#### Nonpolar interactions

silica-based: C<sub>18</sub> ec, C<sub>18</sub>, C<sub>18</sub> Hydra, C<sub>8</sub>, ...  
 polymer-based: HR-X, HR-P, Easy, PS-RP  
 interactions: hydrophobic  
 sample: mostly aqueous  
 elution: solvents with lower polarity (compared to water)  
 MeOH, CH<sub>2</sub>Cl<sub>2</sub>, CHCl<sub>3</sub>, ... hexane



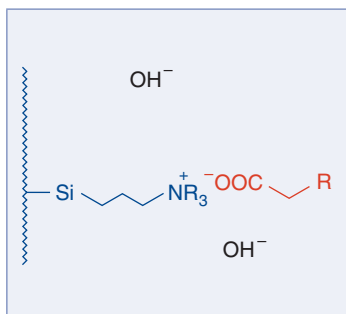
#### Polar interactions

silica-based: SiOH, CN, NH<sub>2</sub>, OH (diol), C<sub>6</sub>H<sub>5</sub>, ...  
 other: Alox, Florisil®, ...  
 interactions: hydrogen bonds, dipole-dipole and π-π interactions  
 sample: mostly organic  
 elution: polar solvents (compared to sample solvent)  
 (nonprotic) ethers, ketones (MTBE, THF, acetone, ...)  
 CH<sub>2</sub>Cl<sub>2</sub>, CHCl<sub>3</sub>, ...



#### Cation exchangers

silica-based: SA (SCX), PCA (WCX), PSA,  
 polymer-based: HR-XC, HR-XCW, PS-H<sup>+</sup>, ...  
 interaction: between charged analytes and functional group of cation exchanger  
 sample: aqueous (pH 3-5)  
 elution: acidic: pH 2 (e.g. HCl, or 20% AcOH in MeOH/acetonitrile)  
 basic: pH 8-9 (e.g. 5% NH<sub>3</sub> in MeOH/acetonitrile)  
 solvents or buffers with higher ionic strength and counter ions with high selectivity (e.g. Ca<sup>2+</sup>, ...)



#### Anion exchangers

silica-based: SB (SAX), NH<sub>2</sub>, DMA, ...  
 polymer-based: HR-XA, HR-XAW, PS-OH<sup>-</sup>, ...  
 interaction: between charged analytes and functional group of anion exchanger  
 sample: aqueous (pH 8-9)  
 elution: basic: pH 10 (e.g. 20% NH<sub>3</sub> in MeOH/acetonitrile)  
 acidic: pH 4-5 (e.g. HCl, or 5% AcOH in MeOH/acetonitrile)  
 solvents or buffers with higher ionic strength and counter ions with high selectivity (e.g. citrate, ...)

It should be noted, that in SPE the interactions described above are not found in pure form, but in combination. For example, modified silicas, unless they have been subjected to endcapping (silanisation of residual silanol groups with short-chain silanes), still possess free silanol groups, which can enter into secondary interactions.



## Sample pretreatment

For direct extraction with adsorbents the sample matrix (sample environment) has to fulfil three conditions:

- the matrix has to be liquid, if possible with low viscosity
- solids should be removed from the liquid matrix
- the matrix (sample environment) should be suitable for retention of the analyte

For solid samples there are different methods to convert the sample into a suitable matrix:

- dissolution of the solid sample in a suitable solvent
- lyophilisation of the sample and dissolution in a suitable solvent
- extraction of the solid sample with a suitable solvent
- homogenisation of the sample in a suitable solvent

In order to find the suitable solvent, one has to consider all desired sample components. Also, the suitable solvent should enhance retention of the analyte. For example, samples with large contents of solids are often homogenised in nonpolar solvents like hexane, while for samples with high water content dissolution in acids, bases, buffers or very polar solvents such as methanol is recommended.

Additionally, SPE allows to alter the properties of the sample matrix. If, for example, natural products are extracted with methanol or acetone, the polarity of the extracts can be increased by dilution with water, in order to enhance nonpolar solid phase extraction on the C<sub>18</sub> material.

## SPE Application Guide

- selection of more than **300 applications** from the fields
  - ✓ biological samples and natural compounds
  - ✓ pharmaceuticals and drugs
  - ✓ food and beverages
  - ✓ environmental samples and pollutants
- detailed application procedures and helpful hints: recovery rates, information for subsequent analysis (GC, HPLC, ...), structural information of interesting compounds ...
- explaining basics and principles of SPE: standard protocols for SPE phases, selection guide for SPE phases and solvents, sample pretreatment for difficult matrices
- detailed description of all standard and special phases and their fields of application, description and handling of CHROMABOND® hardware, accessories and manifolds
- latest and more applications at [www.mn-net.com/apps](http://www.mn-net.com/apps)



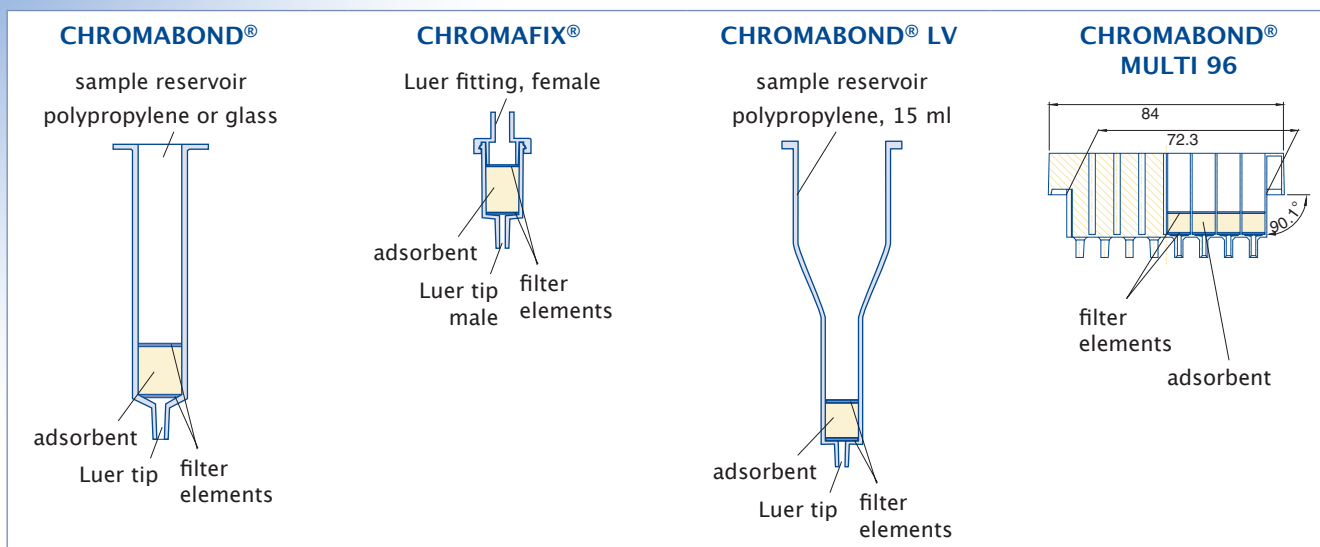
## Our CHROMABOND® QC policy

- highest production standard**  
our facilities are EN ISO 9001:2008 certified
- all of our bonded phases and SPE products are vigorously tested for perfect **reproducibility** from lot-to-lot and within every single batch · careful attention to particle size distribution and pore diameters assures consistent column flow · chemical reproducibility is guaranteed by strict quality control throughout manufacturing
- all products are individually tested to meet our **strict quality specifications**, ensuring our outstanding product reproducibility, reliability and performance
- each product is supplied with a **certificate of analysis** stating the results of internal examinations and quality control





# Basic principles of SPE



## Design of columns, cartridges and 96-well plates

All CHROMABOND® columns, cartridges and 96-well plates are manufactured from polypropylene (PP) with lowest content of extractables (plasticizers, stabilisers, ...) offering blank value free results by usage of most common solvents. The high quality CHROMABOND® adsorbents are kept in place by chemically very inert polyethylene filter elements (PE, standard pore size 20 µm).

### CHROMABOND® polypropylene columns

- PP columns with PE filter elements
- different sizes from 1, 3, 6 up to 150 ml
- adsorbent weights from 20 mg to 50 g
- male luer tip as exit
- compatible with most robots (e.g. Gilson ASPEC™, Caliper AutoTrace®, ...)

### CHROMABOND® glass columns

- glass columns with chemically very inert glass fibre filter elements (nominal pore size 1 µm)
- two different sizes: 3 and 6 ml
- available with all CHROMABOND® phases
- excludes any influence from the column material (e.g. plasticizers, ...)

### CHROMAFIX® cartridges

- PP cartridges with PE filter elements
- three different sizes with different adsorbent weights: Small (0.4 ml), Medium (0.8 ml), Large (1.8 ml)
- female Luer tip at the inlet, male Luer tip as exit
- offers alternative way of handling using positive pressure by syringes or peristaltic pumps
- especially suited for convenient solid phase extraction of small sample volumes

### CHROMABOND® LV columns

- large volume PP columns with PE filter elements
- three different adsorbent weights (100, 200 and 500 mg)
- funnel-shaped reservoir with 15 ml volume
- especially for clinical samples – the whole sample (e.g. urine, serum, blood) can be applied to the column in one step
- can be directly used in the Zymate® lab robots of Zymark

### CHROMABOND® MULTI 96 · SPE in 96-well format

- 96-well polypropylene plates with PE filter elements
- cavity volume 1.5 ml
- adsorbent weights from 25 to 100 mg
- supplied with any CHROMABOND® SPE adsorbents
- for simultaneous preparation of 96 samples
- easy method transfer from CHROMABOND® columns or CHROMAFIX® cartridges to CHROMABOND® MULTI 96
- readily adaptable to all common automated / robotic handling systems (for details see page 52)



For the development kits as well as for all individual CHROMABOND®, CHROMABOND® LV and CHROMAFIX® types columns are sealed in units of five columns each to prevent adsorption of contaminants from the environment, e.g. laboratory air.



## Ordering information

Designation	Contents of the kit	REF
<b>Investigating the best separation mechanism for a clean-up procedure</b>		
CHROMABOND® HR-Xpert development kit I	columns with 3 ml / 60 mg each: 10 columns with HR-X; 5 columns each with HR-XC, HR-XA, HR-XCW, HR-XAW	730723
CHROMABOND® HR-Xpert development kit II	columns with 3 ml / 200 mg each: 10 columns with HR-X; 5 columns each with HR-XC, HR-XA, HR-XCW, HR-XAW	730726
CHROMABOND® polymer development kit	5 columns each with 3 ml / 200 mg: HR-X, HR-XC (MCX), HR-XA (MAX), HR-P, Easy, PS-H <sup>+</sup> , PS-OH <sup>-</sup>	730288
CHROMABOND® standard development kit	5 columns each with 3 ml / 500 mg: C <sub>18</sub> , C <sub>18</sub> ec, C <sub>8</sub> , C <sub>6</sub> H <sub>5</sub> , NH <sub>2</sub> , DMA, OH, CN, SiOH, SA (SCX), SB (SAX)	730496
<b>Selecting the optimum RP phase for a clean-up procedure</b>		
CHROMABOND® RP development kit I	10 columns each with 3 ml / 500 mg: C <sub>18</sub> , C <sub>18</sub> ec, C <sub>8</sub> , C <sub>4</sub> and 10 columns each with 3 ml / 200 mg HR-P, HR-X	730197
CHROMABOND® RP development kit II	10 columns each with 1 ml / 100 mg: C <sub>18</sub> , C <sub>18</sub> ec, C <sub>8</sub> , C <sub>4</sub> , HR-P, HR-X	730207
CHROMAFIX® RP development kit I	10 cartridges each CHROMAFIX® S: C <sub>18</sub> , C <sub>18</sub> ec, C <sub>8</sub> , C <sub>4</sub> , HR-P, HR-X	731883
CHROMABOND® RP development kit III	10 columns each with 3 ml / 500 mg: C <sub>18</sub> , C <sub>18</sub> ec, C <sub>18</sub> Hydra, C <sub>8</sub> and 10 columns each with 3 ml / 200 mg HR-P, HR-X	730490
CHROMABOND® RP development kit IV	10 columns each with 1 ml / 100 mg: C <sub>18</sub> , C <sub>18</sub> ec, C <sub>18</sub> Hydra, C <sub>8</sub> , HR-P, HR-X	730491
CHROMAFIX® RP development kit II	10 cartridges each CHROMAFIX® S: C <sub>18</sub> , C <sub>18</sub> ec, C <sub>18</sub> Hydra, C <sub>8</sub> , HR-P, HR-X	731886
CHROMABOND® RP development kit V	10 columns each with 3 ml / 500 mg: C <sub>6</sub> H <sub>5</sub> , NO <sub>2</sub> , C <sub>6</sub> H <sub>11</sub> ec, C <sub>4</sub> , C <sub>2</sub>	730492
CHROMABOND® RP development kit VI	10 columns each with 1 ml / 100 mg: C <sub>6</sub> H <sub>5</sub> , NO <sub>2</sub> , C <sub>6</sub> H <sub>11</sub> ec, C <sub>4</sub> , C <sub>2</sub>	730493
CHROMAFIX® RP development kit III	10 cartridges each CHROMAFIX® S: C <sub>6</sub> H <sub>5</sub> , NO <sub>2</sub> , C <sub>6</sub> H <sub>11</sub> ec, C <sub>4</sub> , C <sub>2</sub>	731887
<b>Selecting the optimum polar phase for a clean-up procedure</b>		
CHROMABOND® polar development kit I	10 columns each with 3 ml / 500 mg: SiOH, Florisil®, NH <sub>2</sub> , CN, OH	730199
CHROMABOND® polar development kit II	10 columns each with 1 ml / 100 mg: SiOH, Florisil®, NH <sub>2</sub> , CN, OH	730208
CHROMAFIX® polar development kit	10 cartridges each CHROMAFIX® S: SiOH, Florisil®, NH <sub>2</sub> , CN, OH	731884
<b>Selecting the optimum ion exchanger for a clean-up procedure</b>		
CHROMABOND® ion exchange development kit I	10 columns each with 3 ml / 500 mg: SA (SCX), SB (SAX), HR-XC (MCX), HR-XA (MAX), PS-OH <sup>-</sup> , PS-H <sup>+</sup> , DMA	730206
CHROMABOND® ion exchange development kit II	10 columns each with 1 ml / 100 mg: SA (SCX), SB (SAX), HR-XC (MCX), HR-XA (MAX), PS-OH <sup>-</sup> , PS-H <sup>+</sup> , DMA	730209
CHROMAFIX® ion exchange development kit I	10 cartridges each CHROMAFIX® S: SA (SCX), SB (SAX), HR-XC (MCX), HR-XA (MAX), PS-OH <sup>-</sup> , PS-H <sup>+</sup> , DMA	731885
CHROMABOND® cation exchange development kit I	10 columns each with 3 ml / 500 mg: SA (SCX), PSA, PCA, HR-XC (MCX), HR-XCW (WCX), PS-H <sup>+</sup>	730494
CHROMAFIX® cation exchange development kit	10 cartridges each CHROMAFIX® S: SA (SCX), PSA, PCA, HR-XC (MCX), HR-XCW (WCX), PS-H <sup>+</sup>	731888
<b>Phase selection for clean-up procedures for environmental samples</b>		
CHROMABOND® kit I for environmental sample preparation	10 columns each with 3 ml / 200 mg HR-P, 6 ml / 1000 mg C <sub>18</sub> ec, 6 ml / 2000 mg C <sub>18</sub> PAH, 6 ml / 500/1000 mg CN/SiOH, 3 ml / 500/500 mg SA/SiOH	730205
CHROMABOND® kit II for environmental sample preparation	5 columns each with 3 ml / 500/500 mg SiOH-H <sub>2</sub> SO <sub>4</sub> /SA, 3 ml / 500 mg SiOH, 6 ml / 1000 mg Florisil, 3 ml / 500/500 mg SA/SiOH, 6 ml / 700/2000/700 mg NAN	730349



# Summary of MN phases for SPE

Code	Matrix	Modification / Application	Similar phases*	Page
<b>Reversed phases</b>				
HR-X	PS/DVB		ENVI-Chrom P · Strata™-X · Oasis® HLB · Nexus	12
Easy	PS/DVB	polar, bifunctional	Strata™-X · Oasis® HLB · Porapak™ RDX · Nexus, Bond Elut® PPL, Focus™ · Styre Screen® DVB Bakerbond™ H <sub>2</sub> O-philic DVB · Isolute® ENV+	18
HR-P	PS/DVB		Strata™ SDB-L · Bond Elut® ENV, Bond Elut® LMS · DCS-PS/DVB, ENV PS-DVB · Bakerbond™ H <sub>2</sub> O-phobic DVB · Isolute® 101 · LiChrolut® EN	19
PS-RP	PS/DVB	removal of organic components	like HR-P	20
C <sub>18</sub> ec	silica	octadecyl, endcapped	Strata™ C18-E · Sep-Pak® tC18 · Bond Elut® C18 · DSC-18(Lt), ENVI-18, LC-18 · CLEAN-UP® C18, Bakerbond® Octadecyl · Isolute C18(EC), LiChrolut® RP-18 E	21
C <sub>18</sub> ec f	silica	as above, fast flow		21
C <sub>18</sub>	silica	octadecyl, not endcapped	Strata™ C18-U · Accubond® C18 · Bakerbond™ PolarPlus · Isolute® C18 · LiChrolut® RP-18	22
C <sub>18</sub> f	silica	as above, fast flow		22
C <sub>18</sub> PAH	silica	special octadecyl phase, for enrichment of PAHs from water	Bakerbond™ Octadecyl Lightload	40
C <sub>18</sub> Hydra	silica	octadecyl, not endcapped, for polar analytes		23
C <sub>8</sub>	silica	octyl	Strata™ C8 · Sep-Pak® C8 · Bond Elut® C8 · DSC-8, ENVI-8, LC-8 · CLEAN-UP® C8 · Accubond® C8 · Bakerbond™ Octyl · Isolute C8(EC)	24
C <sub>4</sub>	silica	butyl		25
C <sub>2</sub>	silica	dimethyl	Bond Elut® C2	25
C <sub>6</sub> H <sub>11</sub> ec	silica	cyclohexyl, endcapped		26
C <sub>6</sub> H <sub>5</sub>	silica	phenyl	Strata™ PH · Bond Elut® PH · DSC-Ph · CLEAN-UP® Phenyl · Accubond® Phenyl · Bakerbond™ Phenyl · Isolute PH(EC)	27
<b>Normal phases</b>				
SiOH	silica	unmodified	Strata™ Si-1 · Bond Elut® silica · DSC-Si, LC-Si · CLEAN-UP® silica · Accubond® silica, Bakerbond™ silica gel · Isolute® silica · LiChrolut® Si	30
NH <sub>2</sub>	silica	aminopropyl	Strata™ NH <sub>2</sub> · Sep-Pak® NH <sub>2</sub> · Bond Elut NH <sub>2</sub> · DSC-NH <sub>2</sub> , LC-NH <sub>2</sub> · CLEAN-UP® aminopropyl · Accubond® NH <sub>2</sub> · Bakerbond™ amino · Isolute® NH <sub>2</sub> · LiChrolut® NH <sub>2</sub>	29
OH	silica	diol	DSC-Diol, LC-Diol · Accubond® Diol (OH)	28
CN	silica	cyano	Strata™ CN · Sep-Pak® CN · Bond Elut® CN-U · DSC-CN, LC-CN · CLEAN-UP® CN · Accubond® CN · Bakerbond™ cyano · Isolute® CN · LiChrolut® CN	28
Alox A	aluminium oxide acidic		LC-Alumina-A · Accubond® aluminium oxide A	31
Alox N	aluminium oxide neutral		LC-Alumina-N · Accubond® aluminium oxide N	31
Alox B	aluminium oxide basic		LC-Alumina-B · Accubond® aluminium oxide B	31
Florisil®	magnesium silicate		Strata™ FL-PR · Sep-Pak® Florisil® · Bond Elut® Florisil® · ENVI-Florisil®, LC-Florisil® · CLEAN-UP® Florisil® · Accubond® Florisil® · Bakerbond™ Florisil® · Isolute® FL · LiChrolut® Florisil®	32
PA	polyamide 6		DPA-6S	32
<b>Ion exchangers</b>				
SB	silica	quaternary ammonium anion exchanger (SAX)	Strata™ SAX, Sep-Pak® SAX, Bond Elut® SAX · DSC-SAX, LC-SAX · CLEAN-UP® Quaternary Amine · Accubond® SAX · Bakerbond™ Quaternary Amine · Isolute® SAX · LiChrolut® SAX	35

\* phases which provide a similar selectivity based on chemical or physical properties (list not complete)





Code	Matrix	Modification / Application	Similar phases*	Page
SA	silica	benzenesulphonic acid cation exchanger (SCX)	Strata™ SCX · Bond Elut® SCX · DSC-SCX, LC-SCX · CLEAN-UP® Benzenesulfonic Acid · Accubond® SCX · Bakerbond™ Aromatic Sulfonic Acid · Isolute® SCX · LiChrolut® SCX	34
PCA	silica	propylcarboxylic acid cation exchanger (WCX)	Strata™ WCX · Bond Elut® CBA · DSC-WCX, LC-WCX · CLEAN-UP® Carboxylic Acid · Bakerbond™ Carboxylic Acid · Isolute® CBA	33
PSA	silica	propylsulphonic acid cation exchanger		33
HR-XC	PS/DVB	strong mixed mode cation exchanger for basic analytes (MCX)	Oasis® MCX · HyperSep™ Retain™-CX · Strata™ X-C · Styre Screen® DBX	14
HR-XA	PS/DVB	strong mixed mode anion exchanger for acidic analytes (MAX)	Oasis® MAX · HyperSep™ Retain™-AX · Styre Screen® QAX	15
HR-XCW	PS/DVB	weak mixed mode cation exchanger for basic analytes (WCX)	Oasis® WCX · Strata™ X-CW	16
HR-XAW	PS/DVB	weak mixed mode anion exchanger for acidic analytes (WAX)	Oasis® WAX · Strata™ X-AW	17
PS-OH <sup>-</sup>	PS/DVB	strong anion exchanger in OH <sup>-</sup> form	Oasis® MAX	20
PS-H <sup>+</sup>	PS/DVB	strong cation exchanger in H <sup>+</sup> form	Oasis® MCX · Strata™ X-C	20
PS-Mix	PS/DVB	mixture of PS-OH <sup>-</sup> and PS-H <sup>+</sup>		
PS-Ag <sup>+</sup>	PS/DVB	strong cation exchanger in Ag <sup>+</sup> form		20
PS-Ba <sup>2+</sup>	PS/DVB	strong cation exchanger in Ba <sup>2+</sup> form		20
<b>Phases for special applications</b>				
Dry	Na <sub>2</sub> SO <sub>4</sub>	for drying organic samples		45
Drug	silica	bifunctional C <sub>8</sub> /SA, for enrichment of drugs from urine	Strata™ Screen-C · Bond Elut® Certify I · DSC-MCAX · Clean Screen® DAU · Accubond® Evidex · Bakerbond™ Narc-2 · Isolute® HCX · LiChrolut® TSC · HyperSep™ Verify CX	36
Drug II	silica	bifunctional C <sub>8</sub> /SB, for extraction of THC and derivatives and of acidic analytes from biological fluids	Strata™ Screen-A · Bond Elut Certify II · Clean Screen® THC · Bakerbond® Narc-1 · Isolute® HAX · HyperSep™ Verify AX	37
Crosslinks	cellulose	for enrichment of collagen crosslinks		38
Tetracycline	silica	special octadecyl phase, for enrichment of tetracyclines		38
AOX	PS/DVB	for extraction of AOX from water (DIN 38409 - H22)		39
CN/SiOH	silica	combination phase for enrichment of PAHs from soil		42
NH <sub>2</sub> /C <sub>18</sub>	silica	combination phase for enrichment of PAHs from water		40
Na <sub>2</sub> SO <sub>4</sub> /Florisol®		combination phase for extraction of hydrocarbons from water (DIN H-53 / ISO DIS 9377-4)		41
SA/SiOH	silica	combination phase for enrichment of PCB from waste oil		43
SiOH-H <sup>+</sup> /SA	silica	combination phase, used together with SiOH for enrichment of PCB from oil		44
NAN	silica / AgNO <sub>3</sub> + Na <sub>2</sub> SO <sub>4</sub>	combination phase for enrichment of PCB from sludge		42
ABC18	silica	octadecyl, with ion exchange functions, for acrylamide analysis	Isolute® M-M	45
Diamino	silica	primary and secondary amine functions (PSA), for determination of pesticides in food samples (QuEChERS method)	Supelclean PSA, Bond Elut PSA	46
Phase separation		CHROMABOND® PTL/PTS		56
Liquid-liquid extraction		CHROMABOND® XTR	EXtrelut® · Chem Elut™ · Hydromatrix™	54

\* phases which provide a similar selectivity based on chemical or physical properties (list not complete)



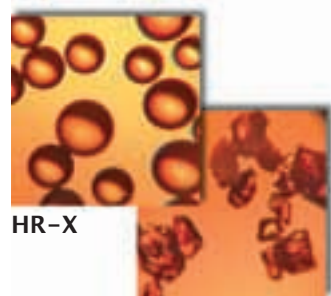
### The professional concept of innovative SPE phases

The **CHROMABOND® HR-Xpert** family comprises 5 polymer-based RP and mixed-mode ion exchange phases:

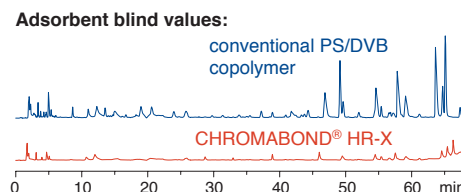
- **CHROMABOND® HR-X** hydrophobic PS/DVB copolymer
- **CHROMABOND® HR-XC** strong mixed-mode cation exchanger
- **CHROMABOND® HR-XA** strong mixed-mode anion exchanger
- **CHROMABOND® HR-XCW** weak mixed-mode cation exchanger
- **CHROMABOND® HR-XAW** weak mixed-mode anion exchanger

### These innovative SPE phases offer

- **state-of-the-art spherical polymer**
  - broad spectrum of application with special suitability for enrichment of pharmaceuticals from biological matrices
  - ideal flow properties due to low content of particulate matter
- **optimised pore structure and high specific surface**
  - high loadability and outstanding elution properties
  - low solvent consumption
  - rapid, economical analyses
- **high-purity adsorber material**
  - allows highest reproducibility with extremely low blind values
  - reliable analyses at ultra trace level
  - no method adaptation for new batches necessary



HR-X  
conventional PS/DVB copolymer



### The HR-Xpert concept guarantees:

- RP and mixed-mode SPE phases with distinct ion exchange and reversed phase properties  
**your benefit:** excellent enrichment of neutral, acidic and basic compounds
- modern, spherical support polymer with optimised pore structure and high surface  
**your benefit:** good reproducibility, reliable and cost-efficient analysis
- possibility for more aggressive washing procedures for matrix removal  
**your benefit:** cleaner samples and protection of your HPLC and GC instruments
- quantification of analytes also from heavily contaminated samples  
**your benefit:** lower limits of detection also for critical matrices

**CHROMABOND® HR-Xpert is the perfect combination for all tasks in sample preparation**

#### Similar phases:

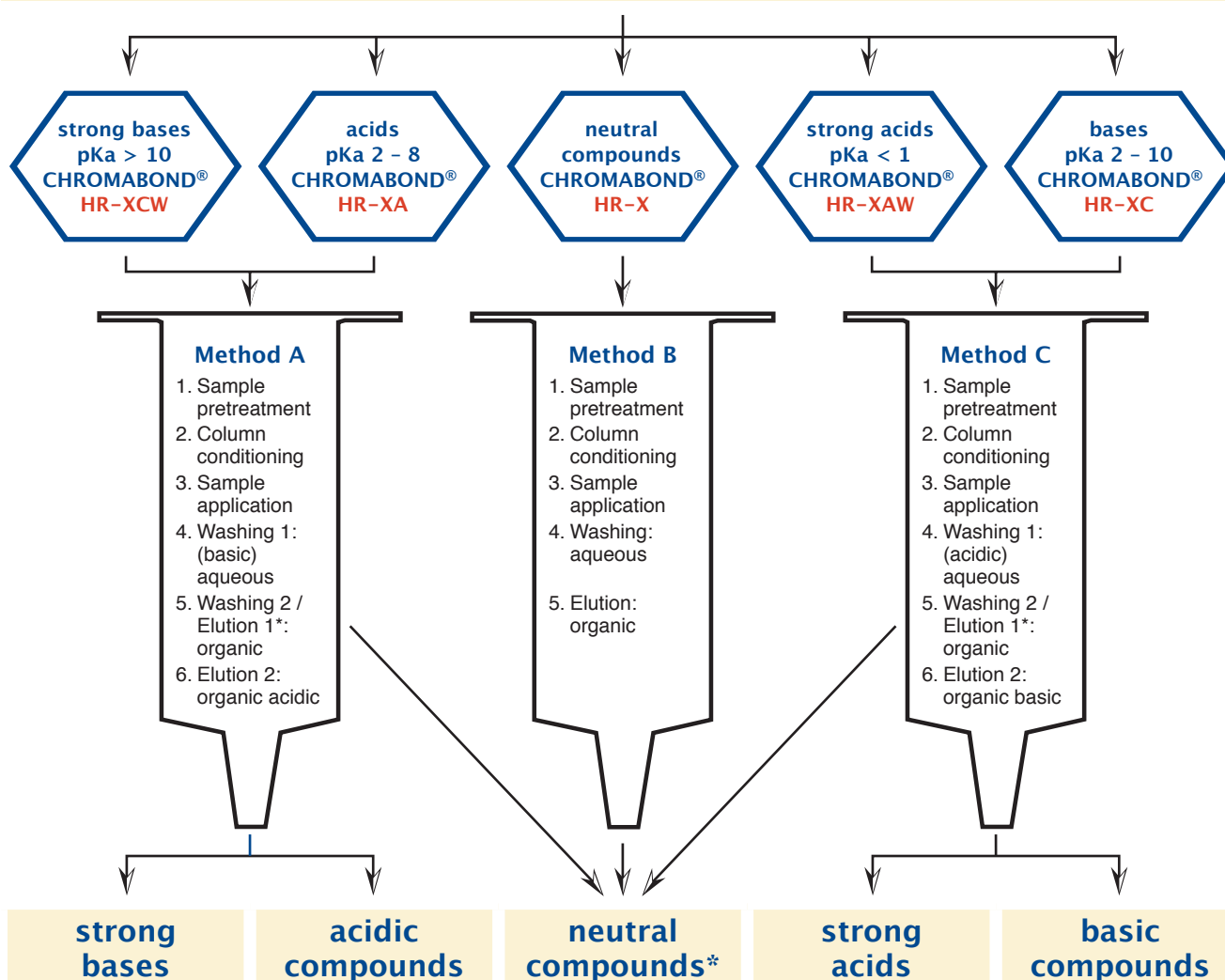
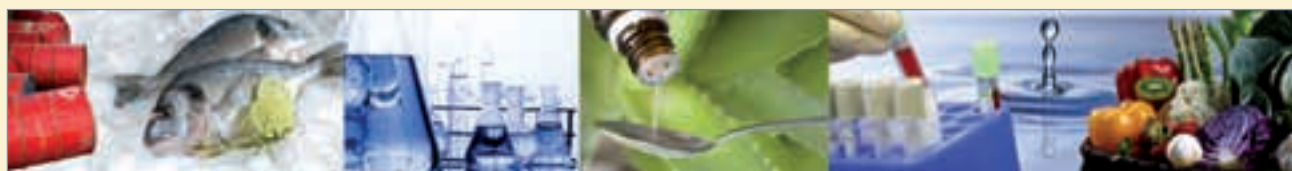
- CHROMABOND® HR-X:** Oasis® HLB, Strata™ X, Nexus, ENVI-Chrom P
- CHROMABOND® HR-XC:** Oasis® MCX, Strata™ X-C, StyreScreen® DBX, HyperSep™ Retain™-CX
- CHROMABOND® HR-XA:** Oasis® MAX, HyperSep™ Retain™-AX, StyreScreen® QAX
- CHROMABOND® HR-XCW:** Oasis® WCX, Strata™ X-CW
- CHROMABOND® HR-XAW:** Oasis® WAX, Strata™ X-AW



## The CHROMABOND® HR-Xpert concept for neutral, acidic and basic analytes

### 3 paths – 1 goal: cleaner samples

Depending on the character of the analytes HR-Xpert offers suitable adsorbents and optimal methods for sample preparation, cleaning and concentration.



Solid Phase Extraction

\* under organic washing and elution conditions the following compounds will be also eluted:

HR-X: polar compounds such as organic acids and bases

HR-XC / HR- XCW: acidic components / impurities

HR-XA / HR- XAW: basic components / impurities



# Polymer-based reversed phases for SPE

## HR-X spherical, hydrophobic polystyrene-divinylbenzene adsorbent resin

- hydrophobic polystyrene-divinylbenzene copolymer
- pH stability 1 – 14
- high-purity material with highest reproducibility and lowest blank values due to a novel manufacturing process
- spherical particles 85 µm; pore size 55 – 60 Å
- very high surface 1000 m<sup>2</sup>/g
- capacity 390 mg/g (caffeine in water)
- excellent recovery rates especially for the enrichment of pharmaceuticals / active ingredients due to the spherical structure of the particles, very homogeneous surface, and optimised pore structure

- recommended application: pharmaceuticals / active ingredients from tablets, creams and water / waste water
- drugs and pharmaceuticals from urine, blood, serum and plasma
- trace analysis of pesticides, herbicides, phenols, PAHs and PCBs from water

### Drugs from water

**Column type:**  
CHROMABOND® HR-X / 3 ml / 200 mg  
REF 730931

**Sample:** 1 µg/ml each in water

**Column conditioning:** 5 ml methanol, 5 ml dist. water

**Sample application:** slowly aspirate 500 ml water (pH 3) through the column

**Column washing:** 5 ml water

**Elution:** after drying 3 x 2 ml acetonitrile

Further analysis: HPLC on NUCLEODUR® C<sub>18</sub> Gravity, 5 µm;  
see MN Appl. No. 121690

#### Recovery rate [%]

Compound	HR-X	Strata™ X
Ketoprofen	98	92
Ibuprofen	91	93
Pentobarbital	99	95
Meclofenamic acid	92	93
Protriptyline	63	45
Nortriptyline	53	39

MN Appl. No. 304240

### Pesticides from water

**Column type:**  
CHROMABOND® HR-X / 3 ml / 200 mg, REF 730931  
CHROMABOND® Easy / 3 ml / 200 mg, REF 730754

**Sample pretreatment:** samples are spiked with 500 ng of each pesticide in 1000 ml water, adjusted to pH 2 with HCl (a) or pH 7

**Column conditioning:** 10 ml methanol, 10 ml dist. water

**Sample application:**  
slowly pass 1000 ml spiked water sample through the column with the aid of a tubing adaptor (REF 730243)

**Elution:** after drying 5 ml methanol – THF (1:1, v/v)

Further analysis: HPLC

#### a) Recovery rates [%]

Compound	HR-X pH 2	Compound	HR-X pH 7
Metamitron	86	Desisopropylatrazine	90
Quinmerac	90	2,4-Dichlorobenzamide	95
Chloridazon	93	Desethylatrazine	89
Picloram	83	Hexazinone	95
Metribuzin	84	Bromacil	103
Cyanazine	83	Simazine	91
Metabenzthiazuron	94	Desethylterbutylazine	89
Chlortoluron	91	Atrazine	88
Isoproturon	89	Metalaxyl	97
Diuron	91	Metazachlor	93
Dimethenamid-P	89	Propazine	88
Linuron	94	Terbutylazine	86
Epoxyconazole	85	Metolachlor	97
Penconazole	90		
Alachlor	93		
Propiconazole-1	89		
Flufenacet	91		
Diffenamicam	58		
Triallate	42		

MN Appl. No. 304250/304260



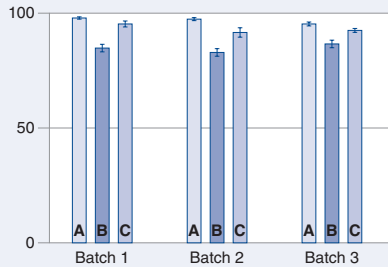


## Highest reproducibility

- ✓ within each batch      ✓ from batch to batch

Compounds:

- A** phenobarbital
- B** pentobarbital
- C** hexobarbital



## Barbiturates from serum

**Column type:**  
CHROMABOND® HR-X / 3 ml / 200 mg  
REF 730931

**Sample:** 100 ng/ml each in serum  
**Column conditioning:** 5 ml methanol, 5 ml dist. water  
**Sample application:** 1 ml spiked serum  
**Column washing:** 5 ml water  
**Elution:** after drying 3 x 2 ml methanol

Further analysis: HPLC on NUCLEODUR® 100-5 C<sub>18</sub> ec, see MN Appl. No. 117820

MN Appl. No. 304290

## Standard protocol for CHROMABOND® HR-X

**Column type:**  
CHROMABOND® HR-X / 3 ml / 200 mg  
REF 730931

**Sample pretreatment:** if necessary, adjust pH value  
**Column conditioning:** 5 ml methanol  
**Equilibration:** 5 ml water  
**Sample application:** slowly aspirate the sample through the column  
**Column washing:** 5 ml water – methanol (95:5, v/v)  
**Elution:** after drying 3 x 2 ml methanol

Further analysis: if necessary, evaporate and redissolve in a suitable solvent; HPLC or GC



MN Appl. No. 304310

## Ordering information

Volume	Adsorbent weight						Pack of
<b>CHROMABOND® HR-X polypropylene columns</b>							
	30 mg	60 mg	100 mg	200 mg	500 mg	1 g	
1 ml	<b>730934</b>		<b>730935</b>				30
3 ml		<b>730936</b>		<b>730931</b>	<b>730937</b>		30
6 ml				<b>730938</b>	<b>730939</b>		30
15 ml					<b>730940</b>	<b>730941</b>	20
<b>CHROMABOND® HR-X polypropylene columns · BIGpacks</b>							
				200 mg			
3 ml				<b>730931.250</b>			250
6 ml				<b>730938.250</b>	<b>730939.250</b>		250
<b>CHROMABOND® HR-X glass columns</b>							
		60 mg		200 mg			
3 ml		<b>730936G</b>					30
6 ml				<b>730938G</b>			30
<b>CHROMABOND® LV-HR-X</b>							
	30 mg	60 mg		200 mg			
15 ml	<b>732130</b>	<b>732131</b>		<b>732132</b>			30
<b>CHROMABOND® MULTI 96 HR-X</b>							
	96 x 25 mg		96 x 50 mg		96 x 100 mg		
	<b>738530.025M</b>		<b>738530.050M</b>		<b>738530.100M</b>		1
<b>CHROMABOND® HR-X adsorbent</b>							
					<b>730663</b>		20 g

CHROMAFIX® cartridges on request



# Polymer-based ion exchangers for SPE

## HR-XC

- strong acidic benzenesulphonic acid cation exchanger  
exchange capacity 1.0 meq/g, pKa < 1
- base material polystyrene-divinylbenzene copolymer  
pH stability 1 - 14
- high purity material, highest reproducibility and  
lowest blank values due to an optimised production process
- spherical particles size 85 µm; pore size 65 - 75 Å
- very large specific surface 800 m<sup>2</sup>/g; pore volume 1.4 cm<sup>3</sup>/g
- RP capacity 300 mg/g (caffeine in water)
- outstanding recovery rates especially for the enrichment of basic analytes

**NEW!**

## strong cation exchanger

- recommended application:  
basic active ingredients  
from heavily matrix-con-  
taminated samples like e.g.  
urine, plasma, serum
- fungicides from food,  
melamine from milk
- basic analytes like e.g.  
amines
- bases with pKa 2 - 10

Solid Phase Extraction



### Standard protocol for CHROMABOND® HR-XC

- Column type:**  
CHROMABOND® HR-XC / 3 ml / 200 mg  
REF 730952
  - Sample pretreatment:** individual sample preparation with refer-  
ence to analytes and matrix
  - Column conditioning:** 5 ml methanol
  - Equilibration:** 5 ml water
  - Sample application:** slowly aspirate sample through the column
  - Washing 1:** 2 ml 0.1 mol/l HCl in water
  - Washing 2 / Elution 1:** 2 ml methanol (neutral and acidic com-  
pounds); if necessary, further washing steps
  - Elution 2:** after drying 5 ml methanol / 5% NH<sub>3</sub> (basic com-  
pounds)
- Further analysis: if necessary, evaporate and redissolve in a  
suitable solvent; HPLC or GC

MN Appl. No. 304740

### Fractionation of acidic, neutral and basic

- Column type:**  
CHROMABOND® HR-XC / 3 ml / 200 mg  
REF 730952
  - Sample:** 1 ml spiked matrix, acidified with 200 µl 2% H<sub>3</sub>PO<sub>4</sub>
  - Column conditioning:** 5 ml methanol, then 5 ml water
  - Sample application:** slowly aspirate sample through the column
  - Washing:** 2 ml 0.1 mol/l HCl
  - Elution:** 2.5 ml methanol (*fraction A:* neutral and acidic analytes);  
then 5 ml methanol - NH<sub>3</sub> 90:10, v/v (*fraction B:* basic analytes)
- Further analysis for fraction A: HPLC e. g. on NUCLEODUR®  
C<sub>18</sub> Gravity, see MN Appl. No. 122230; for fraction B: HPLC on  
NUCLEODUR® C<sub>8</sub> Gravity, see MN Appl. No. 118520

#### Recovery rates [%]

Compound	HR-XC	Recovery rates [%]			
		Fraction A: neutral and acidic analytes	Fraction B: basic analytes		
		HR-XC	Oasis® MCX	Strata™ X-C	
Suprofen	108	1. Doxepin	101	68	82
Naproxen	85	2. Imipramine	95	71	85
Tolmetin	73	3. Amitriptyline	94	72	78
Phenobarbital	108	4. Trimipramine	92	70	81
Indomethacin	33				
Hexobarbital	80				

MN Appl. No. 304780

## Ordering information

	Volume	Adsorbent weight					Pack of
	<b>CHROMABOND® HR-XC polypropylene columns</b>						
		30 mg	60 mg	100 mg	150 mg	200 mg	500 mg
	1 ml	<b>730969</b>		<b>730049</b>			
	3 ml		<b>730956</b>			<b>730952</b>	<b>730953</b>
	6 ml			<b>730957</b>		<b>730955</b>	
	<b>CHROMAFIX® HR-XC cartridges</b>						
	Size	S		M		L	
	adsorbent weight Ø	155 mg		240 mg		500 mg	
		<b>731755</b>		<b>731756</b>		<b>731757</b>	50
	<b>CHROMABOND® HR-XC adsorbent</b>						
						<b>730664</b>	100 g



## HR-XA

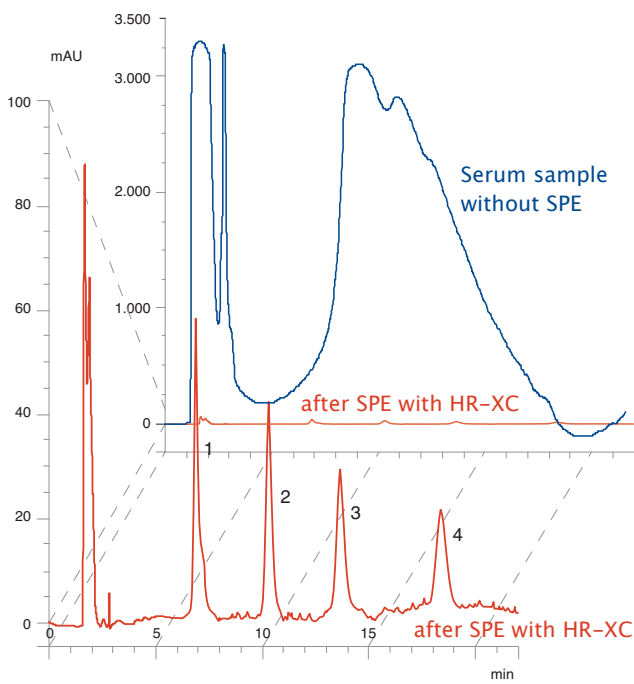
- strong basic quaternary ammonium anion exchanger  
exchange capacity 0.25 meq/g, pKa ~ 18  
base material polystyrene-divinylbenzene copolymer  
pH stability 1 – 14  
high purity material with highest reproducibility and lowest blank values due to an optimised production process  
spherical particles size 85 µm; pore size 55 – 65 Å  
very large specific surface 850 m<sup>2</sup>/g; pore volume 1.4 cm<sup>3</sup>/g  
RP capacity 350 mg/g (caffeine in water)  
outstanding recovery rates especially for the enrichment of acidic analytes

**NEW!**

## strong anion exchanger

- recommended application:  
acidic active ingredients from heavily matrix-contaminated samples like e. g. urine, plasma, serum  
phenolic acids  
acidic herbicides  
weak/medium-strength acids with pKa 2 – 8

### analytes from serum



### Standard protocol for CHROMABOND® HR-XA



#### Column type:

CHROMABOND® HR-XA / 3 ml / 200 mg  
REF 730951

*Sample pretreatment:* individual sample preparation with reference to analytes and matrix

*Conditioning:* 5 ml methanol

*Equilibration:* 5 ml water

*Sample application:* slowly aspirate sample through the column

*Washing 1:* 2 ml 0.1 mol/l NaOH in water

*Washing 2 / Elution 1:* 2 ml methanol (neutral and basic compounds), if necessary, further washing steps

*Elution 2:* after drying 5 ml methanol / 1 – 10 % formic acid (acidic compounds)

Further analyses: if necessary, evaporate and redissolve in a suitable solvent; HPLC or GC

MN Appl. No. 304970

For further applications on  
**CHROMABOND®** polymer phases see  
our online application database at  
[www.mn-net.com/apps](http://www.mn-net.com/apps)

Solid Phase Extraction

## Ordering information

	Volume	Adsorbent weight					Pack of
	<b>CHROMABOND® HR-XA polypropylene columns</b>						
		30 mg	60 mg	100 mg	150 mg	200 mg	500 mg
	1 ml	<b>730968</b>		<b>730727</b>			
	3 ml		<b>730950</b>			<b>730951</b>	<b>730954</b>
	6 ml			<b>730958</b>		<b>730966</b>	
	<b>CHROMAFIX® HR-XA cartridges</b>						
	Size	S		M		L	
	Adsorbent weight Ø	155 mg		240 mg		500 mg	
		<b>731768</b>		<b>731769</b>		<b>731770</b>	
	<b>CHROMABOND® HR-XA adsorbent</b>						
						<b>730671</b>	100 g



# Polymer-based ion exchangers for SPE

## HR-XCW

- weak acidic carboxylic acid cation exchanger  
exchange capacity >0.7 meq/g, pKa ~ 5  
base material spherical PS/DVB copolymer  
pH stability 1 – 14  
high purity material, highest reproducibility and  
lowest blank values due to an optimised production process  
spherical particles size 85 µm; pore size 50 – 60 Å  
very large specific surface 850 m<sup>2</sup>/g; pore volume 1.2 – 1.4 cm<sup>3</sup>/g  
RP capacity 350 mg/g (caffeine in water)  
outstanding recovery rates especially for enrichment of strongly basic analytes

**NEW!**

## weak cation exchanger

- recommended application:  
basic compounds like  
quaternary amines  
active ingredients from  
heavily matrix-contaminated samples like e.g.  
urine, plasma, serum  
strong bases with  
pKa > 10

Solid Phase Extraction

### Standard protocol for CHROMABOND® HR-XCW

**Column type:**  
CHROMABOND® HR-XCW / 3 ml / 200 mg  
REF 730739

**Sample pretreatment:** individual sample preparation with reference to analytes and matrix

**Column conditioning:** 5 ml methanol

**Equilibration:** 5 ml acidified water

**Sample application:** slowly aspirate sample through the column

**Washing 1:** 2 ml acidified water

**Washing 2 / Elution 1:** 2 ml methanol (neutral and acidic compounds), if necessary, further washing steps

**Elution 2:** after drying 2 x 2 ml methanol / 1 – 5 % formic acid (strongly basic compounds)

Further analysis: if necessary, evaporate and redissolve in a suitable solvent; HPLC or GC

MN Appl. No. 305300



### Analysis of perfluorinated

**Column:** 125 x 2 mm NUCLEODUR® Sphinx RP, 3 µm

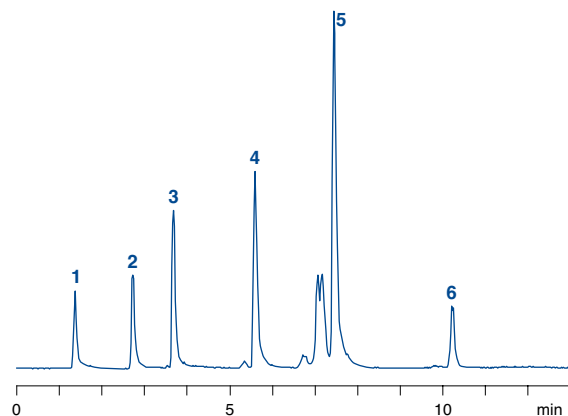
**Eluent:** A) 10 mM NH<sub>4</sub>Ac in water – methanol (75:25, v/v);  
B) 10 mM NH<sub>4</sub>Ac in acetonitrile – methanol (75:25, v/v)

**Gradient:** 10 – 30 % B in 3 min, 30 – 55 % B in 8 min,  
55 – 10 % B in 4 min

**Flow rate:** 0.30 ml/min, temperature 50 °C

**Inj. volume:** 2.5 µl (5 mg/l each after SPE enrichment)

**Detection:** MS, ESI negative



MN Appl. No. 123340

## Ordering information

Volume	Adsorbent weight						Pack of
<b>CHROMABOND® HR-XCW polypropylene columns</b>							
	30 mg	60 mg	100 mg	150 mg	200 mg	500 mg	
1 ml	730731		730733				30
3 ml		730735			730739	730741	30
6 ml				730737		730743	30
<b>CHROMAFIX® HR-XCW cartridges</b>							
	Size	S	M	L			
	adsorbent weight Ø	155 mg	240 mg	500 mg			
		731774	731775	731776			50
<b>CHROMABOND® HR-XCW adsorbent</b>							
						730674	100 g





## HR-XAW

- weak basic secondary and tertiary ammonium anion exchanger, exchange capacity >0.5 meq/g, pKa ~ 6
- base material spherical PS/DVB copolymer
- pH stability 1 – 14
- high purity material with highest reproducibility and lowest blank values due to an optimised production process
- spherical particles size 85 µm; pore size 55 – 65 Å
- very large specific surface 850 m<sup>2</sup>/g; pore volume 1.2 – 1.4 cm<sup>3</sup>/g
- RP capacity 350 mg/g (caffeine in water)
- outstanding recovery rates especially for enrichment of acidic analytes

**NEW!**

## weak anion exchanger

- recommended application:
  - perfluorinated surfactants
  - acidic compounds like sulfonates
  - active ingredients from heavily matrix-contaminated samples like e.g. urine, plasma, serum
  - strong acids with pKa < 1

### surfactants from water

**Column type:**  
CHROMABOND® HR-XAW / 3 ml / 6 mg  
REF 730747

**Sample:** 500 ml water, spiked with 1 ml standard solution (20 µg/l of each compound)

**Conditioning:** 2 ml methanol + 5% ammonia, then 2 ml methanol, finally 2 ml water

**Sample application:** slowly aspirate sample through the column

**Washing:** 2 ml water, then 2 ml acetone – acetonitrile – formic acid (50:50:1, v/v/v), finally 2 ml methanol

**Elution:** 2 ml methanol with 5% ammonia

Further analysis: evaporate to dryness in a stream of nitrogen under slight heating, and redissolve in a suitable solvent for HPLC

#### Recovery rates [%]:

Compound	Recovery
1 Perfluoropropionic acid (PFPrA)	103
2 Perfluoropentanoic acid (PFPeA)	94
3 Perfluorohexanoic acid (PFHxA)	94
4 Perfluorooctanoic acid (PFOA)	95
5 Perfluorooctane sulfonate K salt (PFOS)	81
6 Perfluorododecanoic acid (PFDoDA)	82

MN Appl. No. 305140

For an application in accordance with DIN 38407-42 see Appl. No. 305141 at [www.mn-net.com/apps](http://www.mn-net.com/apps).



impregnated with fluorosurfactants?

### Standard protocol for CHROMABOND® HR-XAW

**Column type:**  
CHROMABOND® HR-XAW / 3 ml / 200 mg  
REF 730748

**Sample pretreatment:** individual sample preparation with reference to analytes and matrix

**Conditioning:** 5 ml methanol

**Equilibration:** 5 ml water

**Sample application:** slowly aspirate sample through the column

**Washing 1:** 25 mM ammonium acetate

**Washing 2 / Elution 1:** 2 ml methanol (neutral and basic compounds), if necessary, further washing steps

**Elution 2:** after drying 2 x 2 ml methanol / 1 – 5% ammonia (strongly acidic compounds)

Further analyses: if necessary, evaporate and redissolve in a suitable solvent; HPLC or GC

MN Appl. No. 305200

## Ordering information

	Volume	Adsorbent weight					Pack of
	<b>CHROMABOND® HR-XAW polypropylene columns</b>						
		30 mg	60 mg	100 mg	150 mg	200 mg	500 mg
	1 ml	<b>730728</b>		<b>730729</b>			
	3 ml		<b>730747</b>			<b>730748</b>	<b>730744</b>
	6 ml			<b>730749</b>		<b>730745</b>	
	<b>CHROMAFIX® HR-XAW cartridges</b>						
	Size	S		M		L	
	Adsorbent weight Ø	155 mg		240 mg		500 mg	
		<b>731771</b>		<b>731772</b>		<b>731773</b>	50
	<b>CHROMABOND® HR-XAW adsorbent</b>						
						<b>730673</b>	100 g



# Polymer-based reversed phases for SPE

## Easy polar, bifunctionally modified polystyrene–divinylbenzene copolymer

- polar modified polystyrene–divinylbenzene copolymer with a weak anion exchanger
- specific surface 650 – 700 m<sup>2</sup>/g, particle size 80 µm, pore size 50 Å, pH stability 1 – 14

### The Easy effect:

- without preconditioning
- due to bifunctional modification much more hydrophilic than conventional polystyrene–divinylbenzene polymers
- easily wettable with water

- recommended application:
  - polar herbicides / pesticides from water (acidic, neutral, basic)
  - polar phenols from water
  - polyaromatic compounds
  - polychlorinated biphenyls
  - drug analysis from urine, blood, serum, plasma, pharmaceuticals / active ingredients from tablets, creams

### Recovery of pesticides

Private communication: Mr. Kühn, GUB, Waldshut Tiengen, Germany

**Column type:**  
CHROMABOND® Easy/ 3 ml / 200 mg  
REF 730754

**Column conditioning:**  
1 ml water, 3 ml methanol, 1 ml water  
**Sample application:** aspirate the sample through the column

**Elution:** 3 x 1 ml acetone

**Further analysis:**  
HPLC with NUCLEOSIL® 120-5 C<sub>18</sub>

MN Appl. No. 303220

#### Recovery rates [%]:

Compound	Recovery	Compound	Recovery
Desisopropylatrazine	90	Metalaxyl	96
2,6-Dichlorobenzamide	93	Isoproturon	94
Desethylatrazine	93	Diuron	94
Hexazinone	69	Metazachlor	97
Terbacil	65	Propazine	95
Simazine	81	Terbuthylazine	93
Cyanazine	93	Linuron	96
Desethylterbuthylazine	91	Metolachlor	97
Methabenzthiazuron	94	Triallate	61
Chlortoluron	91	Standard	64
Atrazine	92		

## Ordering information

Volume	Adsorbent weight						Pack of
<b>CHROMABOND® Easy polypropylene columns</b>							
	30 mg	60 mg	100 mg	200 mg	500 mg	1 g	
1 ml	730751		730752				30
3 ml		730753		730754	730759		30
6 ml				730755	730756		30
15 ml					730757	730758	20
<b>CHROMABOND® Easy polypropylene columns · BIGpacks</b>							
				200 mg			
3 ml				730754.250			250
6 ml				730755.250			250
<b>CHROMABOND® LV-Easy</b>							
				200 mg			
15 ml				732472			30
<b>CHROMABOND® MULTI 96 Easy</b>							
	96 x 25 mg		96 x 50 mg		96 x 100 mg		
	738520.025M		738520.050M		738520.100M		1
<b>CHROMABOND® Easy adsorbent</b>							
						730661	20 g

Glass columns on request.



## HR-P

## polystyrene-divinylbenzene adsorbent resin

- ◆ highly porous polystyrene-divinylbenzene copolymer
  - specific surface 1200 m<sup>2</sup>/g
  - particle size 50 - 100 µm
  - very high binding capacity, up to 30% of adsorbent weight (for comparison: silica adsorbents about 3%)
- ◆ recommended application:
  - aromatic compounds
  - phenols from water
  - nitroaromatics from water
  - pesticides from water
  - PAHs from oil

### Aromatic amines from water samples

Private communication M. Leß, T.C. Schmidt, Department of Chemistry, University Marburg, 1997

*Compounds investigated:* aromatic amines

*Column type:*

CHROMABOND® HR-P / 3 ml / 200 mg  
REF 730108

*Sample pretreatment:* adjust to pH 9 using 10 mol/l NaOH

*Column conditioning:* 2 ml each of methanol, acetonitrile and 10<sup>-5</sup> mol/l sodium hydroxide

*Sample application:*

aspirate sample through the column with about 10 ml/min

*Column washing:*

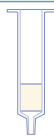


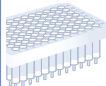

wash with 2 ml dist. water, dry 5 min under vacuum

*Elution:* 3 x 1 ml methanol – acetonitrile (1:1; v/v)

For recovery rates of numerous aromatic amines please see application 301810 at [www.mn-net.com](http://www.mn-net.com).

MN Appl. No. 301810

## Ordering information

Volume	Adsorbent weight			Pack of	
 <b>CHROMABOND® HR-P polypropylene columns</b>					
	100 mg	200 mg	500 mg	1 g	
1 ml	<b>730280</b>			30	
3 ml		<b>730108</b>	<b>730117</b>	30	
6 ml		<b>730119</b>	<b>730111</b>	<b>730118</b>	30
<b>CHROMABOND® HR-P polypropylene columns · BIGpack</b>					
	200 mg				
3 ml	<b>730108.250</b>			250	
<b>CHROMABOND® HR-P glass columns</b>					
		200 mg	500 mg	1 g	
3 ml	<b>730108G</b>			30	
6 ml		<b>730111G</b>	<b>730118G</b>	30	
 <b>CHROMABOND® LV-HR-P</b>					
	200 mg				
15 ml	<b>732108</b>			30	
 <b>CHROMAFIX® HR-P cartridges</b>					
<b>Size</b>	<b>S</b>	<b>M</b>	<b>L</b>		
Adsorbent weight Ø	200 mg	330 mg	680 mg		
	<b>731839</b>	<b>731840</b>	<b>731841</b>	50	
 <b>CHROMABOND® MULTI 96 HR-P</b>					
	96 x 100 mg				
	<b>738111.100M</b>			1	
 <b>CHROMABOND® HR-P adsorbent</b>					
	<b>730615</b>			20 g	



# Polymer-based phases for SPE

## PS-RP / PS-OH<sup>-</sup> / PS-H<sup>+</sup> / PS-Mix PS-Ag<sup>+</sup> / PS-Ba<sup>2+</sup>

phases for RP / ion chromatography

- base material: high purity polystyrene-divinylbenzene copolymers (PS/DVB), pore size 100 Å, particle size 100 µm
- very low degree of swelling, thus very well suited for chromatography
- reliable function over the whole pH range from 0 - 14
- different modifications for different applications from elimination of nonpolar compounds up to the removal of specific polar components

- recommended application:
  - removal of interfering compounds
  - improves chromatographic separation, if the interfering components overlap with the analyte in the chromatogram
  - improves lifetime of the chromatographic column, since interfering components can irreversibly block the column packing
  - enrichment of the analytes

### Properties of the individual modifications:

PS-RP	hydrophobic PS/DVB copolymer	removal of organic interfering components from water
PS-OH <sup>-</sup>	strong PS/DVB anion exchanger, OH <sup>-</sup> form capacity 0.6 meq/g	removal or concentration of anions from water increasing the pH value in acidic samples
PS-H <sup>+</sup>	strong PS/DVB cation exchanger, H <sup>+</sup> form capacity 2.9 meq/g	removal or concentration of cations from water decreasing the pH value of basic samples
PS-Mix	mixture of PS-OH <sup>-</sup> and PS-H <sup>+</sup>	desalting of water
PS-Ag <sup>+</sup>	strong PS/DVB cation exchanger, Ag <sup>+</sup> form	removal of halide ions from water
PS-Ba <sup>2+</sup>	strong PS/DVB cation exchanger, Ba <sup>2+</sup> form	removal of sulphate ions from water

### Application 301930/302750: removal of halides from aqueous samples shown for the trace analysis of nitrate besides an excess of chloride or bromide

*Compounds investigated:* 20 ppm nitrate besides 2500 ppm chloride or 500 ppm bromide, respectively

#### *Sample application and elution:*

apply 4 x 1 ml sample fractions to the cartridge, discard 1<sup>st</sup> ml, collect 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> ml separately

#### *Column type:*

CHROMAFIX® PS-Ag<sup>+</sup> (M)  
0.8 ml / Ø 480 mg, REF 731865  
*Column conditioning:* 1 ml dist. water

Further analysis: HPLC with column 250 x 4 mm NUCLEOSIL® Anion II; eluent 2 mM potassium hydrogen phthalate pH 6, 2 ml/min; detection: indirect UV, 280 nm (see applications 110440 and 110450 at [www.mn-net.com](http://www.mn-net.com))

## Ordering information

Phase	Volume / Adsorbent weight				Pack of		
<b>CHROMABOND® PS polypropylene columns</b>							
	3 ml 200 mg	3 ml 500 mg	6 ml 500 mg	6 ml 900 mg			
PS-RP	<b>730765</b>	<b>730692</b>	<b>730693</b>		30		
PS-OH <sup>-</sup>	<b>730396</b>	<b>730344</b>	<b>730378</b>		30		
PS-H <sup>+</sup>	<b>730690</b>	<b>730376</b>	<b>730377</b>		30		
PS-Mix				<b>730310</b>	30		
<b>CHROMAFIX® PS cartridges</b>							
	Size S	Adsorbent weight Ø	Size M	Adsorbent weight Ø	Size L	Adsorbent weight Ø	
PS-RP	<b>731877</b>	200 mg	<b>731875</b>	320 mg			50
PS-OH <sup>-</sup>	<b>731868</b>	200 mg	<b>731860</b>	380 mg	<b>731862</b>	800 mg	50
PS-H <sup>+</sup>	<b>731867</b>	230 mg	<b>731861</b>	430 mg	<b>731863</b>	900 mg	50
PS-Ag <sup>+</sup>	<b>731866</b>	240 mg	<b>731865</b>	480 mg			50
PS-Ba <sup>2+</sup>	<b>731871</b>	280 mg	<b>731870</b>	550 mg			50



## C<sub>18</sub> ec / C<sub>18</sub> ec f (f = fast flow)

- base material silica, pore size 60 Å, particle size 45 µm for C<sub>18</sub> ec, 100 µm for C<sub>18</sub> ec f (for fast flow), specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- octadecyl phases, endcapped, carbon content 14%
- very nonpolar, hydrophobic interactions with a wide variety of organic compounds
- advantageous for clean-up of samples with large structural variations (polarity differences)

## octadecyl silica, endcapped

- recommended application: nonpolar compounds  
aflatoxins, amphetamines, antibiotics, antiepileptics, barbiturates, caffeine, drugs, preservatives, fatty acids, nicotine, PAHs, pesticides, PCBs, heavy metals, vitamins
- very well suited for desalting of samples
- C<sub>18</sub> ec f for viscous samples

## Ordering information

Volume	Adsorbent weight							Pack of
<b>CHROMABOND® C<sub>18</sub> ec polypropylene columns</b>								
	100 mg	200 mg	500 mg	1 g	2 g	5 g	10 g	
1 ml	730011							100
3 ml		730012	730013					50
6 ml			730014	730015	730141			30
15 ml					730404			20
45 ml						730405		20
70 ml							730259	10
<b>CHROMABOND® C<sub>18</sub> ec polypropylene columns · BIGpacks</b>								
			500 mg	1 g				
3 ml			730013.250					250
6 ml			730014.250	730015.250				250
<b>CHROMABOND® C<sub>18</sub> ec glass columns</b>								
		200 mg	500 mg	1 g				
3 ml		730012G	730013G					50
6 ml			730014G	730015G				30
<b>CHROMABOND® LV-C<sub>18</sub> ec</b>								
		200 mg	500 mg					
15 ml		732012	732013					30
<b>CHROMAFIX® C<sub>18</sub> ec cartridges</b>								
	Size	S		M		L		
	Adsorbent weight Ø	270 mg		530 mg		950 mg		
		731804		731805		731806		50
<b>CHROMABOND® MULTI 96 C<sub>18</sub> ec</b>								
		96 x 25 mg		96 x 50 mg		96 x 100 mg		
		738011.025M		738011.050M		738011.100M		1
<b>CHROMABOND® C<sub>18</sub> ec adsorbent</b>								
						730611		100 g
<b>CHROMABOND® C<sub>18</sub> ec f polypropylene columns (fast flow)</b>								
		200 mg	500 mg	1 g				
3 ml		730269	730018					50
6 ml			730016	730010				30
<b>CHROMABOND® C<sub>18</sub> ec f adsorbent (fast flow)</b>								
						730613		100 g



# Silica-based reversed phases for SPE

## C<sub>18</sub> / C<sub>18</sub> f (f = fast flow)

- base material silica, pore size 60 Å, particle size 45 µm for C<sub>18</sub>, 100 µm for C<sub>18</sub> f (for fast flow), specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- octadecyl phases, not endcapped, carbon content 14%
- similar to C<sub>18</sub> ec, however possesses more free silanols (SiOH), which allow secondary interactions with polar groups of the analytes

## octadecyl silica

- recommended application: nonpolar compounds, pesticides
- C<sub>18</sub> f for viscous samples

Solid Phase Extraction

## Ordering information

Volume	Adsorbent weight							Pack of	
<b>CHROMABOND® C<sub>18</sub> polypropylene columns</b>									
	100 mg	200 mg	500 mg	1 g	2 g	5 g	10 g		
1 ml	730001							100	
3 ml		730002	730003					50	
6 ml			730004	730005	730130			30	
15 ml					730028			20	
45 ml						730400		20	
70 ml							730261	10	
<b>CHROMABOND® C<sub>18</sub> polypropylene columns · BIGpacks</b>									
			500 mg	1 g					
3 ml			730003.250					250	
6 ml			730004.250	730005.250				250	
<b>CHROMABOND® C<sub>18</sub> glass columns</b>									
			500 mg	1 g					
3 ml			730003G					50	
6 ml			730004G	730005G				30	
<b>CHROMABOND® LV-C<sub>18</sub></b>									
		200 mg							
15 ml		732002						30	
<b>CHROMAFIX® C<sub>18</sub> cartridges</b>									
Size	S		M		L				
Adsorbent weight Ø	270 mg		530 mg		950 mg				
	731801		731802		731803			50	
<b>CHROMABOND® MULTI 96 C<sub>18</sub></b>									
	96 x 25 mg				96 x 100 mg				
	738001.025M				738001.100M				1
<b>CHROMABOND® C<sub>18</sub> adsorbent</b>									
						730602		100 g	
<b>CHROMABOND® C<sub>18</sub> f polypropylene columns (fast flow)</b>									
		200 mg	500 mg	1 g					
3 ml		730402	730008					50	
6 ml			730403	730009				30	
<b>CHROMABOND® C<sub>18</sub> f adsorbent (fast flow)</b>									
						730612		100 g	



## C<sub>18</sub> Hydra

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- special octadecyl phase for polar analytes, not end-capped, carbon content 15%

## octadecyl silica for polar analytes

- recommended application: more polar compounds like pesticides and their polar degradation products, phenols, phenoxy-carboxylic acids, nitroaromatics, pharmaceuticals

### Pesticides from water

*Compounds investigated:* triazines and carboxylic amides

*Column type:*

CHROMABOND® C<sub>18</sub> Hydra / 6 ml / 2 g  
REF 730301

*Sample pretreatment:* adjust 1000 ml water to pH 7 – 8 with diluted NH<sub>3</sub> and add 100 µl of the internal standards (1 µg/l).

*Column conditioning:* 2 x 5 ml methanol, then 2 x 5 ml dist. water

*Sample application:* force or aspirate the sample through the column. Then dry for 2 h with 2 bar N<sub>2</sub>.

*Elution:* slowly aspirate 10 ml methanol through the column. Evaporate the eluate to dryness in a tapered flask with a rotation evaporator at 30 °C and store in a refrigerator for ~ 15 min. Redissolve the residue in 200 µl cold, fresh *n*-hexane and transfer the solution to a conic HPLC vial (e.g. REF 702891). Store the solution in a refrigerator until chromatography.

**Recovery rates:** between 95 and 100%

Further analysis: GC with OPTIMA® δ-3 or OPTIMA® δ-6 (e.g. application 250420) or HPLC in accordance with EN ISO 11369: 1997 on NUCLEOSIL® 120-3 C<sub>18</sub> (application 110880)

MN Appl. No. 302060



## Ordering information

	Volume	Adsorbent weight						Pack of	
	<b>CHROMABOND® C<sub>18</sub> Hydra polypropylene columns</b>								
		50 mg	100 mg	200 mg	500 mg	1 g	2 g	3 g	
	1 ml	730294	730295						100
	3 ml			730296	730297	730298			50
	6 ml				730299	730300	730301	730302	30
	<b>CHROMABOND® C<sub>18</sub> Hydra glass columns</b>								
			200 mg	500 mg	1 g				
3 ml			730296G	730297G	730298G			50	
6 ml				730299G	730300G			30	
	<b>CHROMABOND® LV-C<sub>18</sub> Hydra</b>								
	15 ml			200 mg					30
	<b>CHROMAFIX® C<sub>18</sub> Hydra cartridges</b>								
	Size	S		M		L			
	Adsorbent weight Ø	270 mg		530 mg		950 mg			
		731730		731731		731732		50	
	<b>CHROMABOND® MULTI 96 C<sub>18</sub> Hydra</b>								
						96 x 100 mg			
						738294.100M		1	
	<b>CHROMABOND® C<sub>18</sub> Hydra adsorbent</b>								
							730628	100 g	



# Silica-based reversed phases for SPE

**C<sub>8</sub>**

**octyl silica**

- ◆ base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
 octyl phase, not endcapped, carbon content 8%  
 similar to C<sub>18</sub>, however slightly more polar  
 secondary interactions with polar compounds are more pronounced due to shorter alkyl chains

- ◆ recommended application:  
 pesticides, PCB

## Ordering information

Volume	Adsorbent weight				Pack of
<b>CHROMABOND® C<sub>8</sub> polypropylene columns</b>					
	100 mg	200 mg	500 mg	1 g	
1 ml	730021				100
3 ml	730022				50
6 ml	730024		730134		30
<b>CHROMABOND® C<sub>8</sub> glass columns</b>					
	500 mg				
6 ml	730024G				30
<b>CHROMABOND® LV-C<sub>8</sub></b>					
	500 mg				
15 ml	732023				30
<b>CHROMAFIX® C<sub>8</sub> cartridges</b>					
	Size		M		
	Adsorbent weight ∅		520 mg		
	731808				50
<b>CHROMABOND® MULTI 96 C<sub>8</sub></b>					
	96 x 100 mg				
	738021.100M				1
<b>CHROMABOND® C<sub>8</sub> adsorbent</b>					
	730601				100 g

Solid Phase Extraction





## C<sub>4</sub>

## butyl silica

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- butyl phase, not endcapped, carbon content 7%
- slightly more polar than C<sub>18</sub> or C<sub>8</sub>, due to shorter alkyl chains the silica surface is not completely shielded

- recommended application: compounds, which are too strongly retained on C<sub>18</sub> or C<sub>8</sub> e.g. analgetics from blood

### Ordering information

	Volume	Adsorbent weight		Pack of
	<b>CHROMABOND® C<sub>4</sub> polypropylene columns</b>			
		100 mg	500 mg	
	1 ml	730225		100
	3 ml	730227		50
	<b>CHROMAFIX® C<sub>4</sub> cartridges</b>			
	Size	S	M	
	Adsorbent weight Ø	220 mg	440 mg	
		731740	731741	50
	<b>CHROMABOND® C<sub>4</sub> adsorbent</b>			
			730651	100 g

Glass columns, LV columns and MULTI 96 on request.

## C<sub>2</sub>

## dimethyl silica

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- dimethyl phase, not endcapped, carbon content 4%
- similar to C<sub>4</sub>

- recommended application: e.g. antiepileptics from plasma

### Ordering information

	Volume	Adsorbent weight		Pack of
	<b>CHROMABOND® C<sub>2</sub> polypropylene columns</b>			
		100 mg	500 mg	1 g
	1 ml	730169		100
	3 ml	730221		50
	6 ml	730409	730410	30
	<b>CHROMABOND® C<sub>2</sub> adsorbent</b>			
			730652	100 g

Glass columns, LV columns, CHROMAFIX® cartridges and MULTI 96 on request.



# Silica-based reversed phases for SPE

## C<sub>6</sub>H<sub>11</sub> ec

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- cyclohexyl phase, endcapped, carbon content 9%
- alternative phase for the mid-polar range

## cyclohexyl silica, endcapped

- recommended application:
  - phenols from water
  - chloroanilines from waste water
  - anthelmintics from tissue

### Comparison of different phases for phenol analysis

Compounds investigated: phenol, 2,4-dinitrophenol, pentachlorophenol

Column types:

CHROMABOND® C<sub>18</sub> / 6 ml / 2000 mg, REF 730130

CHROMABOND® C<sub>6</sub>H<sub>11</sub> ec / 6 ml / 2000 mg, REF 730469

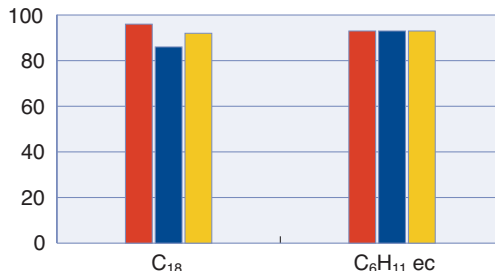
Column conditioning:

10 ml acetone, 10 ml methanol, and 10 ml dist. water (pH 2)

Sample application:

aspirate the sample through the column.

Elution: 10 ml methanol



■ phenol   
 ■ 2,4-dinitrophenol   
 ■ pentachlorophenol

MN Appl. No. 302150

## Ordering information

	Volume	Adsorbent weight		Pack of
	<b>CHROMABOND® C<sub>6</sub>H<sub>11</sub> ec polypropylene columns</b>			
		500 mg	1 g	
	3 ml	730442		50
	6 ml	730443	730444	30
	<b>CHROMABOND® C<sub>6</sub>H<sub>11</sub> ec adsorbent</b>			
			730631	100 g

Glass columns, LV columns, CHROMAFIX® cartridges and MULTI 96 on request.

For further applications on CHROMABOND® phases see our online application database at

[www.mn-net.com/apps](http://www.mn-net.com/apps)



## C<sub>6</sub>H<sub>5</sub>

## phenyl silica

- ◈ base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- phenyl phase, carbon content 8%
- polarity similar to C<sub>8</sub>
- in addition to hydrophobic interactions more selective adsorption is possible by π-π interactions due to the electron density of the phenyl ring

- ◈ recommended application:
  - aflatoxins
  - caffeine
  - phenols

### Flavour compounds from brandy

*Compounds investigated:* asarone, quinine, coumarin, quassin

*Column type:*  
CHROMABOND® C<sub>6</sub>H<sub>5</sub> / 6 ml / 1000 mg  
REF 730412

*Sample pretreatment:*  
mix 10 ml sample with 90 ml water and 10 g sodium chloride and adjust to pH 7 with 0.1 mol/l sodium hydroxide solution

*Column conditioning:*  
10 ml methanol, then 10 ml dist. water

*Sample application:*  
slowly force or aspirate the sample through the column

*Column washing:*  
2.5 ml water, then 2.5 ml pentane

- Elution:*
- 1) 2 x 2.5 ml pentane – diethyl ether (7:3, v/v): asarone, coumarin
  - 2) 10 ml 1 mol/l basic methanol – diethyl ether (9:1, v/v): quinine
  - 3) 5 ml chloroform: quassin

MN Appl. No. 300170



## Ordering information

	Volume	Adsorbent weight			Pack of
	<b>CHROMABOND® C<sub>6</sub>H<sub>5</sub> polypropylene columns</b>				
		100 mg	200 mg	500 mg	
	1 ml	<b>730083</b>			100
	3 ml	<b>730411</b>	<b>730084</b>	50	
	<b>CHROMABOND® C<sub>6</sub>H<sub>5</sub> adsorbent</b>				
			<b>730606</b>		100 g

Glass columns, LV columns, CHROMAFIX® cartridges and MULTI 96 on request.



# Silica-based normal phases for SPE

## CN

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
 cyanopropyl phase, carbon content 5.5%  
 polar to mid-polar  
 in addition to weak hydrophobic interactions selective interactions are possible due to the high electron density of the CN group

## cyanopropyl silica

recommended application:  
 cyclosporins  
 carbohydrates

### Ordering information

Volume	Adsorbent weight			Pack of
<b>CHROMABOND® CN polypropylene columns</b>				
	100 mg	200 mg	500 mg	
1 ml	<b>730061</b>			100
3 ml		<b>730420</b>	<b>730063</b>	50
6 ml			<b>730421</b>	30
<b>CHROMABOND® CN adsorbent</b>				
			<b>730607</b>	100 g

Glass columns, LV columns, CHROMAFIX® cartridges and MULTI 96 on request.

## OH

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
 diol phase, carbon content 5.5%  
 polar  
 properties similar to SiOH

## diol silica

recommended application:  
 antibiotics  
 prostaglandins

### Ordering information

Volume	Adsorbent weight			Pack of
<b>CHROMABOND® OH polypropylene columns</b>				
	100 mg	200 mg	500 mg	
1 ml	<b>730051</b>			100
3 ml		<b>730417</b>	<b>730053</b>	50
6 ml			<b>730418</b>	30
<b>CHROMABOND® OH adsorbent</b>				
			<b>730605</b>	100 g

Glass columns, LV columns, CHROMAFIX® cartridges and MULTI 96 on request.



## NH<sub>2</sub>

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- aminopropyl phase, carbon content 3.5 %
- polar, weak anion exchanger

## aminopropyl silica

- recommended application:  
trace elements  
lipids

### Metals: trace elements from water

*Compounds investigated:* Al, Be, Cu, Cr(VI), Mo(VI), V(V)

*Column type:*

CHROMABOND® NH<sub>2</sub> / 3 ml / 500 mg  
REF 730033

*Sample pretreatment:*

mix 100 ml water sample with 5 ml 0.001 % alizarinsulphonic acid solution and adjust to pH 5.5 with acetic acid or sodium acetate

*Column conditioning:*

2 column volumes 1 mol/l nitric acid, then 2 column volumes dist. water

*Sample application:*

force or aspirate sample through the column with 3 – 4 ml/min

*Column washing:*

2 ml dist. water; dry column under vacuum for 4 min

*Elution:*

2 column volumes 2 mol/l nitric acid

MN Appl. No. 301910



## Ordering information

Volume	Adsorbent weight				Pack of
<b>CHROMABOND® NH<sub>2</sub> polypropylene columns</b>					
	100 mg	200 mg	500 mg	1 g	
1 ml	730031				100
3 ml		730413	730033		50
6 ml			730180	730626	30
<b>CHROMABOND® NH<sub>2</sub> polypropylene columns · BIGpack</b>					
			500 mg		
3 ml			730033.250		250
<b>CHROMABOND® NH<sub>2</sub> glass columns</b>					
			500 mg	1 g	
3 ml			730033G		50
6 ml			730180G	730626G	30
<b>CHROMABOND® LV-NH<sub>2</sub></b>					
			500 mg		
15 ml			732033		30
<b>CHROMAFIX® NH<sub>2</sub> cartridges</b>					
Size	S				
Adsorbent weight Ø	220 mg				
	731813				50
<b>CHROMABOND® MULTI 96 NH<sub>2</sub></b>					
			96 x 100 mg		
			738031.100M		1
<b>CHROMABOND® NH<sub>2</sub> adsorbent</b>					
			730603		100 g



# Silica-based normal phases for SPE

## SiOH

unmodified, weakly acidic silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
 very polar  
 adsorbs humidity from air, for this reason it should be kept well closed and if necessary dried before use  
 due to its high affinity for polar compounds it should not be conditioned with polar (e.g. methanol) or water-containing solvents

## unmodified silica

recommended application:  
 aflatoxins  
 chloramphenicol  
 pesticides  
 steroids  
 vitamins

Solid Phase Extraction

## Ordering information

Volume	Adsorbent weight							Pack of	
<b>CHROMABOND® SiOH polypropylene columns</b>									
	100 mg	200 mg	500 mg	1 g	2 g	5 g	10 g	50 g	
1 ml	730071								100
3 ml		730214	730073						50
6 ml			730070	730075	730107				30
15 ml					730217				20
45 ml						730406			20
70 ml							730072		10
150 ml								730473	10
<b>CHROMABOND® SiOH polypropylene columns · BIGpacks</b>									
			500 mg	1 g	2 g				
3 ml			730073.250						250
6 ml				730075.250	730107.250				250
<b>CHROMABOND® SiOH glass columns</b>									
		200 mg	500 mg	1 g	2 g				
3 ml		730214G	730073G						50
6 ml			730070G	730075G	730107G				30
<b>CHROMABOND® LV-SiOH</b>									
		200 mg	500 mg						
15 ml		732072	732073						30
<b>CHROMAFIX® SiOH cartridges</b>									
	Size	S	M	L					
	Adsorb. weight Ø	230 mg	420 mg	880 mg					
		731828	731829	731830					50
<b>CHROMABOND® MULTI 96 SiOH</b>									
						96 x 100 mg			
						738071.100M			1
<b>CHROMABOND® SiOH adsorbent</b>									
						730608			100 g



## Alox A / Alox N / Alox B

aluminium oxide, acidic, neutral, basic

aluminium oxide, high purity, pore volume 0.90 ml/g, particle size 60 – 150 µm, specific surface 150 m<sup>2</sup>/g

recommended application: together with phase SA for PCB and pesticides

### Properties of the individual modifications:

Alox A:	aluminium oxide, acidic	pH value 4 ± 0.5
Alox N:	aluminium oxide, neutral	pH value 7 ± 0.5
Alox B:	aluminium oxide, basic	pH value 9.5 ± 0.5

## Ordering information

	Phase	Volume	Adsorbent weight			Pack of
	<b>CHROMABOND® Alox polypropylene columns</b>					
			500 mg	1 g	4 g	
	Alox A	3 ml	730452			50
	Alox A	6 ml	730453	730017		30
	Alox A	45 ml			730455	20
	Alox N	3 ml	730446			50
	Alox N	6 ml	730447	730139		30
	Alox N	45 ml			730250	20
	Alox B	3 ml	730429			50
	Alox B	6 ml	730466	730020		30
	Alox B	45 ml			730467	20
		<b>CHROMABOND® Alox glass columns</b>				
			1 g			
Alox N		6 ml	730139G			30
	Alox B	6 ml	730020G			30
	<b>CHROMABOND® LV-Alox</b>					
			1 g			
	Alox A	15 ml	732210			30
	Alox N	15 ml	732091			30
	Alox B	15 ml	732205			30
	<b>CHROMAFIX® Alox cartridges</b>					
		Size	M	L		
	Adsorb. weight Ø	850 mg	1700 mg			
	Alox N		731844	731845		50
	<b>CHROMABOND® MULTI 96 Alox</b>					
			96 x 100 mg			
	Alox A		738253.100M			1
	Alox N		738251.100M			1
	Alox B		738252.100M			1
	<b>CHROMABOND® Alox adsorbents</b>					
	Alox A		730642			100 g
	Alox N		730641			100 g
	Alox B		730640			100 g



# Normal phases for SPE

## Florisil®

## magnesium silicate

matrix magnesium silicate (MgO – SiOH 15:85), high purity, particle size 150 – 250 µm

recommended application: organic tin compounds, aliphatic carboxylic acids, PCBs, PAHs

### Ordering information

Volume	Adsorbent weight				Pack of
<b>CHROMABOND® Florisil® polypropylene columns</b>					
	200 mg	500 mg	1 g	2 g	
3 ml	730457	730081			50
6 ml		730238	730082	730239	30
<b>CHROMABOND® Florisil® polypropylene columns - BIGpack</b>					
			1 g		
6 ml			730082.250		250
<b>CHROMABOND® Florisil® glass columns</b>					
			1 g	2 g	
6 ml			730082G	730239G	30
<b>CHROMAFIX® Florisil® cartridges</b>					
				L	
Size				990 mg	
Adsorbent weight Ø				731848	50
<b>CHROMABOND® Florisil® adsorbent</b>					
			730622		100 g

LV columns and MULTI 96 on request.

## PA

## polyamide 6

matrix polyamide 6, unmodified, high purity, particle size 40 – 80 µm

recommended application: flavonoids, PAHs

### Ordering information

Volume	Adsorbent weight				Pack of
<b>CHROMABOND® PA polypropylene columns</b>					
	200 mg	500 mg	1 g		
3 ml	730384	730126			50
6 ml		730007	730127		30
<b>CHROMAFIX® PA cartridges</b>					
				L	
Size		S			
Adsorbent weight Ø		170 mg		620 mg	
		731849		731851	50
<b>CHROMABOND® PA adsorbent</b>					
			730660		100 g

Glass columns, LV columns and MULTI 96 on request.





## PCA propylcarboxylic acid cation exchanger based on silica

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
 propylcarboxylic acid modified silica  
 weakly acidic cation exchanger (WCX)

recommended application:  
 strong cations

### Ordering information

Volume	Adsorbent weight		Pack of
	<b>CHROMABOND® PCA polypropylene columns</b>		
		500 mg	1 g
	3 ml	<b>730482</b>	50
	6 ml	<b>730483</b>	<b>730484</b> 30
	<b>CHROMABOND® LV-PCA</b>		
	15 ml	500 mg	30
		<b>732482</b>	
	<b>CHROMABOND® PCA adsorbent</b>		
		<b>730629</b>	100 g

Glass columns, CHROMAFIX® cartridges and MULTI 96 on request.

## PSA propylsulphonic acid cation exchanger based on silica

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
 propylsulphonic acid modified silica  
 very strong cation exchanger (capacity ~ 0.7 meq/g)  
 contrary to the SA phase no π-π interactions

recommended application:  
 weak cations

### Ordering information

Volume	Adsorbent weight		Pack of
	<b>CHROMABOND® PSA polypropylene columns</b>		
		100 mg	500 mg
	1 ml	<b>730460</b>	1 g
	3 ml	<b>730462</b>	50
	6 ml	<b>730464</b>	30
	<b>CHROMABOND® PSA adsorbent</b>		
		<b>730630</b>	100 g

Glass columns, LV columns, CHROMAFIX® cartridges and MULTI 96 on request.



# Silica-based ion exchangers for SPE

## SA benzenesulphonic acid cation exchanger based on silica (SCX)

- ◈ base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- benzenesulphonic acid modified silica
- strongly acidic cation exchanger (capacity ~ 0.5 meq/g)
- adsorbent with hydrophobic and π-π interactions (benzene ring)
- ion exchange of organic compounds from aqueous matrix
- elution of interesting compounds with solvent systems, which compensate the ionic and nonpolar interactions, e.g. methanolic HCl

- ◈ recommended application:
  - amino acids
  - amines
  - chlorophyll
  - PCB

### Sulfonamides in meat and kidney

B. Pacciarelli et al., Mitt. Gebiete Lebensm. Hyg. 82 (1991) 45 – 55

**Compounds investigated:** sulfaguandine, sulfanilamide, sulfadiazine, sulfathiazole, sulfapyridine, sulfamerazine, sulfamethizole, sulfadimidine, sulfamethoxy-pyridazine, sulfachlorpyridazine, sulfadoxine, sulfadimethoxine

**Column type:**

CHROMABOND® SA (= SCX) / 3 ml / 500 mg  
REF 730077

**Sample pretreatment:** homogenise 10 g sample and 60 ml dichloromethane – acetone (1:1, v/v) for 30 s with a Polytron. Centrifuge the homogenisate for 10 min at 2500 rpm. Filter the organic phase and wash the filter residue with a little dichloromethane – acetone. Add 5 ml glacial acetic acid to the filtered extract.

**Column conditioning:** apply 6 ml hexane and suck air until the column is dry (10 min). Then apply 6 ml dichloromethane – acetone – glacial acetic acid (10:10:1, v/v/v). Now the column must not run dry.

**Sample application:** 1/10 of the extract volume, flow rate about 2 ml/min; the column must not run dry




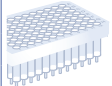

**Column washing:** 5 ml water, then 5 ml methanol; dry for 10 min under vacuum. Now suck NH<sub>3</sub> gas through the column until the acid is neutralised. To control the neutralisation process, press air through the column: a wet pH paper should indicate a neutral or basic pH value.

**Elution:** 3 ml methanol (1 – 2 ml/min); carefully concentrate the eluate on a rotation evaporator (40 °C/100 mbar), dissolve the residue in 0.5 ml of 5.5% acetonitrile in buffer (1.641 g sodium acetate in 1 l water, adjusted to pH 5 with glacial acetic acid) and centrifuge.

Further analysis: HPLC

MN Appl. No. 302710

## Ordering information

	Volume	Adsorbent weight			Pack of	
	<b>CHROMABOND® SA polypropylene columns</b>					
		100 mg	200 mg	500 mg	1 g	
	1 ml	<b>730076</b>			100	
	3 ml		<b>730275</b>	<b>730077</b>	50	
	6 ml			<b>730425</b>	<b>730212</b>	30
	<b>CHROMABOND® SA polypropylene columns · BIGpack</b>					
				500 mg		
	3 ml	<b>730077.250</b>			250	
	<b>CHROMABOND® LV-SA</b>					
	15 ml			500 mg		
				<b>732083</b>	30	
	<b>CHROMAFIX® SA cartridges</b>					
	Size	S	M	L		
	Adsorbent weight Ø	220 mg	450 mg	920 mg		
		<b>731831</b>	<b>731832</b>	<b>731833</b>	50	
	<b>CHROMABOND® MULTI 96 SA</b>					
				96 x 100 mg		
				<b>738141.100M</b>	1	
	<b>CHROMABOND® SA adsorbent</b>					
				<b>730609</b>	100 g	

Glass columns on request.



## SB quaternary ammonium anion exchanger based on silica (SAX)

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- silica modified with quaternary amine
- strongly basic anion exchanger (capacity ~ 0.3 meq/g)
- not suited for very strong anions such as sulphonic acids, because these are difficult to elute

- recommended application:
  - organic acids
  - caffeine
  - saccharin

### Vitamins: folic acid from food (e.g. wheat germs)

**Column type:**  
 CHROMABOND® SB (= SAX) / 3 ml / 500 mg  
 REF 730079

**Sample pretreatment:**  
 homogenise 10 g food sample in 100 ml 0.01 M phosphate buffer pH 7.4 and filter

**Column conditioning:** 2 column volumes *n*-hexane, then 2 column volumes methanol, finally 2 column volumes dist. water

**Sample application:** force or aspirate 10 ml of the filtrate through the column

**Column washing:** 2 column volumes dist. water

**Elution:** 5 ml 10% sodium chloride in 0.1 M sodium acetate buffer

MN Appl. No. 300650



## Ordering information

	Volume	Adsorbent weight			Pack of	
	<b>CHROMABOND® SB polypropylene columns</b>					
		100 mg	200 mg	500 mg	1 g	
	1 ml	<b>730078</b>			100	
	3 ml	<b>730322</b>			50	
	6 ml	<b>730426</b>		<b>730323</b>	30	
	<b>CHROMABOND® SB polypropylene columns · BIGpack</b>					
	3 ml	500 mg			<b>730079.250</b>	250
	<b>CHROMABOND® LV-SB</b>					
	15 ml	500 mg			<b>732088</b>	30
	<b>CHROMAFIX® SB cartridges</b>					
	<b>Size</b>	<b>S</b>	<b>M</b>	<b>L</b>		
	Adsorbent weight ∅	230 mg	460 mg	920 mg		
		<b>731834</b>	<b>731835</b>	<b>731836</b>	50	
	<b>CHROMABOND® MULTI 96 SB</b>					
					96 x 100 mg	<b>738101.100M</b>
	<b>CHROMABOND® SB adsorbent</b>					
					<b>730610</b>	100 g

Glass columns on request.



## Drug

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8
- special bifunctional modification – C<sub>8</sub> / SA (strong cation exchanger – benzenesulphonic acid)

## special silica phase for drug analysis

- recommended application: enrichment of acidic, neutral and basic drugs from urine or plasma

### Drugs from blood serum

W. Weinmann, M. Renz, C. Pelz, P. Brauchle, S. Vogt, S. Pollak, Blutalkohol 35 (1998), 1 – 9

#### Compounds investigated:

benzoylcegonine, amphetamine, codeine, morphine

#### Column type:

CHROMABOND® Drug / 3 ml / 200 mg  
REF 730168

#### Sample pretreatment:

0.1 ml blood serum are mixed with 1.4 ml of a 0.1 mol KH<sub>2</sub>PO<sub>4</sub> buffer (pH 6) and centrifuged

#### Column conditioning:

2 ml methanol, then 2 ml 0.1 mol KH<sub>2</sub>PO<sub>4</sub> buffer (pH 6)

#### Sample application:

slowly force or aspirate the supernatant from the sample pretreatment through the column

#### Column washing:

2 ml 0.1 mol KH<sub>2</sub>PO<sub>4</sub> buffer (pH 6), then 1 ml 0.1 mol acetic acid, then 2 ml methanol; finally dry the column first by centrifugation (2 min, 4000 U/min), then under vacuum for 10 min

#### Elution:

1.5 ml dichloromethane – 2-propanol – 25% ammonia solution (80:20:2, v/v/v)

Further analysis: HPLC with NUCLEOSIL® 100-5 C<sub>18</sub> AB (application 110240) or GC/MS after derivatisation with perfluoropropanoic acid anhydride/pentafluoropropanol, e.g. with column OPTIMA® 5 MS, 0.25 mm film, 30 m x 0.25 mm ID, (REF 726220.30)

MN Appl. No. 302020



Poppy seeds as source of opiates

## Ordering information

	Volume	Adsorbent weight	Pack of
	<b>CHROMABOND® Drug polypropylene columns</b>		
		100 mg    200 mg    500 mg	
	1 ml	<b>730681</b>	100
	3 ml	<b>730168</b>	50
	6 ml	<b>730684</b> <b>730682</b>	30
	<b>CHROMABOND® Drug polypropylene columns · BIGpack</b>		
	1 ml	200 mg <b>730168.250</b>	250
	<b>CHROMABOND® LV-Drug</b>		
	15 ml	200 mg <b>732168</b>	30
	<b>CHROMABOND® MULTI 96 Drug</b>		
		96 x 100 mg <b>738161.100M</b>	1



## Drug II

### extraction of THC and derivatives, acidic analytes from biological fluids (urine, blood, etc.)

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2–8
- special bifunctional modification – C<sub>8</sub> / SB (strong anion exchanger – quaternary amine –NR<sub>3</sub><sup>+</sup>)
- two primary retention mechanisms facilitate use of very strong interferant-eluting solvents, resulting in very pure extracts

- recommended application: extraction of THC and derivatives from urine, blood, serum, plasma
- acidic analytes from biological fluids

#### 11-nor-Δ<sup>9</sup>-THC-carboxylic acid from urine

##### Compounds investigated:

tetrahydrocannabinol, 11-nor-Δ<sup>9</sup>-THC-carboxylic acid

##### Column type:

CHROMABOND® Drug II / 3 ml / 200 mg  
REF 730680

**Sample pretreatment:** add 300 µl 10 M potassium hydroxide solution and internal standard (for GC/MS deuterium labelled 11-nor-9-THC-carboxylic acid) to 5 ml urine. Vortex the sample and then hydrolyse at 60 °C for 15 min. Cool sample and add 200 µl glacial acetic acid and 2 ml 50 mM ammonium acetate solution. If necessary, adjust sample pH to 6 – 7.

**Column conditioning:** 2 ml methanol, then 2 ml dist. water; equilibrate column with 2 ml 50 mM ammonium acetate buffer

**Sample application:** slowly force or aspirate the sample through the column (1 – 2 ml/min)

**Column washing:** elute interferants with 10 ml methanol – water (1:1, v/v); dry the column for 10 min at high vacuum; further wash the column with 2 ml acetonitrile and dry for another 2 min

**Elution:** elute THC metabolites with 3 ml hexane – ethyl acetate – glacial acetic acid (75:25:1, v/v/v)

Further analysis: we recommend GC/MS on an OPTIMA® 5 MS column after derivatisation with 50 µl Silyl-991 (REF 701480; BSTFA – TMCS 99:1) at 70 °C / 20 min; inject 1 – 2 µl onto the GC column.

**Recovery rates:** 70 – 80%

MN Appl. No. 303880



## Ordering information

	Volume	Adsorbent weight			Pack of
	<b>CHROMABOND® Drug II polypropylene columns</b>				
		100 mg	200 mg	500 mg	
	1 ml	<b>730685</b>			100
	3 ml		<b>730680</b>	<b>730686</b>	50
	6 ml		<b>730683</b>		30
	<b>CHROMABOND® LV-Drug II</b>				
	15 ml		200 mg	<b>732681</b>	30
	<b>CHROMABOND® MULTI 96 Drug II</b>				
			96 x 100 mg	<b>738680.100M</b>	1



# SPE phases for pharmaceutical applications

## Crosslinks

### special phase for enrichment of collagen crosslinks

special cellulose phase for enrichment of collagen crosslinks

recommended application: collagen crosslinks in urine

Pyridinoline and deoxypyridinoline are collagen crosslinks occurring in bones and cartilage. If these substances are released, they can be detected in the urine. In cases of increased bone catabolism (e.g. during osteoporosis) the urine concentrations of pyridinoline and deoxypyridinoline are increased.

### Pyridinium crosslinks from urine

*Compounds investigated:* pyridinoline, deoxypyridinoline

*Column type:*  
CHROMABOND® Crosslinks / 3 ml, 300 mg  
REF 730458

*Sample pretreatment:* 250 µl urine and 50 µl of an internal standard (e.g. pyridoxine) are hydrolysed in 250 µl conc. HCl at about 100 – 105 °C for 12 – 16 h. Then 2.5 ml wash solution (*n*-butanol – glacial acetic acid 80:20, v/v) are added to the hydrolysate.

*Column conditioning:*  
5 ml of the wash solution

*Sample application:*  
force or aspirate the pre-treated sample through the column. Discard the flow-through. Wash with 15 – 25 ml of the wash solution.

*Elution:*  
force or aspirate 3 – 5 ml dist. water through the column

MN Appl. No. 302070

## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® Crosslinks polypropylene columns</b>		
	300 mg	
3 ml	<b>730458</b>	50
Product for research purposes only (see page 296)		

## Tetracycline

### special phase for enrichment of tetracyclines

silica phase with special C<sub>18</sub> modification, tested for tetracyclines  
constant recovery rates for the title compounds (every batch individually tested)

recommended application: tetracyclines from biological samples

### Tetracyclines from musculature

Private communication of Mr. Lippold, Chemisches Landesuntersuchungsamt (Chem. Research Agency) Freiburg, Germany

*Compounds investigated:*  
tetracycline, oxytetracycline, chlorotetracycline (100 – 500 mg/kg)

*Column type:*  
CHROMABOND® Tetracycline / 6 ml / 500 mg  
REF 730315

*Sample pretreatment:*  
see detailed description in appl. 302030 at [www.mn-net.com](http://www.mn-net.com)

*Column conditioning:*  
1 column volume methanol, 1 column volume dist. water, then 1 column volume EDTA – succinate buffer (see above)

CAUTION: DO NOT LET THE COLUMN RUN DRY!

*Sample application:*  
force or aspirate 50 ml of the eluate from the sample pretreatment through the CHROMABOND® column

*Elution:*  
with 7.5 ml methanol into a 25-ml tapered flask. Add 1 ml of an ethylene glycol / methanol mixture (22 g ethylene glycol filled up to 100 ml with methanol) and evaporate to dryness with a rotation evaporator (max. 40 °C). Fill up the residue to 400 ml with 0.1 M McIlvain-EDTA buffer (52.5 g citric acid · H<sub>2</sub>O, 44.5 g Na<sub>2</sub>HPO<sub>4</sub> · H<sub>2</sub>O and 93 g Titriplex III dissolved in 2.5 l dist. water, adjusted to pH 4 with NaOH).

Further analysis:  
HPLC with column 250 x 4 mm NUCLEOSIL® 100-5 C<sub>18</sub> HD, REF 721850.40 (application 110710)

**Recovery rates:** tetracycline, chlorotetracycline ~ 50 – 70 %, oxytetracycline ~ 60 – 80 %

MN Appl. No. 302030



## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® Tetracycline polypropylene columns</b>		
6 ml	500 mg 730315	30
Product for research purposes only (see page 296)		

## AOX

## AOX from waters with high salt loads (DIN 38409 – H22)

special PS/DVB phase

recommended application: extraction of AOX (adsorbable organically bonded halogens) from waters containing high salt loads / organic pollutants in accordance with DIN 38409 – H22

### AOX from water (DIN 38409 – H 22)

**Column type:**  
CHROMABOND® AOX / 6 ml / 500 mg  
REF 730111.AOX

**Column conditioning:**  
5 ml methanol, 10 ml dist. water.  
Do not let the column run dry!

**Sample application:**  
force or aspirate 100 ml original or diluted sample (pH 1) through the column (3 – 5 ml/min).  
Do not let the column run dry!

**Column washing:**  
50 ml nitrate rinsing solution (dissolve 17 g NaNO<sub>3</sub> in 100 ml dist. water, add 1.4 ml HNO<sub>3</sub> 10 M, fill up to 1000 ml; take 50 ml and fill to 1000 ml with dist. water). Discard the flow-through.

**Elution:**  
slowly aspirate 1 x 1 ml, then 1 x 4 ml methanol and 10 ml dist. water through the column.  
Collect eluates in 100 ml volumetric flask and fill to 100 ml with dist. water.

MN Appl. No. 302080



## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® AOX polypropylene columns</b>		
6 ml	200 mg 730119.AOX	30
	500 mg 730111.AOX	



# SPE phases for environmental analysis

## C<sub>18</sub> PAH

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
special octadecyl modification for enrichment of PAH, not endcapped, carbon content 14%

## octadecyl silica for PAH analysis

recommended application:  
PAHs from water

### PAHs from water

**Column type:**  
CHROMABOND® C<sub>18</sub> PAH / 6 ml / 2 g  
REF 730166

**Sample pretreatment:**  
mix 1000 ml water sample with 10 ml methanol

**Column conditioning:**

1 column volume methanol, then 1 column volume dist. water

**Sample application:** aspirate 1000 ml water sample through the column (~ 15 to 20 ml/min), then dry column (stream of nitrogen or 24 h in a desiccator over P<sub>2</sub>O<sub>5</sub>)

**Elution:** elute with 4 ml acetonitrile / toluene (3:1, v/v) and then evaporate or fill up to the volume required

**Recovery rates:** (50 ng/l per component): Naphthalene 87%, Acenaphthylene 89%, Acenaphthene 90%, Fluorene 82%, Phenanthrene 85%, Anthracene 90%, Fluoranthene 89%, Pyrene 89%, Benz[a]anthracene 87%, Chrysene 95%, Benzo[b]fluoranthene 91%, Benzo[k]fluoranthene 89%, Benzo[a]pyrene 90%, Dibenz[ah]anthracene 97%, Benzo[ghi]perylene 91%, Indeno[1,2,3-cd]pyrene 96%

MN Appl. No. 301250

## Ordering information

	Volume	Adsorbent weight	Pack of
	<b>CHROMABOND® C<sub>18</sub> PAH polypropylene columns</b>		
	6 ml	2 g 730166	30
	<b>CHROMABOND® C<sub>18</sub> PAH glass columns</b>		
	6 ml	730166G	30
	<b>CHROMABOND® C<sub>18</sub> PAH adsorbent</b>		100 g
		730616	

## NH<sub>2</sub>/C<sub>18</sub>

special combination phase:  
aminopropyl phase for removal of interfering humic acids  
octadecyl phase for enrichment of PAH

## combination phase for PAH analysis

recommended application:  
PAHs from water containing  
humic acids

### PAHs from water containing humic acids

**Column type:**  
CHROMABOND® NH<sub>2</sub>/C<sub>18</sub>, 6 ml, 500 mg/1 g glass column  
REF 730620 G

**Sample pretreatment:**  
mix 500 ml water sample with 25 ml 2-propanol

**Column conditioning:** 10 ml dichloromethane, 10 ml methanol, then 10 ml dist. water – 2-propanol (9:1, v/v)

**Sample application:** aspirate 500 ml prepared water sample through the column (~ 5 ml/min)

**Column washing:** 2 ml dist. water – 2-propanol (9:1, v/v), then dry column (about 20 min, vacuum)

**Elution:** 4 x 0.5 ml CH<sub>2</sub>Cl<sub>2</sub> (let percolate first 0.5 ml into the column packing without vacuum, then apply light vacuum), if necessary evaporate in a stream of N<sub>2</sub> and fill up with a suitable solvent

MN Appl. No. 301260

## Ordering information

	Volume	Adsorbent weight	Pack of
	<b>CHROMABOND® NH<sub>2</sub>/C<sub>18</sub> polypropylene columns</b>		
	6 ml	500/500 mg 730618	500 mg/1 g 730620 30
	<b>CHROMABOND® NH<sub>2</sub>/C<sub>18</sub> glass columns</b>		
	6 ml	730618G	730620G 30





## Na<sub>2</sub>SO<sub>4</sub> / Florisil® hydrocarbons from water acc. to DIN H-53 / ISO DIS 9377-4

◈ special combination phase of sodium sulphate and Florisil®

◈ recommended application:  
hydrocarbons from drinking,  
surface and waste waters

### Hydrocarbons from water

**Column type:**  
CHROMABOND® Na<sub>2</sub>SO<sub>4</sub>/Florisil®, 2000/2000 mg,  
6 ml glass column, REF 730249 G

**Internal standard solution:**  
dissolve 20 mg *n*-tetracontane (C<sub>40</sub>H<sub>82</sub>) in petroleum ether, add  
20 ml *n*-decane (C<sub>10</sub>H<sub>22</sub>) and fill up to one litre with petroleum  
ether. For preparation of the extraction solution dilute standard  
solution 1:10 with petroleum ether.

**Sample pretreatment:**  
adjust 900 ml water (10 °C) with HCl (12 mol/l) to pH 2 and add  
80 g MgSO<sub>4</sub>. Add 50 ml of the extraction solution, close the bot-  
tle and stir the suspension intensely for 30 min. Add enough dist.  
water to separate the organic from the aqueous phase.

**Column conditioning:** 5 ml petroleum ether

**Sample application:**  
slowly aspirate or force the sample through the column

**Elution:**  
wash with 10 ml petroleum ether. Evaporate the combined solu-  
tion from sample application and elution to 1 ml at about 75 °C.  
If necessary, fill up to 1 ml again. (If the hydrocarbon content is  
high, evaporation to 1 ml may not be necessary.)

**Recovery rates:** must be > 80 % for *n*-tetracontane.

MN Appl. No. 302090



## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® Na<sub>2</sub>SO<sub>4</sub> / Florisil® polypropylene columns</b>		
6 ml	2 g/2 g 730249	30
<b>CHROMABOND® Na<sub>2</sub>SO<sub>4</sub> / Florisil® glass columns</b>		
6 ml	2 g/2 g 730249G	30
<b>CHROMABOND® Na<sub>2</sub>SO<sub>4</sub> / Florisil® glass columns - BIGpack</b>		
6 ml	2 g/2 g 730249G.250	250



# SPE phases for environmental analysis

## CN/SiOH

## combination phase for PAH analysis

- special combination phase cyanopropyl phase for selective adsorption of polycyclic aromatics via  $\pi$ - $\pi$  interactions
- unmodified silica phase for removal of polar compounds

- recommended application: extraction of the 16 PAHs according to EPA from soil samples

### PAHs from soil

**Column type:**  
CHROMABOND® CN/SiOH, 6 ml, 500/1000 mg  
REF 730135

**Sample pretreatment:**  
dry 30 g soil with sodium sulphate and reflux 4 h with 250 ml petroleum ether in a Soxhlet extractor. For low PAH contents (colourless or weakly coloured extracts) concentrate extract to 1/10 of its volume in a rotation evaporator.

**Column conditioning:**  
4 ml petroleum ether

**Sample application:**  
aspirate 20 ml of the extract through the column

**Column washing:**  
2 ml petroleum ether

**Elution:**  
2 x 2 ml acetonitrile / toluene (3:1, v/v), then evaporate or fill to the volume required

Further analysis: HPLC, e.g. with column 250 x 3 mm  
NUCLEOSIL® 5 C<sub>18</sub> PAH, REF 720117.30  
For recovery rates see application 301310 at [www.mn-net.com](http://www.mn-net.com)  
MN Appl. No. 301310



## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® CN/SiOH polypropylene columns</b>		
	500 mg/1 g	
3 ml	730112	50
6 ml	730135	30
<b>CHROMABOND® CN/SiOH polypropylene columns · BIGpack</b>		
	500 mg/1 g	
6 ml	730135.250	250
<b>CHROMABOND® CN/SiOH glass columns</b>		
	500 mg/1 g	
6 ml	730135G	30

## NAN

## special phase for PCB analysis

- special combination phase:
  - N: sodium sulphate for removal of trace water;
  - A: SiOH/AgNO<sub>3</sub> phase for removal of sulphur, sulphur-containing and polar compounds

- recommended application: extraction of PCB from sludge



## PCB from sludge

**Compounds investigated:** polychlorinated biphenyls (PCB)  
This method can also be used for soil samples.

**Column type:**  
CHROMABOND® NAN, 6 ml, 700/2000/700 mg  
REF 730149

**Sample pretreatment:** extract 2 g lyophilised sludge with 70 ml *n*-hexane, evaporate extract and fill to 10 ml with *n*-hexane

**Column conditioning:** 10 ml *n*-hexane

**Sample application:** aspirate 2 ml extract into the column  
**Elution:** slowly aspirate 40 ml *n*-hexane through the column with light vacuum, then evaporate and fill to 5 ml with *n*-hexane

**Recovery rates:**  
PCB-28 104 %, PCB-52 100 %, PCB-101 99 %, PCB-138 98 %, PCB-153 101 %, PCB-180 98 %, PCB-209 104 %

MN Appl. No. 301400

## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® NAN polypropylene columns</b>		
	400/1400/400 mg	700/2000/700 mg
3 ml	<b>730109</b>	50
6 ml		30
<b>CHROMABOND® NAN polypropylene columns - BIGpack</b>		
		700/2000/700 mg
6 ml	<b>730149.250</b>	250
<b>CHROMABOND® NAN glass columns</b>		
		700/2000/700 mg
6 ml	<b>730149G</b>	30
<b>CHROMABOND® NAN adsorbent</b>		
	<b>730619</b>	100 g

## SA/SiOH

## combination phase for PCB analysis

special combination phase:

**SA:** strongly acidic cation exchanger based on silica with benzenesulphonic acid modification

**SiOH:** unmodified silica for removal of polar compounds

recommended application:

extraction of PCBs from waste oil (hexane extract)

## PCB from waste oil

**Column type:**  
CHROMABOND® SA/SiOH, 3 ml, 500/500 mg  
REF 730132

**Column conditioning:** 1 ml *n*-hexane

**Sample application:** apply 250 µl waste oil sample to the column and aspirate or force it into the adsorbent with 2 x 1 ml *n*-hexane  
MN Appl. No. 301390

**Elution:** aspirate or force another 2 x 500 µl *n*-hexane through the column; collect all *n*-hexane fractions and if necessary adjust to a concentration suitable for subsequent analysis by either evaporating *n*-hexane in a stream of nitrogen or by dilution with *n*-hexane

**Recovery rates:**  
PCB 28 97 %, PCB 52 96 %, PCB 101 95 %, PCB 138 90 %, PCB 153 95 %, PCB 180 96 %, PCB 209 100 %

## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® SA/SiOH polypropylene columns</b>		
	500/500 mg	
3 ml	<b>730132</b>	50
<b>CHROMABOND® SA/SiOH polypropylene columns - BIGpack</b>		
		500/500 mg
3 ml	<b>730132.250</b>	250



# SPE phases for environmental analysis

Solid Phase Extraction

## SiOH-H<sup>+</sup>/SA

## combination phase for PCB analysis

special combination phase

**SiOH-H<sup>+</sup>:** H<sub>2</sub>SO<sub>4</sub>-impregnated silica phase for oxidation of accompanying compounds to ionic and/or polar compounds

**SA:** strongly acidic cation exchanger based on silica with benzenesulphonic acid modification for removal of ionic and sulphur-containing compounds

This combination column is used together with a SiOH column. Both columns together are available as Kombi-Kit PCB.

recommended application:

extraction of PCB from oil with reference to German industrial standard DIN 51527, part 1

### PCB in oil samples

determination with reference to German industrial standard DIN 51527

**Column type:**

CHROMABOND® SiOH-H<sub>2</sub>SO<sub>4</sub>/SA 3 ml, 500/500 mg and  
CHROMABOND® SiOH / 3 ml / 500 mg  
Cat. Nos. 730085 and 730073  
or Kombi-Kit PCB, REF 730125

**Sample pretreatment:**

extract oil-contaminated solids with *n*-hexane. Homogenise other oil samples and dissolve 1.5 to 2.0 g in 50 ml *n*-hexane. Water which may cause turbidities can be removed with sodium sulphate.

**Column conditioning:**

let 1 ml *n*-hexane flow through the CHROMABOND® SiOH-H<sub>2</sub>SO<sub>4</sub>/SA column

**Sample application:**

aspirate or force 500 µl sample through the CHROMABOND® SiOH-H<sub>2</sub>SO<sub>4</sub>/SA column. This phase offers better removal of interfering substances due to sulphonation. Place CHROMABOND® SiOH-H<sub>2</sub>SO<sub>4</sub>/SA column on top of the SiOH column with the aid of an adaptor and after at least 30 s flush sample into the SiOH column with 2 x 1 ml *n*-hexane.

**Elution:**

elute SiOH column with 3 x 0.5 ml *n*-hexane; adjust to a suitable concentration for subsequent GC analysis by evaporation of *n*-hexane in a stream of nitrogen or by dilution with *n*-hexane

**Recovery rates:**

PCB-28 99%, PCB-52 95%, PCB-101 99%, PCB-138 94%,  
PCB-153 99%, PCB-180 96%, PCB-209 101%

MN Appl. No. 301380



## Ordering information

Volume	Adsorbent weight	Pack of
<b>CHROMABOND® SiOH-H<sup>+</sup>/SA polypropylene columns</b>		
3 ml	500/500 mg 730085	50
<b>CHROMABOND® SiOH-H<sup>+</sup>/SA polypropylene columns - BIGpack</b>		
3 ml	500/500 mg 730085.250	250
<b>CHROMABOND® SiOH-H<sup>+</sup>/SA glass columns</b>		
3 ml	500/500 mg 730085G	50
<b>Kombi-Kit for extraction of PCB from oil with reference to DIN 51527, part 1</b>		
25 columns each of CHROMABOND® SiOH-H <sup>+</sup> /SA and CHROMABOND® SiOH		730125 1 kit




## Dry

## special phase for drying of organic samples

- anhydrous high-purity sodium sulphate which forms Glauber's salt with traces of water
- for removal of larger quantities of water several cartridges can be combined in series

- recommended application: removal of traces of water from organic solutions

## Ordering information

	Adsorbent weight			Pack of
	<b>CHROMAFIX® Dry cartridges</b>			
	<b>Size</b>	<b>S</b>	<b>M</b>	<b>L</b>
	Adsorbent weight $\varnothing$	780 mg	1500 mg	2800 mg
		<b>731852</b>	<b>731853</b>	<b>731854</b>
				50

## ABC18

## special phase for analysis of acrylamide in food

- octadecyl silica phase with ion exchange functions for acrylamide analysis


- recommended application: clean-up of acrylamide from ultra-heated starch-containing food, such as potato chips and other snacks, french fries, crispbread, cereals etc.

### Important notes:

- For "Determination of Acrylamide in Foods, SPE Clean-up Procedure for LC-MS-MS" please see application 303580 at [www.mn-net.com/apps](http://www.mn-net.com/apps).
- Acrylamide is created at temperatures above 100 °C from sugar and proteins, e.g. from potatoes or grain during the process of frying, baking, roasting or grilling. The formation depends on temperature, starting at 120 °C and increasing with more elevated temperatures. In cooked food, no acrylamide is found.
- Minimum concentration of acrylamide should be 70 µg/kg
- The procedure includes no concentration step.
- Acrylamide and the isotopically labelled form, is carcinogenic, mutagenic and neurotoxic.



## Ordering information

	Volume	Adsorbent weight	Pack of
	<b>CHROMABOND® ABC18 polypropylene columns</b>		
	6 ml	500 mg	
		<b>730533</b>	30



### Diamino special silica phase for determination of pesticides in food samples

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m<sup>2</sup>/g, pH stability 2 – 8  
Primary and Secondary Amine functions (PSA), 5 % C  
removes polar compounds (e.g. organic acids, pigments, sugars) from matrices like fruit or vegetables  
similar phases: Supelclean PSA, Bond Elut PSA

recommended application:  
special SPE phase for quick and cheap determination of pesticides in strongly matrix-contaminated samples by GC or HPLC (**QuEChERS** method = **Quick Easy Cheap Effective Rugged Safe**)



#### QuEChERS method and pre-mixes

Within a few years after its development by Anastassiades et al. the QuEChERS method has gained a leading position for determination of pesticide residues in food samples by GC-MS or LC-MS, allowing rapid and cheap clean-up of strongly matrix-contaminated samples.

#### Standard clean-up of food samples

10 g sample are homogenised with 10 ml acetonitrile. After adding the internal standard the sample is shaken with 4 g MgSO<sub>4</sub> and 1 g NaCl and afterwards centrifuged.  
1 ml of the supernatant is spiked with 25 mg CHROMABOND® Diamino and 150 mg MgSO<sub>4</sub> and shaken again. After centrifugation the supernatant is injected into GC/MS.

MN Appl. No. 303770

For optimising the extraction of pH-dependent compounds, for minimising decomposition of sensitive substances, and for broadening the matrix spectrum, different modifications of the QuEChERS method have been elaborated.

In addition to the required adsorbent CHROMABOND® Diamino MACHEREY-NAGEL offers a number of individually weighed and **premixed extraction** and **buffer** mixtures, specially composed for different sample matrices.

For extraction, the European standard EN 15662 recommends a citrate extraction mix (Mix I), while AOAC standard 2007.1 uses an acetate extraction mix (Mix II).

For clean-up, the Diamino phase (PSA) removes e.g. sugars and organic acids. MgSO<sub>4</sub> removes water, C<sub>18</sub> ec removes nonpolar interferences such as fats and the Carbon phase removes pigments, sterols, and nonpolar interferences.

For selection of the proper clean-up mix see table on opposite page.

For detailed instructions please visit [www.mn-net.com](http://www.mn-net.com) or the original references at [www.quechers.com](http://www.quechers.com).







## Ordering information

Volume	Description	Composition	REF	Pack of
<b>CHROMABOND® QuEChERS extraction buffer mixes</b>				
15 ml*	Mix I	citrate extraction mix	4 g MgSO <sub>4</sub> , 1 g NaCl, 0.5 g Na <sub>2</sub> H citrate · 1.5 H <sub>2</sub> O, 1 g Na <sub>3</sub> citrate · 2 H <sub>2</sub> O	730970 50
15 ml*	Mix II	acetate extraction mix	6 g MgSO <sub>4</sub> , 1.5 g Na acetate	730971 50
<b>CHROMABOND® QuEChERS clean-up mixes</b>				
15 ml*	Mix III	Diamino clean-up mix	0.15 g CHROMABOND® Diamino with 0.9 g MgSO <sub>4</sub>	730972 50
15 ml*	Mix IV	Diamino/Carbon clean-up mix	0.15 g CHROMABOND® Diamino with 0.9 g MgSO <sub>4</sub> and 15 mg Carbon	730973 50
15 ml*	Mix V	Diamino/Carbon clean-up mix	0.15 g CHROMABOND® Diamino with 0.9 g MgSO <sub>4</sub> and 45 mg Carbon	730975 50
15 ml*	Mix VI	Diamino/C <sub>18</sub> ec clean-up mix	0.15 g CHROMABOND® Diamino with 0.9 g MgSO <sub>4</sub> and 150 mg C <sub>18</sub> ec	730974 50
<b>CHROMABOND® Diamino polypropylene columns</b>				
3 ml	adsorbent weight 200 mg		730561	50
6 ml	adsorbent weight 500 mg		730562	30
<b>CHROMABOND® Diamino adsorbent</b>				
			730653.20	20 g
			730653	100 g
<b>CHROMABOND® QuEChERS accessories</b>				
	50 ml polypropylene centrifuge tube with screw cap		730223	50

\* 15 ml centrifuge tubes with screw cap (2 ml or 50 ml centrifuge tubes on request)

A number of custom-made QuEChERS mixes is available on request.

## QuEChERS mixes

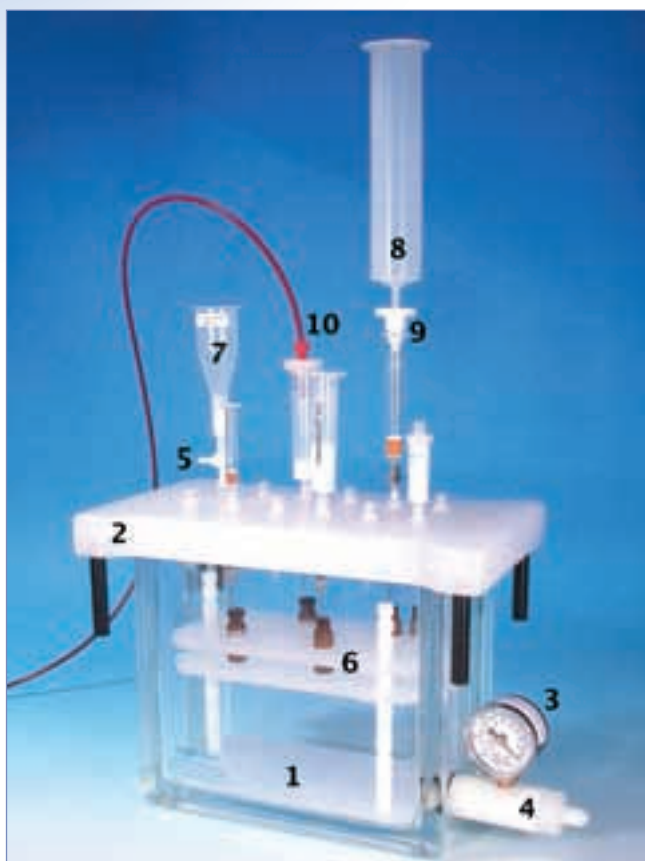
Sample property			
low fat content (e.g. apples, strawberries)	moderate content of chlorophyll and carotenoids (e.g. carrots, lettuce)	higher content of chlorophyll and carotenoids (e.g. bell peppers, spinach)	higher fat content (e.g. avocado)
CHROMABOND® QuEChERS extraction mixes			
citrate or acetate extraction	citrate or acetate extraction	citrate extraction	citrate extraction
Mix I or Mix II	Mix I or Mix II	Mix II	Mix II
CHROMABOND® QuEChERS clean-up mixes			
Diamino clean-up	Diamino/Carbon clean-up	Diamino/Carbon clean-up (higher Carbon content)	Diamino/C <sub>18</sub> ec clean-up
Mix III	Mix IV	Mix V	Mix VI
			



## Accessories for SPE

### CHROMABOND® vacuum manifolds

- for simultaneous preparation of up to 12, 16 or 24 samples
- replacement parts and accessories for special applications



#### Vacuum manifold for 12 columns

- 1 rectangular glass cabinet; 2 sizes available: small for up to 12 CHROMABOND® columns or CHROMAFIX® cartridges; large for up to 16 CHROMABOND® LV columns or up to 24 CHROMABOND® columns or CHROMAFIX® cartridges (depending on lid)
- 2 polypropylene lid
- 3 vacuum gauge for pressure reading
- 4 control valve for adjustment of vacuum
- 5 replaceable valves for vacuum control of individual SPE columns
- 6 variable rack with exchangeable partitions, which accept a wide variety of vessels like test tubes, measuring flasks, scintillation vials, autosampler vials, plastic vials etc.
- 7 CHROMABOND® LV columns with 15 ml sample reservoir for medium size samples
- 8 polypropylene sample reservoirs (30 or 70 ml)
- 9 adaptor for sample reservoirs
- 10 CHROMABOND® tubing adaptors

Full description and manual can be downloaded from [www.mn-net.com](http://www.mn-net.com)

### Ordering information

Description	Pack of	REF
<b>Vacuum manifold complete</b>		
consists of: glass cabinet with lid and lid gasket, removable needles on lower side of lid, vacuum gauge, control valve, valves and caps, variable rack:		
for up to 12 columns or cartridges (including PP tank)	1	730150
for up to 16 LV columns	1	730360
for up to 24 columns or cartridges	1	730151
<b>Glass cabinets without accessories (1)</b>		
for 12 columns	1	730173
for 16 LV or 24 columns	1	730174
<b>Lids with gaskets (2)</b>		
for 12 columns (including Luer fittings and valves (5))	1	730175
for 16 LV columns (including Luer fittings and valves (5))	1	730365
for 24 columns (including Luer fittings and valves (5))	1	730176
Gaskets for lid, for 12 columns	2	730177
Gaskets for lid, for 24 columns	2	730178



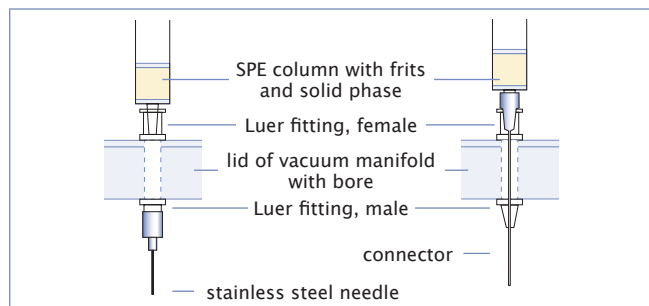


## Ordering information

Description	Pack of	REF
<b>General accessories for vacuum manifolds</b>		
Luer stoppers for vacuum manifold, blue	12	730194
Luer fittings for lid, female	12	730183.12
Luer fittings for lid, male	12	730184.12
Valves, plastic	12	730185
Stainless steel needles	12	730152
Polypropylene needles	12	730154
PP tanks for vacuum manifold for 12 columns (not available for 16- or 24-position manifold)	2	730233
Vacuum gauge, complete with accessories	1	730179
<b>Drying attachment and collecting racks for evaporation of eluates</b>		
Drying attachment, for 12 columns (11)	1	730187
Drying attachment, for 24 columns	1	730188
Collecting rack for 12 columns (6)	1	730157
Collecting rack for 16 LV columns	1	730366
Collecting rack for 24 columns	1	730153
<b>Products for protection from cross contamination</b>		
Valve, brass, tarnished	1	730189.1
Valves, as above	12	730189.12
Stainless steel connectors	12	730106
PTFE connectors (application of connectors see below)	12	730564
PTFE connectors with valve	12	730563
<b>Tubing adaptors for application of large sample volumes (10)</b>		
for 1, 3 and 6 ml glass columns	4	730387
for 1, 3 and 6 ml polypropylene columns	4	730243
for 15, 45 and 70 ml polypropylene columns (PTFE tube length approx. 1 m)	4	730386

### Protection from cross contamination

For special applications, which require maximum protection from cross contamination we supply chrome-plated brass valves and stainless steel or PTFE connectors, the application of which is shown below. These special connectors are fitted through the lid; thus the sample only has contact with the inert connector and can flow directly into the receptacle.



### Drying attachment

If the eluate has to be evaporated, this can be performed with the so-called drying attachment (11, see below). This special lid has a gas connector on one side (12), from which the gas is fed simultaneously to the 12 or 24 stations (13). Thus 12 or 24 eluates can be evaporated simultaneously by just changing the lid and applying a stream of inert gas, e.g. nitrogen.





## Accessories for SPE

### CHROMABOND® empty columns and accessories

for individual packing of SPE columns with CHROMABOND® adsorbents

#### Ordering information

Description	Pack of	REF
Empty polypropylene columns with PE frits, 1 ml	100	730159
Empty polypropylene columns with PE frits, 3 ml	50	730160
Empty polypropylene columns with PE frits, 6 ml	30	730161
Empty polypropylene columns with PE frits, 15 ml	20	730230
Empty polypropylene columns with PE frits, 30 ml	20	730380
Empty polypropylene columns with PE frits, 45 ml	20	730355
Empty polypropylene columns with PE frits, 70 ml	20	730158
Empty polypropylene columns with PE frits, 150 ml	20	730474
PE frits for polypropylene columns 1 ml	250	730164
PE frits for polypropylene columns 3 ml	250	730162
PE frits for polypropylene columns 6 ml	250	730163
PE frits for polypropylene columns 15 ml	250	730351
PE frits for polypropylene columns 30 ml	250	730034
PE frits for polypropylene columns 45 ml	250	730356
PE frits for polypropylene columns 70 ml	250	730026
PE frits for polypropylene columns 150 ml	250	730475
Empty glass columns with glass fibre frits, 3 ml	50	730171
Empty glass columns with glass fibre frits, 6 ml	30	730172
Glass fibre frits for glass columns 3 ml	250	730191
Glass fibre frits for glass columns 6 ml	250	730192
Empty LV polypropylene columns with PE frits, 15 ml, for 100 mg adsorbent weight	50	732500
Empty LV polypropylene columns with PE frits, 15 ml, for 200/500 mg adsorbent weight	50	732501
PE frits for LV polypropylene columns 15 ml for 100 mg adsorbent weight	250	732019
PE frits for LV polypropylene columns 15 ml for 200/500 mg adsorbent weight	250	732020
Adaptor (PVDF) for glass columns (3 and 6 ml)	4	730104.4
Adaptors as above	10	730105
Adaptor (PP) for polypropylene columns (1, 3 and 6 ml)	4	730100.4
Adaptors as above	10	730101
Adaptor (PE) for polypropylene columns (15, 45, 70 ml)	4	730350.4
Adaptors as above	10	730385
Adaptor (PE) for polypropylene columns (30 and 70 ml)	1	730566
<b>Reservoir columns for application of medium-size samples</b>		
Reservoir column 30 ml, polypropylene, with one adaptor for 1, 3, 6 ml CHROMABOND® polypropylene columns	1	730102
10 Reservoir columns 30 ml, polypropylene with one adaptor for 1, 3, 6 ml CHROMABOND® polypropylene columns	1 kit	730103
Reservoir column 70 ml, polypropylene, with one adaptor for 1, 3, 6 ml CHROMABOND® polypropylene columns	1	730381
10 Reservoir columns 70 ml, polypropylene with one adaptor for 1, 3, 6 ml CHROMABOND® polypropylene columns	1 kit	730382
Reservoir column 70 ml, polypropylene, with one adaptor for 15, 45, 70 ml CHROMABOND® polypropylene columns	1	730388
10 Reservoir columns 70 ml, polypropylene with one adaptor for 15, 45, 70 ml CHROMABOND® polypropylene columns	1 kit	730389



## Automated and on-line SPE

Performing Solid Phase Extraction (SPE) manually can be time consuming and nerve-racking, especially when recovery and reproducibility are lacking due to sample variability. If SPE can be reliably automated, it becomes a much more efficient and reproducible process

On-line SPE is a powerful method in automated sample preparation where the SPE hardware is technically integrated into a HPLC system. Crude samples are placed in an autosampler and processed fully automatic prior to injection into a GC (MS) or LC (MS) system.

MN offers different on-line column configurations designed to fit your on-line SPE analysis needs and filled with a choice of different adsorbents, modifications and particle sizes:

- Special SPE columns already equipped with special caps and needles to be used in the SPE unit of the **Gerstel MultiPurposeSampler (MPS)**, available in 1, 3 and 6 ml.
- Columns for **Gilson ASPEC™** systems are ready-to-use assembled with caps. In addition to the columns and phases listed below, all 1, 3 and 6 ml **CHROMABOND®** polypropylene columns from our program can be supplied assembled with ASP caps.

Please contact us for further information or special request at [info@mn-net.com](mailto:info@mn-net.com).



SPE cartridges for Gerstel MPS system



Gerstel MPS system



Columns for the Gilson ASPEC™

### Ordering information

#### Gilson ASPEC™ columns

Column size	Weight [mg]	Pack of [columns]	REF
<b>CHROMABOND® SiOH</b>			
1 ml	100	100	730071ASP
3 ml	500	100	730073ASP
6 ml	1000	100	730075ASP
<b>CHROMABOND® C18 ec</b>			
1 ml	100	100	730011ASP
3 ml	500	100	730013ASP
6 ml	1000	100	730015ASP

### Ordering information

#### Gerstel MPS columns

Column size	Weight [mg]	Pack of [columns]	REF
<b>CHROMABOND® SiOH</b>			
3 ml	200	50	730214MPS
3 ml	500	50	730073MPS
6 ml	1000	30	730075MPS
<b>CHROMABOND® C18 ec</b>			
1 ml	100	100	730011MPS
3 ml	200	50	730012MPS
3 ml	500	50	730013MPS
<b>CHROMABOND® HR-X</b>			
1 ml	100	30	730935MPS
3 ml	200	30	730931MPS
6 ml	500	30	730939MPS



## High-throughput SPE

### CHROMABOND® MULTI 96 for robot systems

Alternatively CHROMABOND® Multi 96 plates provide a means of high throughput sample preparation by processing 96 samples in a standard 8x12 microcolumn plate format compatible with standard 96-well plate liquid handling technologies and injection systems. CHROMABOND® Multi 96 plates are available for solid phase extraction (SPE) and for filtration.

#### CHROMABOND® MULTI 96 · SPE in microtitre format

- 96-well PP microtitre plates with PE filter elements
- cavity volume 1.5 ml
- adsorbent weights from 25 to 100 mg
- supplied with any CHROMABOND® SPE adsorbents
- for simultaneous preparation of 96 samples
- easy method transfer from CHROMABOND® columns or CHROMAFIX® cartridges to CHROMABOND® MULTI 96

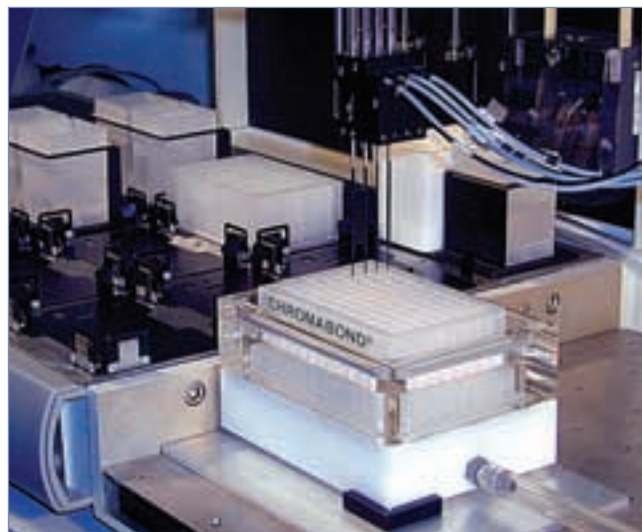
#### Advantages of this high-throughput system:

- simultaneous preparation of 96 samples; this means a 4-fold increase over traditional 24-position SPE processors
- economical by saving time and solvent
- use of multi-channel pipettors facilitates liquid transfer steps
- readily adaptable to all common automated / robotic handling systems
- minimised dead volume ( $\leq 40 \mu\text{l}$ )

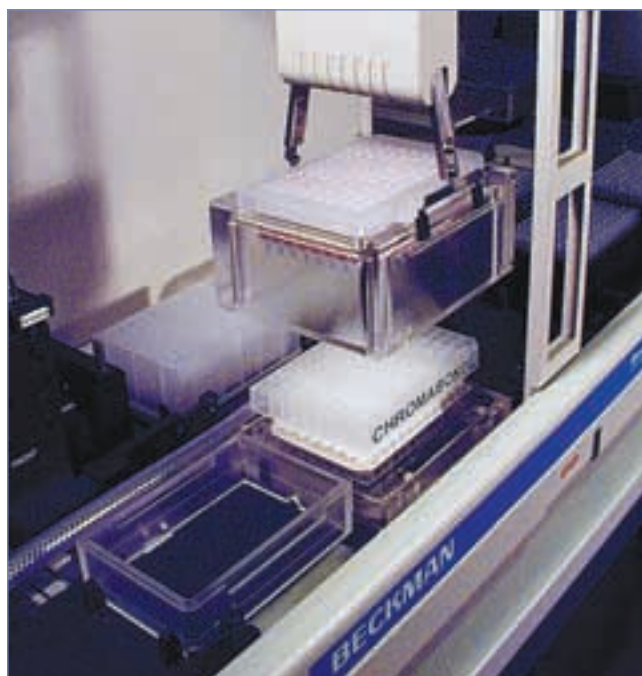
#### Instrument compatibility

CHROMABOND® MULTI 96 SPE microtitre or filtration plates are compatible with e.g. the following liquid handling and/or SPE automation systems:

- Perkin Elmer MultiProbe® II
- Tomtec Quadra 3® and Quadra 3® SPE
- Hamilton Microlab® SPE Workstation
- Beckman Coulter Biomek® 2000
- Caliper Life Science RapidTrace®
- Gilson ASPEC™ XL4 and ASPEC™ XL
- Gilson 215 SPE Liquid Handler
- Tecan Genesis™ FE500



Multiprobe® II (Perkin-Elmer)



Biomek® 2000 (Beckman Coulter)



## CHROMABOND® MULTI 96 vacuum manifold

for handling of CHROMABOND® MULTI 96 SPE plates for up to 96 samples

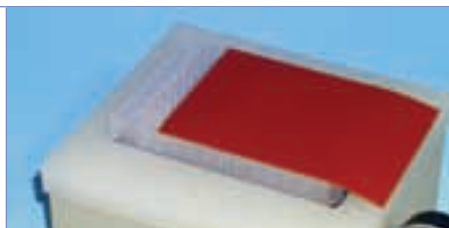
CHROMABOND® MULTI 96 is designed for use in common robotic workstations or commercially available liquid handling systems. Alternatively, use of multi-channel pipettors facilitates a manual liquid transfer. Extraction is carried out using the CHROMABOND® MULTI 96 vacuum manifold. With the help of the control valve the vacuum of the manifold can be adjusted leading to an optimum flow rate through the CHROMABOND® MULTI 96 SPE plate.

A reservoir tank and 96-well collection plates (96 x 0.5 or 96 x 2 ml) made of polypropylene can be supplied as accessories. An interesting alternative for collection of the eluates is a collection rack, which can be fitted with twelve 8-well strips of polypropylene tubes (each 1 ml). If you have to work on less than 96 samples, you can seal individual rows of the 96-well plate with a PTFE-covered rubber pad.



### Ordering information

Description	Pack of	REF
CHROMABOND® MULTI 96 vacuum manifold with reservoir tank, vacuum gauge, and control valve	1	738630.M
96-well microtitre plates (polypropylene) 96 x 0.25 ml	10	738651
96-deep-well collecting plate (polypropylene) 96 x 2 ml	5	738650.5
Collection racks with polypropylene tube strips (twelve 8-well strips) 96 x 1.0 ml	5	738637
Polypropylene tube strips (twelve 8-well strips) 96 x 1.0 ml	10	738652
8-well strip sealing caps for PP tube strips (REF 738652)	30	738638
Reservoir tanks (polypropylene)	2	738639.M
Butyl rubber pad, PTFE covered for sealing of individual rows of the 96-well plate, 125 x 85 mm	1	738645



For CHROMABOND® MULTI 96 filter plates see page 75. The ordering information of 96-well plates packed with individual CHROMABOND® adsorbents is listed with the respective phases.



# Kieselguhr phase for liquid-liquid extraction

## CHROMABOND® XTR

## for liquid-liquid extraction

- ◆ base material coarse-grained kieselguhr (also known as diatomaceous earth, hydromatrix, celite)
  - large pore size, high pore volume, constantly high batch-to-batch quality
  - pH working range 1 – 13
- ◆ **application:**
  - liquid-liquid extraction of highly viscous aqueous solutions such as physiological fluids (blood, plasma, and serum) in clinical chemistry, dyes in textiles, environmental and food analysis without use of a separation funnel
  - high water loadability without breakthrough of water during elution with organic solvents
  - also suited for removing small amounts of water from solvents which are not miscible with water
- ◆ **advantages:**
  - fast, reproducible and economical
  - simultaneous preparation of several samples
  - no problems with phase separation · no formation of emulsions
  - high recovery rates
  - saving of time and solvents
  - organic solutions need not to be dried after separation

# Liquid-Liquid Extraction

### Solvents applicable for elution

- ✓ diethyl ether
- ✓ *tert*-butyl methyl ether
- ✓ ethyl acetate
- ✓ *n*-hexane
- ✓ cyclohexane
- ✓ toluene
- ✓ methylene chloride (dichloromethane)
- ✓ chloroform (trichloromethane)
- ✓ chloroform / methanol (90:10, v/v)
- ✓ chloroform / methanol (85:15, v/v)
- ✓ diethyl ether / ethanol (90:10, v/v)
- ✓ diethyl ether / ethanol (80:20, v/v)
- ✓ methylene chloride / 2-propanol (90:10, v/v)
- ✓ methylene chloride / 2-propanol (85:15, v/v)

Eluents with too high alcohol contents cause an increase in volume of the aqueous phase on the CHROMABOND® XTR. Here the column could be overloaded and the aqueous phase displaced from the column. In this case, a greater capacity column should be used.

Depending on the concentration of the analytes eluates can be analysed immediately, or the organic solvent is evaporated. The pH value of the aqueous solution can be altered on the column, which enables elution of different compounds of a sample under optimised conditions. Under certain circumstances, acidic, neutral, and basic compounds can be fractionated in this way.

### General column parameters

CHROMABOND® XTR volume	amount of adsorbent	max. volume capacity of aq. solution	waiting period before elution	elution volume
1 ml	250 mg	0.25 ml	5 min	3 ml
3 ml	500 mg	0.5 ml	5 min	6 ml
6 ml	1 g	1 ml	5 – 10 min	8 ml
15 ml	3 g	3 ml	5 – 10 min	12 ml
30 ml	4.5 g	5 ml	5 – 10 min	16 ml
45 ml	8.3 g	10 ml	10 – 15 min	24 ml
70 ml	14.5 g	20 ml	10 – 15 min	40 ml
150 ml	37.5 g	50 ml	10 – 15 min	90 ml



Sample application



Spreading of the sample



Sample elution



## Determination of azo dyes and aromatic amines in coloured textile materials (with reference to § 35 German Law for Food and Consumer Goods/LMBG)

### Sample pretreatment:

Weigh about 1 g cut-up textile sample (coloured textiles about 0.1 g) in a 100 ml threaded vial. (Degrease leather samples before processing: cover sample with technical purity *n*-hexane and put the vial in an ultrasonic bath for 20 min. After decanting the *n*-hexane rinse with little *n*-hexane and dry sample by gentle heating and blowing with air or N<sub>2</sub>.)

Add 250 µl internal standard (IS: 1.2 mg/ml tetramethylbenzidine in methanol – ethyl acetate (1:1, v/v)), 17.0 ml citrate buffer (pH 6) (25.05 g citric acid and 12.64 g NaOH, fill up with deionized water to 2 l) and heat 30 min at 70 °C. Then add 3 ml of a freshly prepared solution of 0.2 g/ml sodium dithionite in water and heat for exactly 30 min to 70 °C while shaking occasionally.

### Sample application:

cool the solution immediately (put vial in water – stopping of reductive cleavage). After 5 – 10 min pour it onto the CHROMABOND® XTR column (squeeze textile remains).




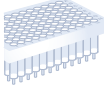
### Elution:

allow solution to be soaked up by the adsorbent for 15 min. Then elute four times with 20 ml each of diethyl ether or diethyl ether – ethanol (90:10, v/v) (see recovery rates), using the first 40 ml to rinse the sample remains. Evaporate the eluates to 3 ml with a rotation evaporator and transfer the solution into a 10 ml measuring flask with the help of a pasteur pipette and by rinsing with methanol. Fill up to the marking with methanol, shake, and pipette about 1 ml into a vial.

Further analysis: Fast GC on OPTIMA® δ-3, 10 m, 0.1 mm ID, 0.1 µm film, REF 726 410.10 (application 210820) or HPLC on NUCLEOSIL® 100-5 C<sub>18</sub> HD (application 110500 at [www.mn-net.com](http://www.mn-net.com))

MN Appl. No. 302100

## Ordering information

	column volume	1 ml	3 ml	6 ml	15 ml	30 ml	45 ml	70 ml	150 ml
	adsorbent weight	250 mg	500 mg	1 g	3 g	4.5 g	8.3 g	14.5 g	37.5 g
	max. volume capacity of aqueous solution	0.25 ml	0.5 ml	1 ml	3 ml	5 ml	10 ml	20 ml	50 ml
	pack of	100	50	30	30	30	30	30	10
	<b>CHROMABOND® XTR polypropylene columns</b>								
		730501	730502	730487	730489	730505	730506	730507	730509
	<b>CHROMABOND® XTR polypropylene columns · BIGpacks</b>								
		730487.250 (250 col.)					730507.100 (100 col.)		
	<b>CHROMABOND® MULTI 96 XTR</b>								
	96-well plates 96 x 150 mg, packs of 1 plate, for max. 96 x 0.2 ml aqueous solution	738131.150M							
	<b>CHROMABOND® XTR adsorbent</b>								
	50 bags of 14.5 g, for max. max. 20 ml aqueous solution each)								
	for 70 ml PP columns with 100 PE filter elements	for NT20 with 50 PE filter elements (10 mm dia.)							
			500 g	1 kg	5 kg				
	730585	730586	730595.500	730595.1000	730595.5000				
	<b>Accessories for liquid-liquid extraction with CHROMABOND® XTR</b>								
	variable polypropylene rack for 24 positions, incl. 24 PP stopcocks and 24 PP needles								730508

For parallel processing of up to 24 CHROMABOND® XTR columns 1 – 150 ml we recommend the polypropylene rack REF 730508 consisting of:

two side walls (1), middle part including stopcocks and needles (2), bottom part (3), top part for stabilising 45 ml, 70 ml and 150 ml CHROMABOND® XTR columns (4).

This rack can be adjusted to various heights depending on the CHROMABOND® XTR columns and the collection vials used. Each position of the middle part is equipped with a polypropylene stopcock on the top (REF 730185) and a polypropylene needle on the bottom (REF 730154).

For collection of the sample, vessels such as vials, test tubes, round bottom or tapered flasks, can be used. For our programme of sample vials, please see the chapter "Vials and accessories" from page 76.





# Columns for gravity flow phase separation

## CHROMABOND® PTS and PTL

columns for phase separation

- automatic separation of a two-phase mixture without separation funnel  
two-phase mixtures are completely applied to the column and the phase boundary is determined without further work. The special membrane stops automatically and the interesting phase is separated.  
columns **must not** be run with vacuum or pressure
- PTS**  
for solvents **heavier** than water, e.g. for chloroform, dichloromethane etc.  
maximum size 150 ml
- PTL**  
for solvents **lighter** than water, e.g. for diethyl ether, hexane etc.  
maximum size 70 ml

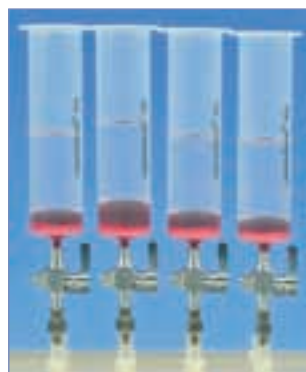
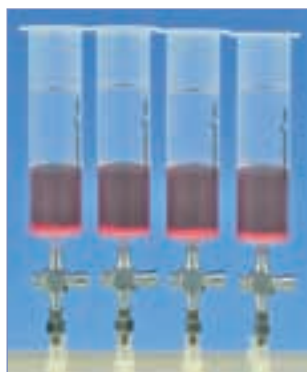
Phase Separation

### Ordering information

Column volume [ml]	Pack of [columns]	REF
<b>CHROMABOND® PTS</b> for solvents heavier than water		
1	100	730710
3	100	730712
6	100	730714
15	100	730716
30	100	730718
45	50	730720
70	50	730722
150	20	730724
<b>CHROMABOND® PTL</b> for solvents lighter than water		
1	100	730730
3	100	730732
6	100	730734
15	100	730736
30	100	730738
45	50	730740
70	50	730742



the ideal tool for breaking emulsions



CHROMABOND® PTL in action: organic upper phase (colourless), aqueous lower phase (red)





## Glass columns and accessories for Flash chromatography

- economic low-tech method for the synthesis laboratory suited for the separation of compounds up to gram levels no expensive equipment required
- MN flash chromatography kits include a glass column, eluent reservoir, silica 60 and accessories. Glass columns of different sizes and accessories can be ordered separately.

These columns are normally filled to a height of about 15 cm, working pressures are 1.5 to 2 bar.

The most used adsorbent is silica 60 with particle size 40 – 63  $\mu\text{m}$  (see page 179), however, you may also use our range of POLYGOPREP silica phases (see page 177 – 178). Particle sizes < 25  $\mu\text{m}$  should only be used with very low-viscosity mobile phases, because otherwise flow rates will be very low.

These columns are to be packed by the user.



## Ordering information

Designation	Pack of	REF
<b>Flash chromatography kits</b>		
Flash chromatography kit I, consists of 1 glass column 20 mm ID x 400 mm, one 1-l eluent reservoir, 100 g silica 60 (40 – 63 $\mu\text{m}$ ), sea sand, silanised glass fibre wadding	1 kit	727450
Flash chromatography kit II, consists of 1 glass column 40 mm ID x 450 mm, one 2-l eluent reservoir, 100 g silica 60 (40 – 63 $\mu\text{m}$ ), sea sand, silanised glass fibre wadding	1 kit	727451
<b>Flash chromatography columns</b>		
complete with adaptor and PTFE tap, fitted with a polyethylene net to protect against bursting		
20 mm ID x 200 mm length	1 column	727400
20 mm ID x 400 mm length	1 column	727401
25 mm ID x 200 mm length	1 column	727402
25 mm ID x 400 mm length	1 column	727403
30 mm ID x 300 mm length	1 column	727404
30 mm ID x 400 mm length	1 column	727405
40 mm ID x 300 mm length	1 column	727406
40 mm ID x 450 mm length	1 column	727407
<b>Accessories for flash chromatography glass columns</b>		
Eluent reservoir 1 l with adaptor, covered with a protective plastic sleeve for burst protection; this also prevents build-up of UV-induced radicals in the eluent	1	727420
Eluent reservoir as above, however 2 l volume	1	727421
Pressure gauge for controlling flow rates	1	727422
Sea sand, acid washed and calcined	1000 g	727423
Glass fibre wadding, silanised	25 g	718002



# CHROMABOND® Flash RS cartridges

## CHROMABOND® Flash RS cartridges

ideal for Flash separations from 10 mg up to 160 g

- ◆ **for convenient operation and reliable upscaling**  
 the complete program of ready-to-use Flash cartridges for the ISCO® Companion® and other Teledyne Isco CombiFlash® systems, or as stand-alone version for all pump/detector combinations, e.g. from Biotage®, Büchi®, from 4 g to 1600 g adsorbent from one of the leading companies in silica and TLC business
- ◆ **increases flexibility**  
 considerable program of different phases and modifications
- ◆ **saves time and money**  
 convenient prices, short delivery times
- ◆ **increases analytical safety**  
 high pressure stability of 15 bar/220 psi (12 bar for cartridges > 200 g), excellent separation efficiency, good reproducibility



Flash Chromatography

### Technical features

- ◆ **Distribution of eluent stream via highly porous frits**
- ◆ **Cartridge material and geometry:**  
 organic solvent resistant, low bleed polypropylene, thick column walls, one piece body, sophisticated length to diameter quotient for high plate numbers and excellent separation efficiencies
- ◆ **Cartridge/column connections**

CHROMABOND® RS cartridges are 100% compatible with the ISCO® Companion®, no additional hardware is needed for this type of purification systems.

CHROMABOND® RS cartridges (except RS 800 and RS 1600 with Maxi Luers) can also be used as stand alone system with any pump/detector/fraction collector combination using the CHROMABOND® Flash Starter Kit or the CHROMABOND® Flash Stand Alone Kit.

For the RS 800 and RS 1600 we offer stand alone adaptors Maxi Luer to ¼"-28 screws:

**Column inlet:**  
Maxi Luer connector, male maxi luer to ¼"-28 inner screw, stainless steel, single use product

**Column exit:**  
Aluminium bridge with stainless steel screw for Maxi Luer Output, female Maxi luer to ¼"-28 inner screw for RS 800 or RS 1600, respectively.



CHROMABOND® Flash Starter Kit





## Accessories for CHROMABOND® Flash columns - Ordering information

Description	Pack of	REF
<b>CHROMABOND® Flash Starter Kit</b>		
consists of: 1/8" PTFE tubing, ID 1.5 mm, length 3 m; 5 x 1/4"-28 PP nuts; 5 x 1/8" ETFE ferrules; 5 x 1/4"-28 nylon unions; 2 x 1/4"-28 PP luer locks female; 1 x 1/4"-28 PP luer locks male; 1 x 1/4"-28 PP luer tip male	1 kit	730798
<b>CHROMABOND® Flash Stand Alone Kit</b>		
consists of: 1 x 1/4"-28 PP luer lock female; 1 x 1/4"-28 PP luer lock male; 2 x 1/8" ETFE ferrules; 2 x 1/4"-28 nylon unions; 2 x 1/4"-28 PP nuts	1 kit	732903
<b>Accessories</b>		
CHROMABOND® maxi luer connector for RS 800 and RS 1600 (inlet)	1	732900
CHROMABOND® Flash aluminium bridge with stainless steel screw for RS 800 (exit)	1	732901
CHROMABOND® Flash aluminium bridge with stainless steel screw for RS 1600 (exit)	1	732902

## CHROMABOND® Flash solutions for specific Flash instruments

- product range designed for use in the Teledyne Isco CombiFlash® systems (Companion®, Rf etc.) and Flash systems of Biotage AB (FlashMaster™) without additional connectors or capillaries
- on request all column types listed below can be packed with any adsorbent as described on page 8 – 9 (please note that other packings often result in differing adsorbent weights)

## Ordering information

Designation	Column length [cm]	ID [mm]	Adsorbent weight [g]	Pack of	REF
<b>CHROMABOND® Flash RS columns for Teledyne Isco® systems</b>					
All CHROMABOND® Flash RS types can be directly used in the Teledyne Isco Companion®, Rf, etc.					
CHROMABOND® Flash RS 4 SiOH	9.8	12.4	4	20	732800
CHROMABOND® Flash RS 15 SiOH	11.6	21.2	15	20	732801
CHROMABOND® Flash RS 25 SiOH	16.5	21.2	25	15	732802
CHROMABOND® Flash RS 40 SiOH	17.1	26.4	40	15	732803
CHROMABOND® Flash RS 80 SiOH	24.0	30.8	80	12	732804
CHROMABOND® Flash RS 120 SiOH	25.5	36.0	120	10	732805
CHROMABOND® Flash RS 200 SiOH	20.0	60.0	200	6	732806
CHROMABOND® Flash RS 330 SiOH	27.0	60.0	330	4	732807
CHROMABOND® Flash RS 800 SiOH	38.5	82.0	800	2	732808
CHROMABOND® Flash RS 1600 SiOH	43.0	104.0	1600	2	732809
CHROMABOND® Flash RS 4 C <sub>18</sub> ec	9.8	12.4	4.3	2	732810
CHROMABOND® Flash RS 15 C <sub>18</sub> ec	11.6	21.2	16.4	1	732811
CHROMABOND® Flash RS 25 C <sub>18</sub> ec	16.5	21.2	26	1	732812
CHROMABOND® Flash RS 40 C <sub>18</sub> ec	17.1	26.4	43	1	732813
CHROMABOND® Flash RS 80 C <sub>18</sub> ec	24.0	30.8	86	1	732814
CHROMABOND® Flash RS 120 C <sub>18</sub> ec	25.5	36.0	130	1	732815
CHROMABOND® Flash RS 200 C <sub>18</sub> ec	20.0	60.0	220	1	732816
CHROMABOND® Flash RS 330 C <sub>18</sub> ec	27.0	60.0	360	1	732817
CHROMABOND® Flash RS 800 C <sub>18</sub> ec	38.5	82.0	880	1	732818
CHROMABOND® Flash RS 1600 C <sub>18</sub> ec	43.0	104.0	1760	1	732819



# CHROMABOND® Flash RS cartridges

Flash Chromatography

Designation	Column length [cm]	ID [mm]	Adsorbent weight [g]	Pack of	REF
CHROMABOND® Flash RS 4 NH <sub>2</sub>	9.8	12.4	4.3	2	732820
CHROMABOND® Flash RS 15 NH <sub>2</sub>	11.6	21.2	16.4	1	732821
CHROMABOND® Flash RS 25 NH <sub>2</sub>	16.5	21.2	26	1	732822
CHROMABOND® Flash RS 40 NH <sub>2</sub>	17.1	26.4	43	1	732823
CHROMABOND® Flash RS 80 NH <sub>2</sub>	24.0	30.8	86	1	732824
CHROMABOND® Flash RS 120 NH <sub>2</sub>	25.5	36.0	130	1	732825
CHROMABOND® Flash RS 200 NH <sub>2</sub>	20.0	60.0	220	1	732826
CHROMABOND® Flash RS 330 NH <sub>2</sub>	27.0	60.0	360	1	732827
CHROMABOND® Flash RS 4 OH	9.8	12.4	4.3	2	732830
CHROMABOND® Flash RS 15 OH	11.6	21.2	16.4	1	732831
CHROMABOND® Flash RS 25 OH	16.5	21.2	26	1	732832
CHROMABOND® Flash RS 40 OH	17.1	26.4	43	1	732833
CHROMABOND® Flash RS 4 CN	9.8	12.4	4.3	2	732840
CHROMABOND® Flash RS 15 CN	11.6	21.2	16.4	1	732841
CHROMABOND® Flash RS 25 CN	16.5	21.2	26	1	732842
CHROMABOND® Flash RS 40 CN	17.1	26.4	43	1	732843
CHROMABOND® Flash RS 80 CN	24.0	30.8	86	1	732844
CHROMABOND® Flash RS 120 CN	25.5	36.0	130	1	732845
CHROMABOND® Flash RS 4 ALOX A	9.8	12.4	8	20	732870
CHROMABOND® Flash RS 4 ALOX N	9.8	12.4	8	20	732871
CHROMABOND® Flash RS 4 ALOX B	9.8	12.4	8	20	732872
CHROMABOND® Flash RS 15 ALOX A	11.6	21.2	30	20	732874
CHROMABOND® Flash RS 15 ALOX N	11.6	21.2	30	20	732873
CHROMABOND® Flash RS 15 ALOX B	11.6	21.2	30	20	732875
CHROMABOND® Flash RS 25 ALOX A	16.5	21.2	50	15	732876
CHROMABOND® Flash RS 25 ALOX N	16.5	21.2	50	15	732877
CHROMABOND® Flash RS 25 ALOX B	16.5	21.2	50	15	732878
CHROMABOND® Flash RS 40 ALOX A	17.1	26.4	80	15	732879
CHROMABOND® Flash RS 40 ALOX N	17.1	26.4	80	15	732881
CHROMABOND® Flash RS 40 ALOX B	17.1	26.4	80	15	732880

## CHROMABOND® Flash RS cartridges for stand-alone operation

incl. Maxi Luer connector at the top and bores for the aluminium bridge at the exit of the cartridges

CHROMABOND® Flash RS 800 SiOH stand alone	38.5	82.0	800	2	732808S
CHROMABOND® Flash RS 1600 SiOH stand alone	43.0	104.0	1600	2	732809S

## CHROMABOND® Flash columns for Biotage® FlashMaster™ systems

CHROMABOND® Flash FM 15/2 SiOH	9.0	15.8	2.0	50	730881
CHROMABOND® Flash FM 25/5 SiOH	10.0	20.5	5.0	50	730891
CHROMABOND® Flash FM 25/10 SiOH	10.0	20.5	10.0	50	730666
CHROMABOND® Flash FM 70/10 SiOH	15.4	26.8	10.0	30	730885
CHROMABOND® Flash FM 70/20 SiOH	15.4	26.8	20.0	30	730915
CHROMABOND® Flash FM 70/25 SiOH	15.4	26.8	25.0	30	730892
CHROMABOND® Flash FM 150/25 SiOH	17.0	38.2	25.0	20	730667
CHROMABOND® Flash FM 150/50 SiOH	17.0	38.2	50.0	20	730887
CHROMABOND® Flash FM 150/70 SiOH	17.0	38.2	70.0	20	730880
CHROMABOND® Flash FM 15/2 C <sub>18</sub> ec	9.0	15.8	2.0	50	730890
CHROMABOND® Flash FM 25/5 C <sub>18</sub> ec	10.0	20.5	5.0	20	730884
CHROMABOND® Flash FM 70/10 C <sub>18</sub> ec	15.4	26.8	10.0	20	730886
CHROMABOND® Flash FM 150/50 C <sub>18</sub> ec	17.0	38.2	50.0	10	730888
CHROMABOND® Flash FM 70/10 NH <sub>2</sub>	15.4	26.8	10.0	20	730768
CHROMABOND® Flash FM 70/20 NH <sub>2</sub>	15.4	26.8	20.0	20	730767



## Technical support

### Loadability

Due to the narrow particle size distribution, the excellent packing quality and the optimised stationary phases (acid washed silica, reduced particulate matter) our cartridges can realize highest loadability at best possible separation efficiency. Additionally, the large range of different cartridge lengths and diameters eases to find the optimum in loadability for a given sample amount.

*Rule of thumb for the loadability:*

separation	loadability	g sample / g adsorbent
difficult	low	≤ 1 %
easy	high	≥ 10 %

### Loadability table

SiOH cartridge	Average loadability per cartridge [g]	
	difficult separation	easy separation
RS 4	0,04	0,4
RS 15	0,15	1,5
RS 25	0,25	2,5
RS 40	0,4	4
RS 80	0,8	8
RS 120	1,2	12
RS 200	2	20
RS 330	3,3	33
RS 800	8	80
RS 1600	16	160

### Back pressure/pressure stability

The back pressure always depends on flow rate and viscosity of the eluent mixture, column length and diameter and particle size. The new ultra performance CHROMABOND® Flash RS cartridges up to 200 g silica are stable up to 15 bar (220 psi, > 200 g: 12 bar)

*Back pressure of CHROMABOND® SiOH Flash RS cartridges for the eluent hexane – ethyl acetate 9:1 or 8:2*

	Flow rate						
	20 ml/min	40 ml/min	80 ml/min	120 ml/min	160 ml/min	200 ml/min	240 ml/min
RS 4	0.75 bar	1.5 bar					
RS 15	0.25 bar	0.75 bar	1.5 bar	2.0 bar			
RS 25	0.5 bar	1.0 bar	1.75 bar	3.0 bar	4.0 bar	5.0 bar	
RS 40		0.75 bar	1.5 bar		3.0 bar		3.5 bar
RS 80			1.5 bar	2.5 bar	3.0 bar	3.5 bar	4.0 bar
RS 120			1.0 bar	1.5 bar	2.0 bar	2.5 bar	3.0 bar
RS 200			1.0 bar		2.0 bar		3.0 bar
RS 330			1.5 bar		3.0 bar		4.0 bar

*Conditioning volumes for CHROMABOND® Flash RS cartridges (normally 1.5 column volumes of eluent)*

Cartridge	Eluent volume for conditioning	Cartridge	Eluent volume for conditioning
RS 4	20 ml	RS 120	440 ml
RS 15	60 ml	RS 200	750 ml
RS 25	90 ml	RS 330	1100 ml
RS 40	140 ml	RS 800	2900 ml
RS 80	280 ml	RS 1600	5000 ml

### Upscaling of the optimum flow rate

This depends on the eluent and the separation problem.

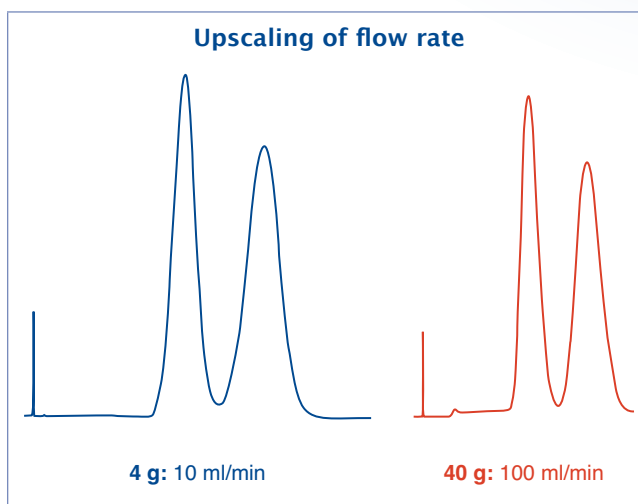
For RS cartridges the upscaling relation is easy:

silica [g] to flow = 1:1 (for the same polarity of eluent)

e.g.

4 g silica → optimum flow: ~ 6 – 12 ml/min

40 g silica → optimum flow: ~ 60 – 120 ml/min





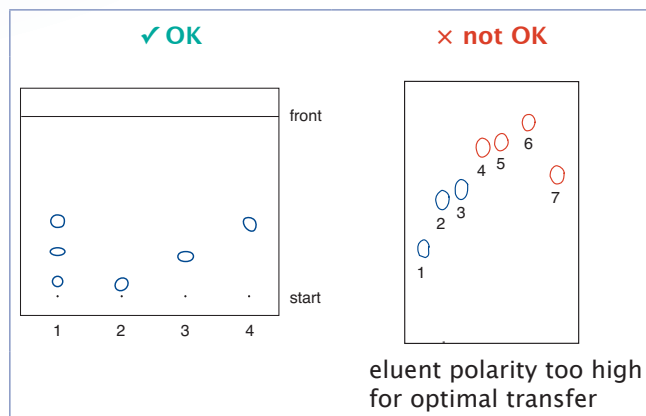
# CHROMABOND® Flash adsorbents

## TLC upscaling

TLC is often used for the development of a selective and reproducible method in Flash chromatography, because it is often necessary to test a large number of eluent and/or adsorbent combinations. MN TLC plates and sheets are coated with the same base silica, which is used in our CHROMABOND® Flash cartridges. This is an important prerequisite for the reproducible transfer of a TLC separation to the Flash column, because the parameters are identical in both systems.

### Examples:

R<sub>f</sub> values of the TLC separation should be in the range of 0.1 - 0.4 (low height).

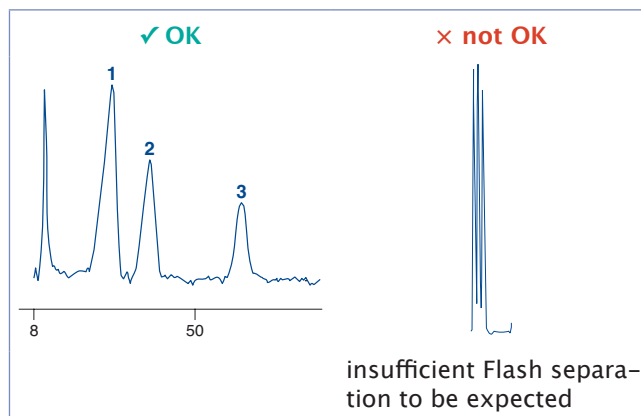


## How can a successful TLC separation be transferred to a Flash column?

MN as a TLC manufacturer uses the same base material/silica on TLC plates as in Flash cartridges:

- same selectivities and easy upscaling from TLC to Flash is guaranteed
- saves time and money, because expensive optimisations are not necessary

ΔR<sub>f</sub> values on the TLC plate should be as high as possible.



During TLC optimisation always use solvents, which are well suited for the following Flash chromatography!

## MN adsorbents

## a unique variety of phases

- as with our SPE products, all Flash columns and cartridges from MN are available with our whole range of CHROMABOND® phases (more than 40, e.g. C<sub>18</sub>, C<sub>8</sub>, OH, Alox etc. as listed on page 8 - 9)  
Additionally you can choose from our range of POLYGOPREP silica packings in particle sizes from 20 to 130 μm and pore sizes from 60 to 4000 Å (see page 177 - 178).
- for high performance Flash separations you can order columns packed with spherical NUCLEODUR® featuring very high separation efficiency and extremely increased column lifetime (particle size > 20 μm as listed on page 172)

For corresponding offers please contact your local MN distributor.

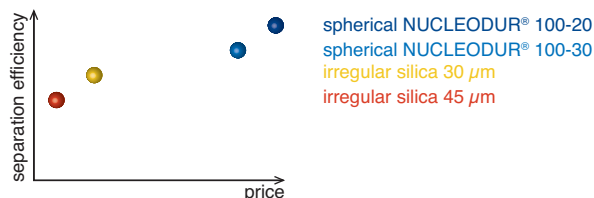
## Technical silica information

### Silica specifications:

acid-washed irregular silica, pore size 60 Å, particle size 45 μm, specific surface 500 m<sup>2</sup>/g, pH stability 2 - 8, for modified and plain silica

### Additionally available silicas/particle sizes:

- irregular silica, 60 Å with a particle size of 30 μm
- spherical silica (NUCLEODUR®, 110 Å) with a particle size of 20 μm or 30 μm



## separation efficiency and price of irregular versus spherical silica

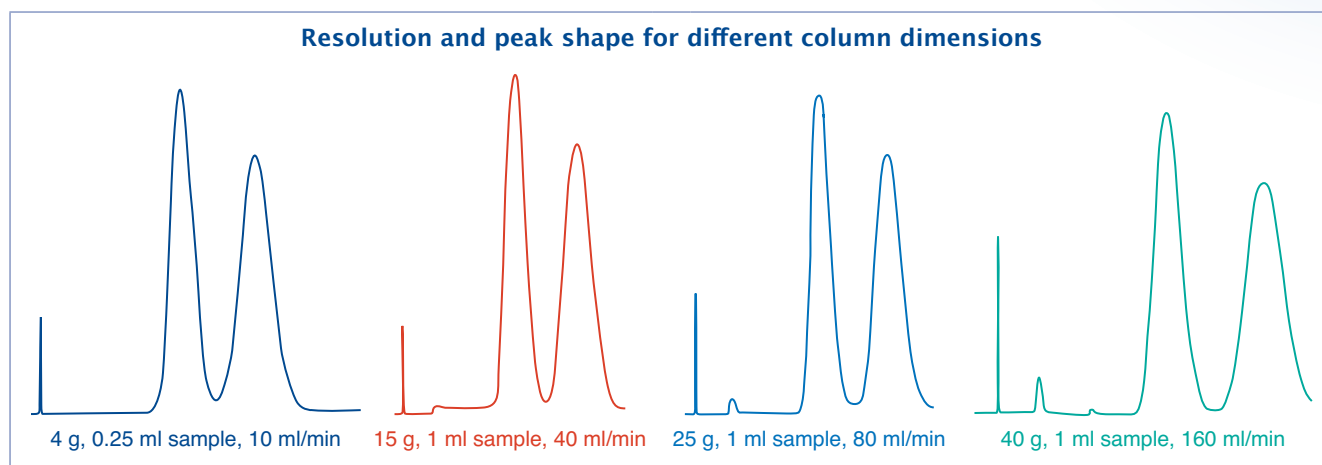


## Separation efficiency and reproducibility tests

Our optimised automatic packing process leads to an excellent packing quality, irrespective of the phase or particle size distribution (normal phase or reversed phase, spherical or irregular particles).

MN, as a manufacturer of silicas, has decades of experience in the production of first class separation phases and columns. This leads to highest separation efficiencies of the columns, a constant back pressure (via controlled narrow particle size distribution) and good reproducibilities from cartridge to cartridge.

The separation efficiency is in the first step not influenced by the dimension or the geometry of the Flash RS cartridges. The chromatograms below show an identical resolution and peak form for different column dimensions, when flow and sample amount is adjusted correctly. This is positive for optimization and upscaling experiments.



## MN Flash Safety System

meeting today's customers' demands

### features:

- maximum safety during use under pressure
- increased column life time
- high separation efficiency
- excellent reproducibility
- high loadability
- easy and flexible installation, even with different instruments / hardware

### the CHROMABOND® Flash Safety System

can be used as stand-alone system for any pump / detector / fraction collector combination with ¼"-28 fittings

CHROMABOND® safety holder, available in 5 different sizes (90, 180, 240, 360, 750/1000 ml)

holder can be equipped with either luer lock inlet, ¼"-28 threads or Swagelok® connection

cartridges with luer lock exit for a safe and pressure stable tube connection

maximum safety up to 9 bar

### holders with cartridges



40 mm ID



65 mm ID

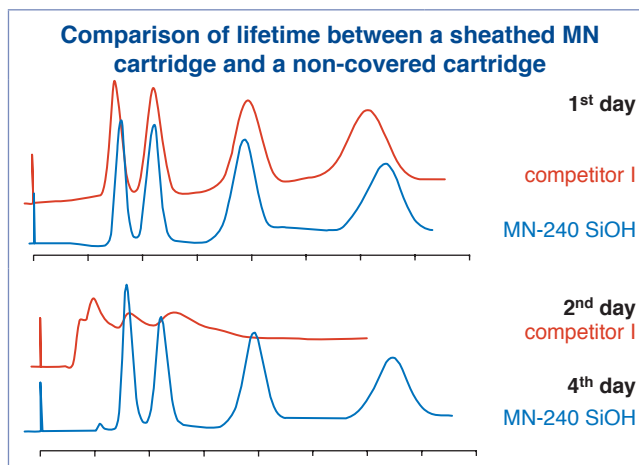


# CHROMABOND® Flash Safety System

## Safety and column lifetime

Both points are closely connected for the CHROMABOND® Flash Safety System. The metal casing around the cartridge increases the security for the user compared to pure plastic cartridges without casing.

Our CHROMABOND® Flash Safety System is tested and proofed up to 9 bar. This increases the flexibility due to the use of a broader range of feasible solvents (i.e. with higher viscosity) and reduces the analysis time by higher possible flow rates. The metal casing inhibits the deformation or twisting of the cartridge and through this, avoids a damage of the packing by swelling or solvent effects. The increase in cartridge lifetime is now measured in days, not only in hours or a few runs.



## CHROMABOND® Flash Safety System · Holders and replacement parts

Description	Dimension	Pack of	REF
CHROMABOND® Flash holder 90 (complete with cap (luer lock, female) and casing)	60 x 108 mm	1	730896
CHROMABOND® Flash holder 180 as above	60 x 187 mm	1	730897
CHROMABOND® Flash holder 240 as above	60 x 232 mm	1	730899
CHROMABOND® Flash holder 360 as above	60 x 318 mm	1	730898
CHROMABOND® Flash holder 750 (complete with cap, star-shaped distribution device, seal, retaining ring and casing)	95 x 300 mm	1	730834

## CHROMABOND® Flash cartridges with luer lock · Ordering information

Description	Dimensions		Adsorbent SiOH			Adsorbent C18 ec		
	length [mm]	ID [mm]	adsorbent weight [g]	pack of	REF	adsorbent weight [g]	pack of	REF
CHROMABOND® Flash MN-90	114	40	40	10	730810	55	2	730814
CHROMABOND® Flash MN-180	194	40	90	10	730811	110	2	730815
CHROMABOND® Flash MN-240	240	40	130	10	730784	150	2	730816
CHROMABOND® Flash MN-360	325	40	180	5	730813	220	1	730817
CHROMABOND® Flash MN-750	270	65	330	5	730835	440	1	730836
CHROMABOND® Flash MN-1000	365	65	450	2	730838	620	1	730837

For operation of these cartridges the corresponding holder is required (see above)

## Injection accessories for CHROMABOND® Flash columns · Ordering information

Description	Dimension	Pack of	REF
<b>Liquid injection accessories</b>			
VALCO Cheminert® injection valve, 6 ways, 2 positions, manual, 1/4"-28		1	724C226186
CHROMABOND® Flash PP luer lock, female, 1/4"-28		5	730805
CHROMABOND® Flash PP luer lock, male, 1/4"-28		5	730801
CHROMABOND® Flash 3-way adaptor with valve, 1/4"-28 connections		1	730895
<b>Solid injection system</b>			
CHROMABOND® Flash solid injection adaptor 3 ml	3 ml	1	730821
CHROMABOND® Flash solid injection adaptor 6 ml	6 ml	1	730822
CHROMABOND® Flash solid injection adaptor 10 ml	10 ml	1	730823
CHROMABOND® Flash solid injection adaptor 30/55 ml	30 ml	1	730831





Description	Dimension	Pack of	REF
CHROMABOND® Flash solid injections cartridge with luer lock, incl. filter elements	3 ml	10	730824
CHROMABOND® Flash solid injections cartridge with luer lock, incl. filter elements	6 ml	10	730825
CHROMABOND® Flash solid injections cartridge with luer lock, incl. filter elements	10 ml	10	730826
CHROMABOND® Flash solid injections cartridge with luer lock, incl. filter elements	30 ml	10	730833
CHROMABOND® Flash solid injections cartridge with luer lock, incl. filter elements*	55 ml	10	730927
CHROMABOND® Flash solid injection filter elements for 3 ml cartridges	10 mm	20	730827
CHROMABOND® Flash solid injection filter elements for 6 ml cartridges	13 mm	20	730828
CHROMABOND® Flash solid injection filter elements for 10 ml cartridges *	16.5 mm	20	730829
CHROMABOND® Flash Viton® sealing ring for 10 ml solid injection adaptor *		5	730925

\* other sizes on request

## Alternative injection systems and methods (in stand-alone mode)

- ◆ **liquid injection systems:** the sample is applied to the flash column e.g. via syringe and 3-way valve or with a VICI® medium pressure valve with sample loop (see figures below)
- ◆ **solid injection systems:** the sample is adsorbed to a suitable adsorbent (e.g. CHROMABOND® XTR), and the loaded adsorbent is filled into a solid injection cartridge fitted with the corresponding adaptor (right figures below)

The solid injection cartridges

- ◆ can be connected directly to the upper luer lock of the cartridges for a pressure tight connection
- ◆ are available in 5 different dimensions, because different sample amounts always require adequate solutions
- ◆ can be filled easily and are reusable



Liquid injection via syringe and 3-way valve



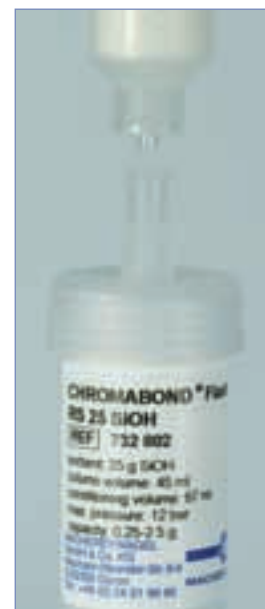
VICI® medium pressure valve



Solid injection cartridges



Solid injection cartridge on Flash RS



Detail