



Solid Phase Extraction (SPE)

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Basic principles of SPE

Solid Phase Extraction

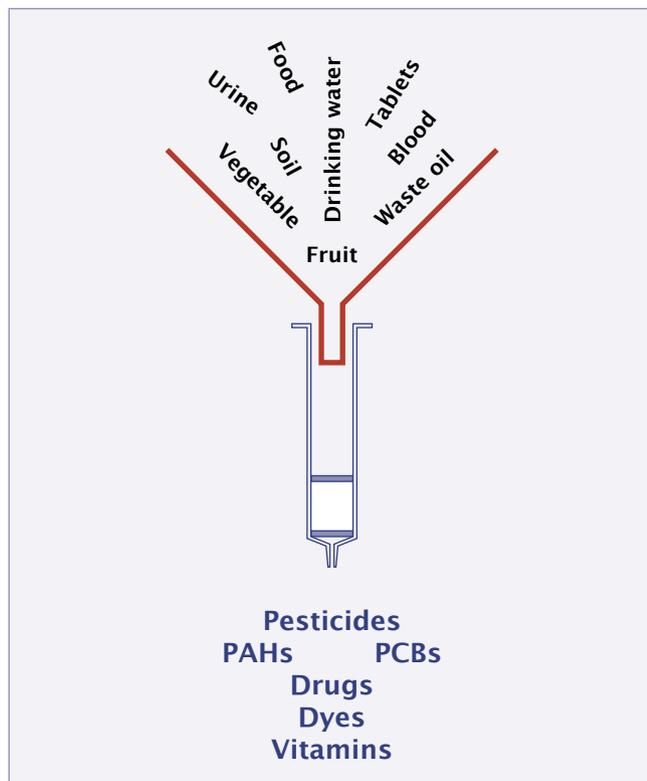


Solid phase extraction (SPE) is a powerful method for sample preparation and is used by most chromatographers today.

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



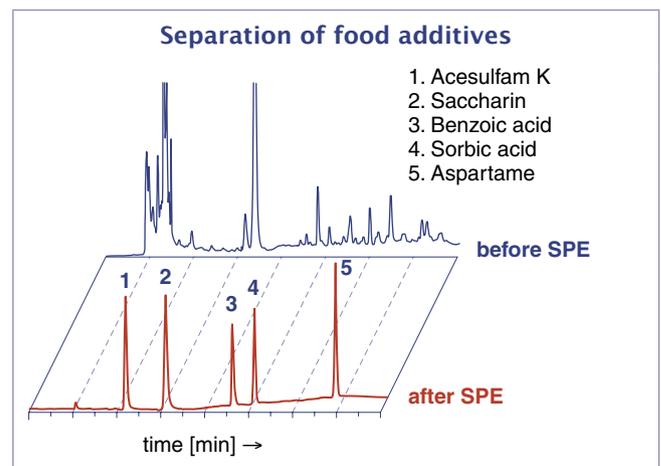
SPE is a form of digital (step-wise) chromatography designed to extract, partition, and/or adsorb one or more components from a liquid phase (sample) onto a stationary phase (adsorbent or resin). An adsorbed substance can be removed from the adsorbent by step-wise increase of elution strength of the 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.

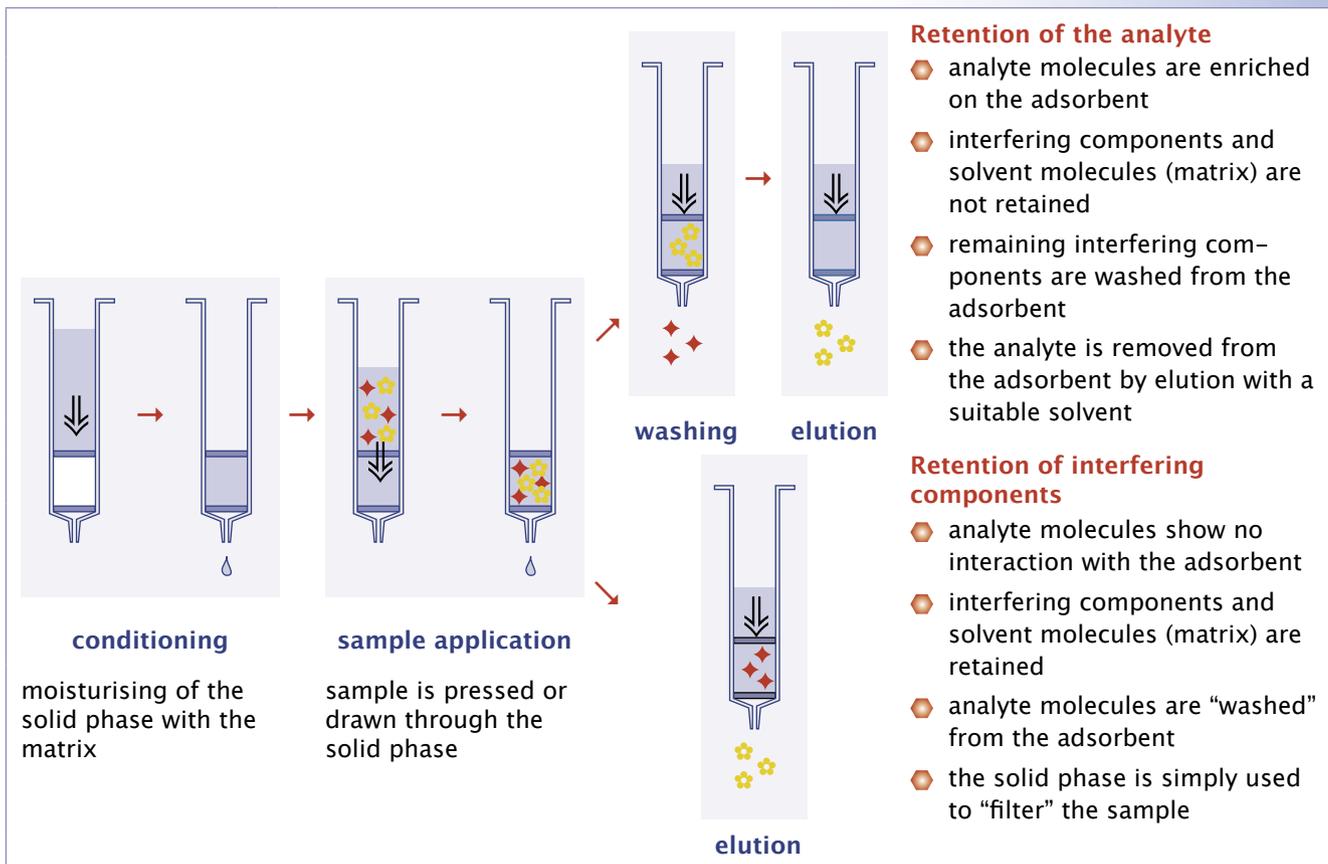
In general, SPE is used for three important purposes in state-of-the-art analyses:

- 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

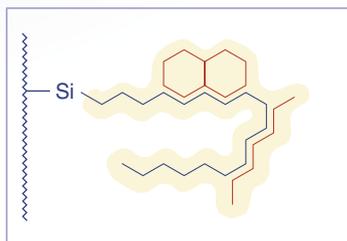
Molecular interactions in SPE

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

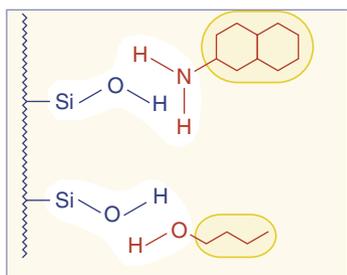
- Reversed Phase Extraction of hydrophobic or polar organic analytes from aqueous matrix
- Normal Phase Extraction of polar analytes from non-polar organic solvents
- Ion Exchanger Extraction of charged analytes from aqueous or non-polar organic samples

Types of retention mechanisms:



Nonpolar interactions

silica-based: C18 ec, C18, C18 Hydra, C8, ...
 polymer-based: HR-P, HR-X, Easy, PS-RP
 interactions: hydrophobic
 sample: mostly aqueous
 elution: solvents with lower polarity (compared to water)
 MeOH, CH₂Cl₂, CHCl₃, ... hexane



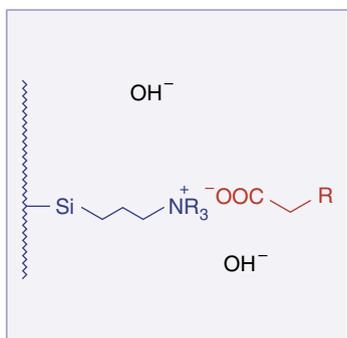
Polar interactions

silica-based: SiOH, CN, NH₂, OH (diol), C₆H₅, ...
 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, ...)
 CH₂Cl₂, CHCl₃, ...



Cation exchangers

silica-based: SA (SCX), PCA (WCX), PSA,
 polymer-based: PS-H⁺, ...
 interaction: between charged analytes and functional group of cation exchanger
 sample: aqueous (pH 3-5)
 elution: acidic: protic pH 2 (e.g. HCl, or 20% AcOH in MeOH/acetonitrile)
 basic: pH 8-9 (e.g. 5% NH₃ in MeOH/acetonitrile)
 solvents or buffers with higher ionic strength and counter ions with high selectivity (e.g. Ca²⁺, ...)



Anion exchangers

silica-based: SB (SAX), NH₂, DMA, ...
 polymer-based: PS-OH⁻, ...
 interaction: between charged analytes and functional group of anion exchanger
 sample: aqueous (pH 8-9)
 elution: basic: pH 10 (e.g. 20% NH₃ 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:

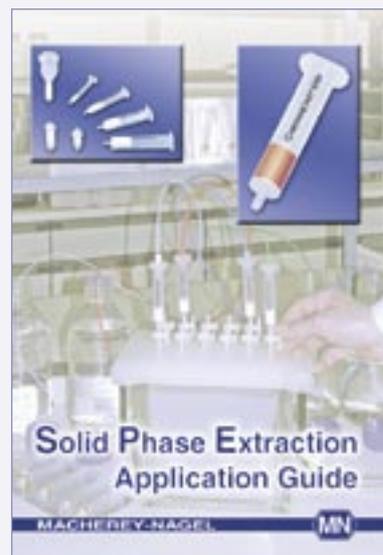
- dissolution of the solid sample in a suitable solvent
- lyophilisation of the sample and dissolution in a suitable solvent
- extraction of the solid sample with a suitable solvent
- homogenisation of the sample in a suitable solvent

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 C18 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



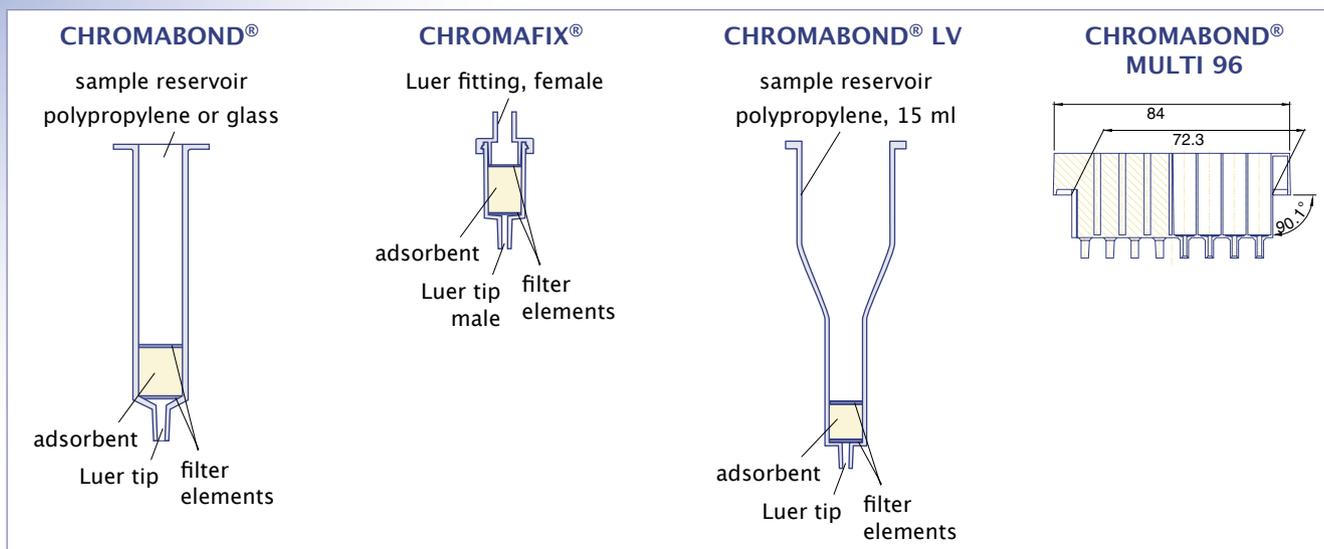
Our CHROMABOND® QC policy

- highest production standard**
our facilities are EN ISO 9001:2000 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
- 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 44)



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	Cat. No.
Investigating the best separation mechanism for a clean-up procedure		
CHROMABOND [®] standard development kit	10 columns each with 1 ml / 100 mg: C18, C18 ec, C8, C ₆ H ₅ , NH ₂ , DMA, OH, CN, SiOH, SA (SCX), SB (SAX)	730110
CHROMABOND [®] polymer development kit	10 columns each with 1 ml / 100 mg: HR-X, HR-P, Easy, PS-H ⁺ , PS-OH ⁻	730290
Selecting the optimum RP phase for a clean-up procedure		
CHROMABOND [®] RP development kit I	10 columns each with 3 ml / 500 mg: C18, C18 ec, C8, C4 and 10 columns with 3 ml / 200 mg HR-P	730197
CHROMABOND [®] RP development kit II	10 columns each with 1 ml / 100 mg: C18, C18 ec, C8, C4, HR-P	730207
CHROMAFIX [®] RP development kit I	10 cartridges each CHROMAFIX [®] S: C18, C18 ec, C8, C4, HR-P	731883
CHROMABOND [®] RP development kit III	10 columns each with 3 ml / 500 mg: C18, C18 ec, C18 Hydra, C8 and 10 columns with 3 ml / 200 mg HR-P	730490
CHROMABOND [®] RP development kit IV	10 columns each with 1 ml / 100 mg: C18, C18 ec, C18 Hydra, C8, HR-P	730491
CHROMAFIX [®] RP development kit II	10 cartridges each CHROMAFIX [®] S: C18, C18 ec, C18 Hydra, C8, HR-P	731886
CHROMABOND [®] RP development kit V	10 columns each with 3 ml / 500 mg: C ₆ H ₅ , NO ₂ , C ₆ H ₁₁ ec, C4, C2	730492
CHROMABOND [®] RP development kit VI	10 columns each with 1 ml / 100 mg: C ₆ H ₅ , NO ₂ , C ₆ H ₁₁ ec, C4, C2	730493
CHROMAFIX [®] RP development kit III	10 cartridges each CHROMAFIX [®] S: C ₆ H ₅ , NO ₂ , C ₆ H ₁₁ ec, C4, C2	731887
Selecting the optimum polar phase for a clean-up procedure		
CHROMABOND [®] polar development kit I	10 columns each with 3 ml / 500 mg: SiOH, Florisil [®] , NH ₂ , CN, OH	730199
CHROMABOND [®] polar development kit II	10 columns each with 1 ml / 100 mg: SiOH, Florisil [®] , NH ₂ , CN, OH	730208
CHROMAFIX [®] polar development kit	10 cartridges each CHROMAFIX [®] S: SiOH, Florisil [®] , NH ₂ , CN, OH	731884
Selecting the optimum ion exchanger for a clean-up procedure		
CHROMABOND [®] ion exchange development kit I	10 columns each with 3 ml / 500 mg: SA (SCX), SB (SAX), PS-OH ⁻ , PS-H ⁺ , DMA	730206
CHROMABOND [®] ion exchange development kit II	10 columns each with 1 ml / 100 mg: SA (SCX), SB (SAX), PS-OH ⁻ , PS-H ⁺ , DMA	730209
CHROMAFIX [®] ion exchange development kit I	10 cartridges each CHROMAFIX [®] S: SA (SCX), SB (SAX), PS-OH ⁻ , PS-H ⁺ , DMA	731885
CHROMABOND [®] ion exchange development kit III	10 columns each with 3 ml / 500 mg: SA (SCX), PSA, PCA (WCX), PS-H ⁺	730494
CHROMABOND [®] ion exchange development kit IV	10 columns each with 1 ml / 100 mg: SA (SCX), PSA, PCA (WCX), PS-H ⁺	730495
CHROMAFIX [®] ion exchange development kit II	10 cartridges each CHROMAFIX [®] S: SA (SCX), PSA, PCA (WCX), PS-H ⁺	731888
Phase selection for clean-up procedures for environmental samples		
CHROMABOND [®] kit for environmental sample preparation	10 columns each with 3 ml / 200 mg HR-P, 6 ml / 1000 mg C18 ec, 6 ml / 2000 mg C18 PAH, 6 ml / 500/1000 mg CN/SiOH, 3 ml / 500/500 mg SA/SiOH	730205



Summary of MN phases for SPE

Code	Matrix	Modification / Application	Similar phases*	Page
Reversed phases				
HR-X	PS/DVB		ENVI-Chrom P · Strata™-X · Oasis® HLB · Nexus	10
Easy	PS/DVB	polar, bifunctional	Strata™-X · Oasis® HLB · Porapak™ RDX · Nexus, Bond Elut® PPL, Focus™ · Styre Screen® DVB Bakerbond™ H ₂ O-philic DVB · Isolute® ENV+	12
HR-P	PS/DVB		Strata™ SDB-L · Bond Elut® ENV, Bond Elut® LMS · DCS-PS/DVB, ENV PS-DVB · Bakerbond™ H ₂ O-phobic DVB · Isolute® 101	14
PS-RP	PS/DVB	removal of organic components	like HR-P	30
C18 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	15
C18 ec f	silica	as above, fast flow		15
C18	silica	octadecyl, not endcapped	Strata™ C18-U · Accubond® C18 · Bakerbond™ PolarPlus · Isolute® C18 · LiChrolut® RP-18	16
C18 f	silica	as above, fast flow		16
C18 PAH	silica	special octadecyl phase, for enrichment of PAHs from water	Bakerbond™ Octadecyl Lightload	34
C18 Hydra	silica	octadecyl, not endcapped, for polar analytes		17
C8	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)	18
C4	silica	butyl		19
C2	silica	dimethyl	Bond Elut® C2	19
C ₆ H ₁₁ ec	silica	cyclohexyl, endcapped		20
C ₆ H ₅	silica	phenyl	Strata™ PH · Bond Elut® PH · DSC-Ph · CLEAN-UP® Phenyl · Accubond® Phenyl · Bakerbond™ Phenyl · Isolute PH(EC)	20
Normal phases				
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	24
NH ₂	silica	aminopropyl	Strata™ NH ₂ · Sep-Pak® NH ₂ · Bond Elut NH ₂ · DSC-NH ₂ , LC-NH ₂ · CLEAN-UP® aminopropyl · Accubond® NH ₂ · Bakerbond™ amino · Isolute® NH ₂ · LiChrolut® NH ₂	22
DMA	silica	dimethylamino		23
OH	silica	diol	DSC-Diol, LC-Diol · Accubond® Diol (OH)	23
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	21
NO ₂	silica	nitrophenyl		21
Alox A	aluminium oxide	acidic	LC-Alumina-A · Accubond® aluminium oxide A	25
Alox N	aluminium oxide	neutral	LC-Alumina-N · Accubond® aluminium oxide N	25
Alox B	aluminium oxide	basic	LC-Alumina-B · Accubond® aluminium oxide B	25
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®	26
PA	polyamide 6		DPA-6S	26

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



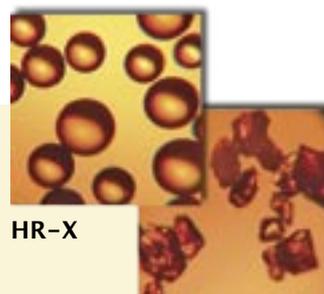
Code	Matrix	Modification / Application	Similar phases*	Page
Ion exchangers				
SB	silica	quaternary ammonium anion exchanger (SAX)	Strata™ SAX, Sep-Pak® SAX, Bond Elut® SAX · DSC-SAX, LC-SAX · CLEAN-UP® Quaternary Amine · Accubond® SAX · Bakerbond™ Quaternary Amine · Isolute® SAX · LiChrolut® SAX	29
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	28
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	27
PSA	silica	propylsulphonic acid cation exchanger		27
PS-OH ⁻	PS/DVB	strong anion exchanger in OH ⁻ form	Oasis® MAX	30
PS-H ⁺	PS/DVB	strong cation exchanger in H ⁺ form	Oasis® MCX · Strata™-X-C	30
PS-Ag ⁺	PS/DVB	strong cation exchanger in Ag ⁺ form		30
PS-Ba ²⁺	PS/DVB	strong cation exchanger in Ba ²⁺ form		30
Phases for special applications				
Dry	Na ₂ SO ₄	for drying organic samples		31
Drug	silica	bifunctional C8/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	31
Drug II	silica	bifunctional C8/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	32
Crosslinks	cellulose	for enrichment of collagen crosslinks		32
Tetracycline	silica	special octadecyl phase, for enrichment of tetracyclines		33
AOX	PS/DVB	for extraction of AOX from water (DIN 38409 - H22)		34
CN/SiOH	silica	combination phase for enrichment of PAHs from soil		35
NH ₂ /C18	silica	combination phase for enrichment of PAHs from water		35
Na ₂ SO ₄ /Florisil®		combination phase for extraction of hydrocarbons from water (DIN H-53 / ISO DIS 9377-4)		36
SA/SiOH	silica	combination phase for enrichment of PCB from waste oil		36
SiOH-H ⁺ /SA	silica	combination phase, used together with SiOH for enrichment of PCB from oil		37
NAN	silica / AgNO ₃ + Na ₂ SO ₄	combination phase for enrichment of PCB from sludge		38
ABC18	silica	octadecyl, with ion exchange functions, for acrylamide analysis		38
Diamino	silica	primary and secondary amine functions (PSA), for determination of pesticides in food samples (QuEChERS method)	Supelclean PSA, Bond Elut PSA	39
Flash chromatography				46
Phase separation		CHROMABOND® PTL/PTS		53
Liquid-liquid extraction		CHROMABOND® XTR		54
* phases which provide a similar selectivity based on chemical or physical properties (list not complete)				



NEW!

This innovative SPE phase offers

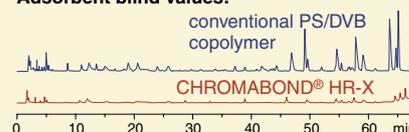
- ◆ **state-of-the-art spherical polymer**
 broad spectrum of application with special suitability for enrichment of pharmaceuticals from biological matrices
 ideal flow properties due to low content of particulate matter
- ◆ **optimised pore structure and high specific surface**
 high loadability and 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

Adsorbent blind values:



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 m²/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 applications:
 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
 Cat. No. 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® C₁₈ 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

Sulfonamides from serum

Column type:
 CHROMABOND® HR-X / 3 ml / 200 mg
 Cat. No. 730931
Sample: 2 µg/ml each in serum
Column conditioning: 5 ml methanol, 5 ml dist. water
Sample application: slowly aspirate 1 ml spiked serum through the column
Column washing: 5 ml water – methanol (95:5, v/v)
Elution: after drying 3 x 2 ml methanol

Further analysis: HPLC on NUCLEODUR® C₁₈ Gravity, 5 µm; see MN Appl. No. 117880

Recovery rate [%]

Compound	HR-X	Oasis® HLB	Strata™ X
Sulfanilamide	66	62	63
Sulfadiazine	107	101	108
Sulfamerazine	114	111	111
Sulfadimidine	94	86	89
Succinylsulfathiazole	70	43	48

MN Appl. No. 304220

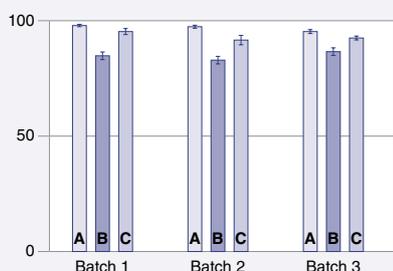


Highest reproducibility

- ✓ 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
Cat. No. 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 C₁₈ ec, see MN Appl. No. 117820

MN Appl. No. 304290

Standard protocol for method development with CHROMABOND® HR-X

Column type:
CHROMABOND® HR-X / 3 ml / 200 mg
Cat. No. 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
CHROMABOND® HR-X polypropylene columns							
	30 mg	60 mg	100 mg	200 mg	500 mg	1 g	
1 ml	730934		730935				30
3 ml		730936		730931	730937		30
6 ml				730938	730939		30
15 ml					730940	730941	20
CHROMABOND® HR-X polypropylene columns - BIGpacks							
				200 mg			
3 ml				730931.250			250
6 ml				730938.250			250
CHROMABOND® HR-X glass columns							
		60 mg		200 mg			
3 ml		730936 G					30
6 ml				730938 G			30
CHROMABOND® LV-HR-X							
	30 mg	60 mg		200 mg			
15 ml	732130	732131		732132			30
CHROMABOND® MULTI 96 HR-X							
	96 x 25 mg		96 x 50 mg		96 x 100 mg		
	738530.025M		738530.050M		738530.100M		1
CHROMABOND® HR-X adsorbent							
					730663		20 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 m²/g,
 - particle size 80 µm, pore size 50 Å,
 - pH stability 1 – 14
- due to bifunctional modification much more hydrophilic than conventional polystyrene–divinylbenzene polymers and thus easily wettable with water

- recommended applications:
 - 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

Due to the bifunctional modification CHROMABOND® Easy is considerably more hydrophilic than conventional polystyrene–divinylbenzene polymers and thus easily wettable with water.

The Easy effect:

aqueous samples can be loaded directly **without preconditioning!** This means that little or even no conditioning is needed, in contrast to standard SPE materials, where recovery rates normally decrease, in the worst case down to zero! Depending on the separation task conditioning may be required and is recommended for method development.

A positive side effect of the excellent wettability:

there is no decrease of recovery rates, if the cartridge runs dry, therefore automation is easier or, in some cases – compared to silica materials – only feasible with CHROMABOND® Easy, because a permanent vacuum can be used without supervision.

Further advantages of using a polymeric material:

- high surface, this means very high binding capacity (2 – 5 times higher than silica–based adsorbents)
- less adsorbent is needed in the cartridge (without losing sensitivity or recovery)
- faster analysis, because the height of the adsorbent bed can be reduced
- acidic or basic solvents (e.g. TFA) do not destroy the phase, or lead to unintended side products

Because of the polar modification the material is suitable for a broad range of compounds (acidic, neutral, basic, polar and nonpolar substances). Highly reproducible recovery rates can be obtained, even if the cartridge runs dry (especially advantageous when using 96–well plates, where stopcocks are not available!)

Comparison of recovery rates for CHROMABOND® Easy and other SPE phases

Compounds investigated: ciprofloxacin (1), doxepin (2), cinoxacin (3)

Column types: CHROMABOND® Easy, 500 mg, 3 ml, Cat. No. 730759,

Oasis®, CHROMABOND® HR-P, CHROMABOND® C18 ec

Column conditioning: a) 2 ml methanol, than 2 ml dist. water, b) no conditioning

Sample application: slowly force or aspirate the sample (100 – 200 µg/compound in 200 µl water) through the column

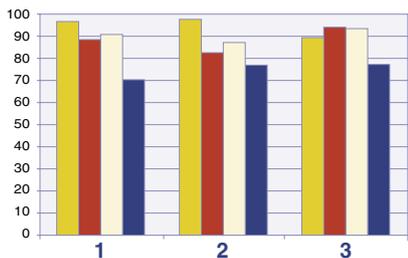
Column washing: 10 ml water; Elution: slowly aspirate 10 ml methanol – THF (1:1, v/v) through the column

a) Procedure with conditioning and equilibration

conditioning with methanol
equilibration with water

sample application

washing
elution



Easy, Oasis®, HR-P, C18 ec

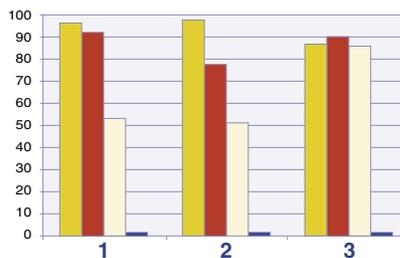
b) Procedure without conditioning and equilibration

~~conditioning with methanol
equilibration with water~~

sample application

let the cartridge run dry

washing
elution



Easy, Oasis®, HR-P, C18 ec, all faulty method

MN Appl. No. 302780



Recovery of pesticides

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

Column type:
CHROMABOND® Easy/ 3 ml / 200 mg
Cat. No. 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 C₁₈

Recovery rates:

Compound	Recovery	Compound	Recovery
Desisopropylatrazine	90.3 %	Metalaxyl	95.5 %
2,6-Dichlorobenzamide	93.1 %	Isoproturon	93.5 %
Desethylatrazine	92.7 %	Diuron	94.4 %
Hexazinone	69.3 %	Metazachlor	97.0 %
Terbacil	65.1 %	Propazine	94.6 %
Simazine	81.4 %	Terbutylazine	93.2 %
Cyanazine	92.8 %	Linuron	95.7 %
Desethylterbutylazine	90.6 %	Metolachlor	97.3 %
Methabenzthiazuron	93.7 %	Triallate	61.4 %
Chlortoluron	91.4 %	Standard	63.7 %
Atrazine	92.4 %		

MN Appl. No. 303220

Ordering information

Volume	Adsorbent weight						Pack of
CHROMABOND® Easy polypropylene columns							
	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
CHROMABOND® Easy polypropylene columns · BIGpacks							
				200 mg			
3 ml				730754.250			250
6 ml				730755.250			250
CHROMABOND® Easy glass columns							
		60 mg		200 mg			
3 ml		730753 G					30
6 ml				730755 G			30
CHROMABOND® LV-Easy							
				200 mg			
15 ml				732472			30
CHROMABOND® MULTI 96 Easy							
	96 x 25 mg		96 x 50 mg		96 x 100 mg		
	738520.025M		738520.050M		738520.100M		1
CHROMABOND® Easy adsorbent							
					730661		20 g

CHROMAFIX® cartridges on request



Polymer-based reversed phases for SPE

HR-P

polystyrene-divinylbenzene adsorbent resin

- highly porous polystyrene-divinylbenzene copolymer
- specific surface 1200 m²/g
- particle size 50 - 100 µm
- very high binding capacity, up to 30 % of adsorbent weight (for comparison: silica adsorbents about 3 %)

- recommended applications:
- 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
Cat. No. 730108

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

Column conditioning: 2 ml each of methanol, acetonitrile and 10⁻⁵ 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 under www.mn-net.com.

MN Appl. No. 301810

Ordering information

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



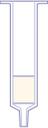
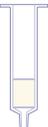
C18 ec / C18 ec f (f = fast flow)

- base material silica, pore size 60 Å, particle size 45 µm for **C18 ec**, 100 µm for **C18 ec f** (for fast flow), specific surface 500 m²/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 applications: 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
- C18 ec f** for viscous samples

Ordering information

	Volume	Adsorbent weight						Pack of	
	CHROMABOND® C18 ec polypropylene columns								
		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
	CHROMABOND® C18 ec polypropylene columns · BIGpacks								
				500 mg	1 g				
3 ml			730013.250					250	
6 ml			730014.250	730015.250				250	
CHROMABOND® C18 ec glass columns									
		200 mg	500 mg	1 g					
3 ml		730012 G	730013 G					50	
6 ml			730014 G	730015 G				30	
	CHROMABOND® LV-C18 ec								
			200 mg	500 mg					
	15 ml		732012	732013				30	
	CHROMAFIX® C18 ec cartridges								
	Size		S		M		L		
	Adsorbent weight Ø		270 mg		530 mg		950 mg		
			731804		731805		731806	50	
	CHROMABOND® MULTI 96 C18 ec								
			96 x 25 mg		96 x 50 mg		96 x 100 mg		
			738011.025M		738011.050M		738011.100M	1	
	CHROMABOND® C18 ec adsorbent								
							730611	100 g	
	CHROMABOND® C18 ec f polypropylene columns (fast flow)								
			200 mg	500 mg	1 g				
	3 ml		730269	730018				50	
	6 ml			730016	730010			30	
	CHROMABOND® C18 ec f adsorbent (fast flow)								
							730613	100 g	



Silica-based reversed phases for SPE

C18 / C18 f (f = fast flow)

octadecyl silica

- base material silica, pore size 60 Å, particle size 45 µm for C18, 100 µm for C18 f (for fast flow), specific surface 500 m²/g, pH stability 2 – 8
- octadecyl phases, not endcapped, carbon content 14 %
- similar to C18 ec, however possesses more free silanols (SiOH), which allow secondary interactions with polar groups of the analytes

- recommended applications:
 - nonpolar compounds
 - pesticides
- C18 f for viscous samples

Ordering information

Volume	Adsorbent weight							Pack of	
	100 mg	200 mg	500 mg	1 g	2 g	5 g	10 g		
CHROMABOND® C18 polypropylene columns									
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	
CHROMABOND® C18 polypropylene columns · BIGpacks									
			500 mg	1 g					
3 ml			730003.250					250	
6 ml			730004.250	730005.250				250	
CHROMABOND® C18 glass columns									
			500 mg	1 g					
3 ml			730003 G					50	
6 ml			730004 G	730005 G				30	
CHROMABOND® LV-C18									
		200 mg							
15 ml		732002						30	
CHROMAFIX® C18 cartridges									
Size	S		M		L				
Adsorbent weight Ø	270 mg		530 mg		950 mg				
	731801		731802		731803			50	
CHROMABOND® MULTI 96 C18									
	96 x 25 mg				96 x 100 mg				
	738001.025M				738001.100M				1
CHROMABOND® C18 adsorbent									
						730602		100 g	
CHROMABOND® C18 f polypropylene columns (fast flow)									
		200 mg	500 mg	1 g					
3 ml		730402	730008					50	
6 ml			730403	730009				30	
CHROMABOND® C18 f adsorbent (fast flow)									
						730612		100 g	



C18 Hydra

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- special octadecyl phase for polar analytes, not end-capped, carbon content 15 %

octadecyl silica for polar analytes

- recommended applications: 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® C18 Hydra / 6 ml / 2 g

Cat. No. 730301

Sample pretreatment: adjust 1000 ml water to pH 7 – 8 with diluted NH₃ 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 N₂.

MN Appl. No. 302060

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. Cat. No. 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 C₁₈ (application 110880)

Ordering information

	Volume	Adsorbent weight						Pack of	
	CHROMABOND® C18 Hydra polypropylene columns								
		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
	CHROMABOND® C18 Hydra glass columns								
			200 mg	500 mg	1 g				
	3 ml		730296 G	730297 G	730298 G				50
	6 ml			730299 G	730300 G				30
	CHROMABOND® LV-C18 Hydra								
	15 ml		200 mg						30
	CHROMAFIX® C18 Hydra cartridges								
	Size		S		M		L		
	Adsorbent weight Ø		270 mg		530 mg		950 mg		
			731730		731731		731732		50
	CHROMABOND® MULTI 96 C18 Hydra								
							96 x 100 mg		
							738294.100M		1
	CHROMABOND® C18 Hydra adsorbent								
							730628		100 g



Silica-based reversed phases for SPE

C8

octyl silica

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- octyl phase, not endcapped, carbon content 8 %
- similar to C18, however slightly more polar
- secondary interactions with polar compounds are more pronounced due to shorter alkyl chains

- recommended applications: pesticides, PCB

Ordering information

Volume	Adsorbent weight				Pack of
CHROMABOND® C8 polypropylene columns					
	100 mg	200 mg	500 mg	1 g	
1 ml	730021				100
3 ml		730022	730023		50
6 ml			730024	730134	30
CHROMABOND® C8 glass columns					
			500 mg		
6 ml			730024 G		30
CHROMABOND® LV-C8					
			500 mg		
15 ml			732023		30
CHROMAFIX® C8 cartridges					
	Size		M		
	Adsorbent weight Ø		520 mg		
			731808		50
CHROMABOND® MULTI 96 C8					
			96 x 100 mg		
			738021.100M		1
CHROMABOND® C8 adsorbent					
			730601		100 g



C4

butyl silica

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- butyl phase, not endcapped, carbon content 7 %
- slightly more polar than C18 or C8, due to shorter alkyl chains the silica surface is not completely shielded

- recommended applications: compounds, which are too strongly retained on C18 or C8 e.g. analgetics from blood

Ordering information

	Volume	Adsorbent weight		Pack of
	CHROMABOND® C4 polypropylene columns			
		100 mg	500 mg	
	1 ml 3 ml	730225	730227	100 50
	CHROMAFIX® C4 cartridges			
	Size	S	M	
	Adsorbent weight Ø	220 mg	440 mg	
		731740	731741	50
	CHROMABOND® C4 adsorbent			
			730651	100 g

Glass columns, LV columns and MULTI 96 on request

C2

dimethyl silica

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- dimethyl phase, not endcapped, carbon content 4 %
- similar to C4

- recommended applications: e.g. antiepileptics from plasma

Ordering information

	Volume	Adsorbent weight		Pack of
	CHROMABOND® C2 polypropylene columns			
		100 mg	500 mg	1 g
	1 ml 3 ml 6 ml	730169	730221 730409	730410
				100 50 30
	CHROMABOND® C2 adsorbent			
			730652	100 g

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



Silica-based reversed phases for SPE

C₆H₁₁ ec

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- cyclohexyl phase, endcapped, carbon content 9%
- alternative phase for the mid-polar range

cyclohexyl silica, endcapped

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

Comparison of different phases for phenol analysis

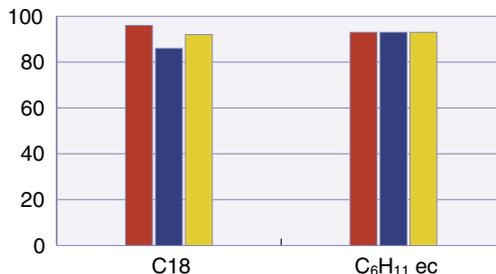
Compounds investigated: phenol, 2,4-dinitrophenol, pentachlorophenol

Column types:
CHROMABOND® C18 / 6 ml / 2000 mg, Cat. No.730130
CHROMABOND® C₆H₁₁ ec / 6 ml / 2000 mg, Cat. No.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
CHROMABOND® C₆H₁₁ ec polypropylene columns			
	500 mg	1 g	
3 ml	730442		50
6 ml	730443	730444	30
CHROMABOND® C₆H₁₁ ec adsorbent			
		730631	100 g

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

C₆H₅

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- phenyl phase, carbon content 8%
- polarity similar to C8
- in addition to hydrophobic interactions more selective adsorption is possible by π-π interactions due to the electron density of the phenyl ring

phenyl silica

- recommended applications:
 - aflatoxins
 - caffeine
 - phenols

Flavour compounds from brandy

Compounds investigated: asarone, quinine, coumarin, quassin

Column type:
CHROMABOND® Phenyl / 6 ml / 1000 mg
Cat. No. 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:

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

MN Appl. No. 300170



Ordering information

Volume	Adsorbent weight			Pack of
CHROMABOND® C₆H₅ polypropylene columns				
	100 mg	200 mg	500 mg	
1 ml	730083			100
3 ml		730411	730084	50
CHROMABOND® C₆H₅ adsorbent				
			730606	100 g

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

NO₂

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
nitrophenyl phase, carbon content 5.5 %

nitrophenyl silica

recommended applications:
aromatics

Ordering information

Volume	Adsorbent weight			Pack of
CHROMABOND® NO₂ polypropylene columns				
			500 mg	
3 ml			730143	50
CHROMABOND® NO₂ adsorbent				
			730614	100 g

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

CN

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/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 applications:
cyclosporins
carbohydrates

Ordering information

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

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



Silica-based normal phases for SPE

NH₂

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- aminopropyl phase, carbon content 3.5 %
- polar, weak anion exchanger

aminopropyl silica

- recommended applications:
trace elements
lipids

Metals: trace elements from water

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

Column type:

CHROMABOND® NH₂ / 3 ml / 500 mg

Cat. No. 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

Solid Phase Extraction

Ordering information

Volume	Adsorbent weight				Pack of
CHROMABOND® NH₂ polypropylene columns					
	100 mg	200 mg	500 mg	1 g	
1 ml	730031				100
3 ml		730413	730033		50
6 ml			730180	730626	30
CHROMABOND® NH₂ polypropylene columns · BIGpacks					
			500 mg		
3 ml			730033.250		250
CHROMABOND® NH₂ glass columns					
			500 mg	1000 mg	
3 ml			730033 G		50
6 ml			730180 G	730626 G	30
CHROMABOND® LV-NH₂					
			500 mg		
15 ml			732033		30
CHROMAFIX® NH₂ cartridges					
	Size		S		
	Adsorbent weight Ø		220 mg		
			731813		50
CHROMABOND® MULTI 96 NH₂					
				96 x 100 mg	
				738031.100M	1
CHROMABOND® NH₂ adsorbent					
				730603	100 g



DMA

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- dimethylaminopropyl phase, carbon content 3.5 %
- polar, weak anion exchanger

dimethylaminopropyl silica

- recommended applications: similar to NH₂ – slightly weaker anion exchanger

Ordering information

	Volume	Adsorbent weight		Pack of
	CHROMABOND® DMA polypropylene columns			
		100 mg	500 mg	
	1 ml 3 ml	730041	730043	100 50

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 m²/g, pH stability 2 – 8
- diol phase, carbon content 5.5 %
- polar
- properties similar to SiOH

diol silica

- recommended applications: antibiotics, prostaglandins

Ordering information

	Volume	Adsorbent weight			Pack of
	CHROMABOND® OH polypropylene columns				
		100 mg	200 mg	500 mg	
	1 ml 3 ml 6 ml	730051	730417	730053 730418	100 50 30
	CHROMABOND® OH glass columns				
	3 ml		500 mg		
			730053 G		50
	CHROMABOND® LV-OH				
	15 ml		500 mg	732053	30
	CHROMABOND® MULTI 96 OH				
			96 x 100 mg	738051.100M	1
	CHROMABOND® OH adsorbent				
			730605		100 g

CHROMAFIX® cartridges on request



Silica-based normal phases for SPE

Solid Phase Extraction

SiOH

unmodified silica

- ◆ unmodified, weakly acidic silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/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

- ◆ recommended applications:
 aflatoxins
 chloramphenicol
 pesticides
 steroids
 vitamins

Ordering information

Volume	Adsorbent weight							Pack of	
CHROMABOND® SiOH polypropylene columns									
	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
CHROMABOND® SiOH polypropylene columns · BIGpacks									
		500 mg	1 g	2 g					
3 ml		730073.250							250
6 ml			730075.250	730107.250					250
CHROMABOND® SiOH glass columns									
		200 mg	500 mg	1 g	2 g				
3 ml		730214 G	730073 G						50
6 ml			730070 G	730075 G	730107 G				30
CHROMABOND® LV-SiOH									
		200 mg	500 mg						
15 ml		732072	732073						30
CHROMAFIX® SiOH cartridges									
Size		S		M		L			
Adsorb. weight ∅		230 mg		420 mg		880 mg			
		731828		731829		731830			50
CHROMABOND® MULTI 96 SiOH									
						96 x 100 mg			
						738071.100M			1
CHROMABOND® SiOH adsorbent									
						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 m²/g

recommended applications:
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	
CHROMABOND® Alox polypropylene columns						
			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	
CHROMABOND® Alox glass columns						
		1 g				
Alox N	6 ml		730139 G		30	
Alox B	6 ml		730020 G		30	
CHROMABOND® LV-Alox						
		1 g				
Alox A	15 ml		732210		30	
Alox N	15 ml		732091		30	
Alox B	15 ml		732205		30	
CHROMAFIX® Alox cartridges						
		Size	M	L		
		Adsorb. weight Ø	850 mg	1700 mg		
Alox N			731844	731845	50	
CHROMABOND® MULTI 96 Alox						
		96 x 100 mg				
Alox A			738253.100M		1	
Alox N			738251.100M		1	
Alox B			738252.100M		1	
CHROMABOND® Alox adsorbents						
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 applications:
organic tin compounds,
aliphatic carboxylic acids,
PCBs, PAHs

Ordering information

Volume	Adsorbent weight			Pack of
CHROMABOND® Florisil® polypropylene columns				
	200 mg	500 mg	1 g	
3 ml	730457	730081		50
6 ml		730238	730082	30
CHROMABOND® Florisil® polypropylene columns · BIGpack				
			1 g	
6 ml			730082.250	250
CHROMABOND® Florisil® glass columns				
			1 g	
6 ml			730082 G	30
CHROMAFIX® Florisil® cartridges				
Size			L	
Adsorbent weight Ø			990 mg	
			731848	50
CHROMABOND® Florisil® adsorbent				
			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 applications:
flavonoids, PAHs

Ordering information

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

Glass columns, LV columns and MULTI 96 on request



PCA propylcarboxylic acid cation exchanger based on silica (WCX)

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
 propylcarboxylic acid modified silica
 weakly acidic cation exchanger (WCX)

recommended applications:
 strong cations

Ordering information

	Volume	Adsorbent weight		Pack of
	CHROMABOND® PCA polypropylene columns			
		500 mg	1 g	
	3 ml	730482		50
	6 ml	730483	730484	30
	CHROMABOND® LV-PCA			
	15 ml	500 mg		30
	CHROMABOND® PCA adsorbent			
			730629	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 m²/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 applications:
 weak cations

Ordering information

	Volume	Adsorbent weight		Pack of
	CHROMABOND® PSA polypropylene columns			
		100 mg	500 mg	1 g
	1 ml	730460		100
	3 ml		730462	50
	6 ml		730464	30
	CHROMABOND® PSA adsorbent			
			730630	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 m²/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 applications:
 amino acids
 amines
 chlorophyll
 PCB

Sulfonamides in meat and kidney

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

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

Column type:

CHROMABOND® SA (= SCX) / 3 ml / 500 mg
 Cat. No. 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 NH₃ 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	
CHROMABOND® SA polypropylene columns					
	100 mg	200 mg	500 mg	1 g	
1 ml	730076				100
3 ml		730275	730077		50
6 ml			730425	730212	30
CHROMABOND® SA polypropylene columns · BIGpack					
			500 mg		
3 ml			730077.250		250
CHROMABOND® LV-SA					
			500 mg		
15 ml			732083		30
CHROMAFIX® SA cartridges					
Size	S	M	L		
Adsorbent weight Ø	220 mg	450 mg	920 mg		
	731831	731832	731833		50
CHROMABOND® MULTI 96 SA					
			96 x 100 mg		
			738141.100M		1
CHROMABOND® SA adsorbent					
			730609		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 m²/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 applications:
 - organic acids
 - caffeine
 - saccharin

Vitamins: folic acid from food

Column type:
 CHROMABOND® SB (= SAX) / 3 ml / 500 mg
 Cat. No. 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	
	CHROMABOND® SB polypropylene columns					
		100 mg	200 mg	500 mg	1 g	
	1 ml	730078			100	
	3 ml	730322			50	
	6 ml	730426			30	
	CHROMABOND® SB polypropylene columns · BIGpack					
	3 ml	500 mg			730079.250	250
	CHROMABOND® LV-SB					
	15 ml	500 mg			732088	30
	CHROMAFIX® SB cartridges					
	Size	S	M	L		
	Adsorbent weight Ø	230 mg	460 mg	920 mg		
		731834	731835	731836	50	
	CHROMABOND® MULTI 96 SB					
					96 x 100 mg	
					738101.100M	1
	CHROMABOND® SB adsorbent					
					730610	100 g

Glass columns on request



Polymer-based ion exchangers for SPE

PS-RP / PS-OH⁻ / PS-H⁺ / PS-Mix PS-Ag⁺ / PS-Ba²⁺

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 applications:
 - 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 ⁻	strong PS/DVB anion exchanger, OH ⁻ form capacity 0.6 meq/g	removal or concentration of anions from water increasing the pH value in acidic samples
PS-H ⁺	strong PS/DVB cation exchanger, H ⁺ 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 ⁻ and PS-H ⁺	desalting of water
PS-Ag ⁺	strong PS/DVB cation exchanger, Ag ⁺ form	removal of halide ions from water
PS-Ba ²⁺	strong PS/DVB cation exchanger, Ba ²⁺ 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

Samples: 20 ppm nitrate besides 2500 ppm chloride or 500 ppm bromide, respectively

Sample preparation: SPE

Column type:
CHROMAFIX® PS-Ag⁺ (M)
0.8 ml / Ø 480 mg, Cat. No. 731865
Column conditioning: 1 ml dist. water

Sample application and elution:

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

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)

Ordering information

Phase	Adsorbent weight				Pack of		
CHROMABOND® PS polypropylene columns							
	3 ml / 200 mg	3 ml / 500 mg	6 ml / 500 mg	6 ml / 900 mg			
PS-RP	730765	730692	730693		30		
PS-OH ⁻	730396	730344.30	730378		30		
PS-H ⁺	730690	730376.30	730377		30		
PS-Mix				730310	30		
CHROMAFIX® PS cartridges							
	Size S	Adsorbent weight Ø	Size M	Adsorbent weight Ø	Size L	Adsorbent weight Ø	
PS-RP	731877	200 mg	731875	320 mg			50
PS-OH ⁻	731868	200 mg	731860	380 mg	731862	800 mg	50
PS-H ⁺	731867	230 mg	731861	430 mg	731863	900 mg	50
PS-Ag ⁺	731866	240 mg	731865	480 mg			50
PS-Ba ²⁺	731871	280 mg	731870	550 mg			50



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
	CHROMAFIX® Dry cartridges				
	Size	S	M	L	
	Adsorbent weight Ø	780 mg	1500 mg	2800 mg	
		731852	731853	731854	50

Drug

special silica phase for drug analysis

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
special bifunctional modification – C8 / SA (strong cation exchanger – benzenesulphonic acid)

recommended applications:
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

Cat. No. 730168

Sample pretreatment: 0.1 ml blood serum are mixed with 1.4 ml of a 0.1 mol KH₂PO₄ buffer (pH 6) and centrifuged

Column conditioning:

2 ml methanol, then 2 ml 0.1 mol KH₂PO₄ buffer (pH 6)

Sample application: slowly force or aspirate the supernatant from the sample pretreatment through the column

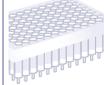
Column washing: 2 ml 0.1 mol KH₂PO₄ buffer (pH 6), then 1 ml 0.1 mol acetic acid, then 2 ml methanol; finally dry the column first by centrifugation (2 min, 4000 U/min), then under vacuum for 10 min

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

Further analysis: HPLC with NUCLEOSIL® 100-5 C₁₈ 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, (Cat. No. 726220.30)

MN Appl. No. 302020

Ordering information

		Adsorbent weight			Pack of
	CHROMABOND® Drug polypropylene columns				
		100 mg	200 mg	500 mg	
	1 ml	730681	730168	730684	100
	3 ml			730682	50
	6 ml			730682	30
CHROMABOND® Drug polypropylene columns · BIGpack					
		200 mg			
	1 ml	730168.250			250
	CHROMABOND® LV-Drug				
			200 mg		
	15 ml		732168		30
	CHROMABOND® MULTI 96 Drug				
			96 x 100 mg		
			738161.100M		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 m²/g, pH stability 2–8
 special bifunctional modification – C8 / SB (strong anion exchanger – quaternary amine –NR₃⁺)
 two primary retention mechanisms facilitate use of very strong interferant-eluting solvents, resulting in very pure extracts
- ◆ recommended applications:
 extraction of THC and derivatives from urine, blood, serum, plasma
 acidic analytes from biological fluids

11-nor-Δ⁹-THC-carboxylic acid from urine

Compounds investigated:

tetrahydrocannabinol, 11-nor-Δ⁹-THC-carboxylic acid

Column type:

CHROMABOND® Drug II / 3 ml / 200 mg
 Cat. No. 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 (Cat. No. 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
	CHROMABOND® Drug II polypropylene columns				
		100 mg	200 mg	500 mg	
	1 ml	730685			100
	3 ml	730680	730686	730683	50
	6 ml				30
	CHROMABOND® LV-Drug II				
	15 ml	200 mg	732681		30
	CHROMABOND® MULTI 96 Drug II				
		96 x 100 mg	738680.100M		1

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
 Cat. No. 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
CHROMABOND® Crosslinks polypropylene columns		
	300 mg	
3 ml	730458	50
Product for research purposes only (see page 263)		

Tetracycline

special phase for enrichment of tetracyclines

silica phase with special C18 modification, tested for tetracyclines
 constant recovery rates for the title compounds (every batch individually tested)

recommended applications:
 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
 Cat. No. 730315

Sample pretreatment: weigh 10 g of a cut-up sample in a centrifuge glass and add 93 g succinate buffer pH 4 (5.0 g succinic acid anhydride in 1 l dist. water, pH adjusted with 1 M NaOH). Mix intensively (Ultra-Turrax, 2 min), homogenise in an ultrasonic bath (3 min), and centrifuge 15 min at 5000 g. Aspirate 50 ml of the supernatant through a Cu-loaded chelating sepharose column. Wash the column with 10 ml dist. water, 30 ml methanol and 2 x 10 ml dist. water, finally elute (4 ml/min) with 50 ml EDTA - succinate buffer (37.2 g Titriplex III · H₂O in 1 l succinate buffer).

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

Column washing:

2 ml dist. water (removal of Cu ions), 1 ml *n*-hexane

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 · H₂O, 44.5 g Na₂HPO₄ · H₂O 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 C₁₈ HD, Cat. No. 721850.40 (application 110710)

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

MN Appl. No. 302030

Ordering information

Volume	Adsorbent weight	Pack of
CHROMABOND® Tetracycline polypropylene columns		
	500 mg	
6 ml	730315	30
Product for research purposes only (see page 263)		



SPE phases for environmental analysis

AOX

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

special PS/DVB phase

recommended application:
extraction of AOX 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
Cat. No. 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), don't let the column run dry; discard the flow-through

Column washing: 50 ml nitrate rinsing solution (dissolve 17 g NaNO₃ in 100 ml dist. water, add 1.4 ml HNO₃ 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
	CHROMABOND® AOX polypropylene columns		
	6 ml	200 mg 730119.AOX	500 mg 730111.AOX 30

C18 PAH

octadecyl silica for PAH analysis

base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
special octadecyl modification for enrichment of PAH, not endcapped, carbon content 14 %

recommended applications:
PAHs from water

PAHs from water

Column type:
CHROMABOND® C18 PAH / 6 ml / 2 g
Cat. No. 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 P₂O₅)

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 %, Dibenzo[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
	CHROMABOND® C18 PAH polypropylene columns		
	6 ml	2 g 730166	30
	CHROMABOND® C18 PAH glass columns		
	6 ml	730166 G	30
	CHROMABOND® C18 PAH adsorbent		100 g



CN/SiOH

combination phase for PAH analysis

- ◆ special combination phase
- cyanopropyl phase for selective adsorption of polycyclic aromatics via π - π 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
Cat. No. 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

MN Appl. No. 301310

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 C₁₈ PAH, Cat. No. 720117.30

For recovery rates see application 301310 at www.mn-net.com

Ordering information

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

NH₂/C18

combination phase for PAH analysis

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

- ◆ recommended application: PAHs from water containing humic acids

PAHs from water containing humic acids

Column type:
CHROMABOND® NH₂/C18, 6 ml, 500 mg/1 g glass column
Cat. No. 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 CH₂Cl₂ (let percolate first 0.5 ml into the column packing without vacuum, then apply light vacuum), if necessary evaporate in a stream of N₂ and fill up with a suitable solvent

MN Appl. No. 301260

Ordering information

Volume	Adsorbent weight	Pack of
CHROMABOND® NH₂/C18 polypropylene columns		
	500/500 mg	500 mg/1 g
6 ml	730618	730620
		30
CHROMABOND® NH₂/C18 glass columns		
6 ml	730618 G	730620 G
		30



SPE phases for environmental analysis

Na₂SO₄ / 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® Na₂SO₄/Florisil®, 2000/2000 mg,
6 ml glass column,
Cat. No. 730249 G

Internal standard solution: dissolve 20 mg *n*-tetracontane (C₄₀H₈₂) in petroleum ether, add 20 ml *n*-decane (C₁₀H₂₂) 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 MgSO₄. Add 50 ml of the extraction solution, close the bottle 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 solution 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
CHROMABOND® Na₂SO₄ / Florisil® polypropylene columns		
6 ml	2 g/2 g 730249	30
CHROMABOND® Na₂SO₄ / Florisil® glass columns		
6 ml	2 g/2 g 730249 G	30
CHROMABOND® Na₂SO₄ / Florisil® glass columns · BIGpack		
6 ml	2 g/2 g 730249.250	250

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
Cat. No. 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
CHROMABOND® SA/SiOH polypropylene columns		
	500/500 mg	
3 ml	730132	50
CHROMABOND® SA/SiOH polypropylene columns · BIGpack		
	500/500 mg	
3 ml	730132.250	250

SiOH-H⁺ /SA

combination phase for PCB analysis

◆ special combination phase

SiOH-H⁺: H₂SO₄-impregnated silica phase for oxidation of accompanying compounds to ionic and/or polar compounds

SA: strongly acidic cation exchanger based on silica with benzene-sulphonic 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-H₂SO₄/SA 3 ml, 500/500 mg and
CHROMABOND® SiOH / 3 ml / 500 mg
Cat. Nos. 730085 and 730073
or Kombi-Kit PCB, Cat. No. 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-H₂SO₄/SA column

MN Appl. No. 301380

Sample application: aspirate or force 500 µl sample through the CHROMABOND® SiOH-H₂SO₄/SA column. This phase offers better removal of interfering substances due to sulphonation. Place CHROMABOND® SiOH-H₂SO₄/SA column on top of the SiOH columns with the aid of an adaptor and after at least 30 sec 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 %

Ordering information

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



SPE phases for environmental and food analysis

NAN

special phase for PCB analysis

special combination phase:

N: sodium sulphate for removal of trace water; **A:** SiOH/AgNO₃ 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
Cat. No. 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
	CHROMABOND® NAN polypropylene columns		
		400/1400/400 mg	700/2000/700 mg
	3 ml 6 ml	730109	730149
			50 30
	CHROMABOND® NAN polypropylene columns - BIGpack		
		400/1400/400 mg	700/2000/700 mg
	6 ml	730149.250	
			250
	CHROMABOND® NAN glass columns		
		400/1400/400 mg	700/2000/700 mg
	6 ml	730149 G	
			30
	CHROMABOND® NAN adsorbent		
		730619	100 g

ABC18

special phase for analysis of acrylamide in food

octadecyl silica phase with ion exchange functions for acrylamide analysis

recommended applications:

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

Important note:

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.

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.

Ordering information

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



Diamino

NEW!

special silica phase for determination of pesticides in food samples

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/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 (**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 MgSO₄ and 1 g NaCl and afterwards centrifuged.
1 ml of the supernatant is spiked with 25 mg CHROMABOND® Diamino and 150 mg MgSO₄ 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 buffer** and **extraction** mixtures, specially composed for different sample matrices.

Procedure 1 for standard food samples:

The sample is extracted with **Mix II**, then purified with **Mix III** or **Mix IV** (food with higher fat content)

Procedure 2 for complex or rich food samples:

The sample is extracted with **Mix I**, then purified with

- Mix III** (samples with low fat content),
- Mix IV** (moderate content of chlorophyll and carotenoids; e.g. carrots, lettuce),
- Mix V** (high content of chlorophyll and carotenoids; e.g. bell peppers, spinach) or
- Mix VI** (higher fat content; e.g. avocados)

For detailed instructions please visit www.mn-net.com or the original references at www.quechers.com.

Ordering information

	Volume	Description	Composition	Cat. No.	Pack of	
	CHROMABOND® QuEChERS extraction buffer mixes					
	15 ml*	Mix I	citrate extraction mix	4 g MgSO ₄ , 1 g NaCl, 0.5 g Na ₂ H citrate · 1.5 H ₂ O, 1 g Na ₃ citrate · 2 H ₂ O	730970	50
	15 ml*	Mix II	acetate extraction mix	6 g MgSO ₄ , 1.5 g Na acetate	730971	50
	CHROMABOND® QuEChERS clean-up mixes containing 0.15 g CHROMABOND® Diamino each					
	15 ml*	Mix III	Diamino clean-up mix	with 0.9 g MgSO ₄	730972	50
	15 ml*	Mix IV	Diamino/Carbon clean-up mix	with 0.9 g MgSO ₄ and 0.015 g Carbon	730973	50
	15 ml*	Mix V	Diamino/Carbon clean-up mix	with 0.9 g MgSO ₄ and 0.045 g Carbon	730975	50
	15 ml*	Mix VI	Diamino/C18 ec clean-up mix	with 0.9 g MgSO ₄ and 0.15 g C18 ec	730974	50
	CHROMABOND® Diamino polypropylene columns					
	3 ml	adsorbent weight 200 mg		730561	50	
	6 ml	adsorbent weight 500 mg		730562	30	
	CHROMABOND® Diamino adsorbent					
				730653.20	20 g	
				730653	100 g	
	CHROMABOND® QuEChERS accessories					
		50 ml polypropylene centrifuge tube with screw cap		730223	50	

* 15 ml centrifuge tubes with screw cap



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 replaceable valves for vacuum control of individual SPE columns
- 5 variable rack with exchangeable partitions, which accept a wide variety of vessels like test tubes, measuring flasks, scintillation vials, autosampler vials, plastic vials etc.
- 6 control valve for adjustment of vacuum
- 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

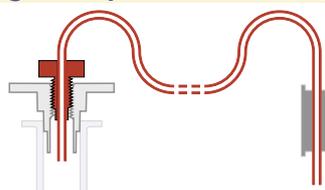
Ordering information

Description	Pack of	Cat. No.
Vacuum manifold complete		
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	1	730150
for up to 16 LV columns	1	730360
for up to 24 columns or cartridges	1	730151
Glass cabinets without accessories (1)		
for 12 columns	1	730173
for 16 LV or 24 columns	1	730174
Lids with gaskets (2)		
for 12 columns (including Luer fittings and valves (4))	1	730175
for 16 LV columns (including Luer fittings and valves (4))	1	730365
for 24 columns (including Luer fittings and valves (4))	1	730176
Gaskets for lid, for 12 columns	2	730177
Gaskets for lid, for 24 columns	2	730178



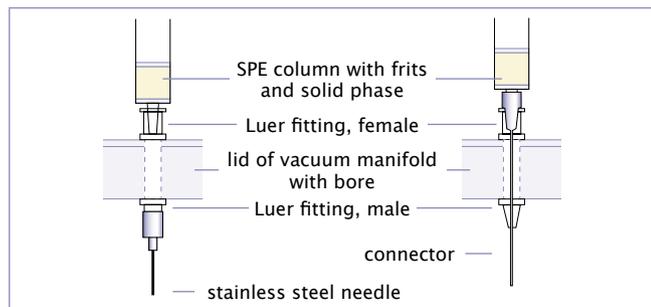
Ordering information

Description	Pack of	Cat. No.
General accessories for vacuum manifolds		
Luer stoppers for vacuum manifold, blue	12	730194
Luer fitting for lid, female	1	730183
Luer fittings as above	12	730183.12
Luer fitting for lid, male	1	730184
Luer fittings as above	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- of 24-position manifold)	2	730233
Vacuum gauge, complete with accessories	1	730179
Drying attachment		
for evaporation of eluates		
Drying attachment, for 12 columns	1	730187
Drying attachment, for 24 columns	1	730188
Collecting rack for 12 columns	1	730157
Collecting rack for 16 LV columns	1	730366
Collecting rack for 24 columns	1	730153
Products for protection from cross contamination		
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
Tubing adaptors for application of large sample volumes (10)		
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 (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	Cat. No.
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 (1, 3 and 6 ml)	1	730104
Adaptors as above	10	730105
Adaptor (PP) for polypropylene columns (1, 3 and 6 ml)	1	730100
Adaptors as above	10	730101
Adaptor (PE) for polypropylene columns (15, 45, 70 ml)	1	730350
Adaptors as above	10	730385
Adaptor (PE) for polypropylene columns (30 and 70 ml)	1	730566
Reservoir columns for application of medium-size samples		
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 particle sizes and modifications:

- ◆ special SPE columns already equipped with special caps and needles to be used in the SPE unit of the **Gerstel MultiPurposeSampler (MPS)**
- ◆ 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.



SPE cartridges for Gerstel MPS system



Gerstel MPS system

Ordering information for Gilson ASPEC™ columns

Column size	Weight [g]	Pack of [columns]	Cat. No.
CHROMABOND® SiOH			
1 ml	0.1	100	730071ASP
3 ml	0.5	100	730073ASP
6 ml	1	100	730075ASP
CHROMABOND® C18 ec			
1 ml	0.1	100	730011ASP
3 ml	0.5	100	730013ASP
6 ml	1	100	730015ASP



Columns for the Gilson ASPEC™



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
- 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

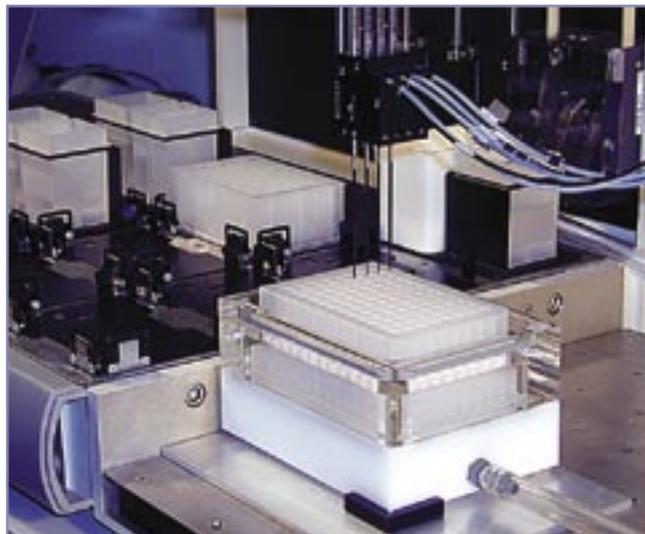
Advantages of this high-throughput system:

- 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 ($\leq 40 \mu\text{l}$)

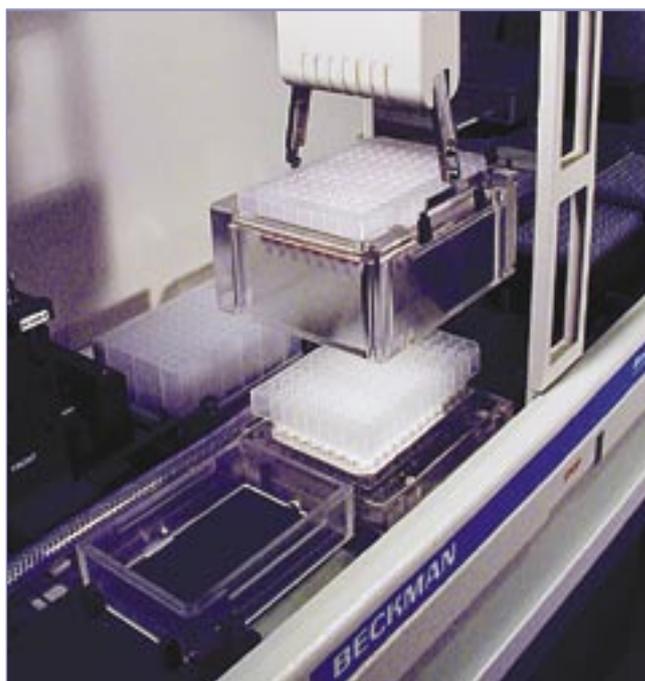
Instrument compatibility

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

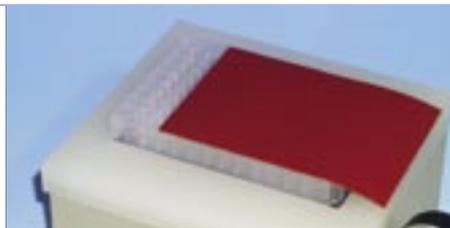
CHROMABOND® MULTI 96 is designed for use in common robotic workstations or commercially available liquid handling systems. Alternatively, use of multi-channel pipettors facilitates a manual liquid transfer. Extraction is carried out using the CHROMABOND® MULTI 96 vacuum manifold. With the help of the 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	Cat. No.
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	1	738650
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 (Cat. No. 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 63. The ordering information of 96-well plates packed with individual CHROMABOND® adsorbents is listed with the respective phases.



Packings for 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 35, e.g. C18, C8, OH, Alox etc. as listed on page 8 - 9)

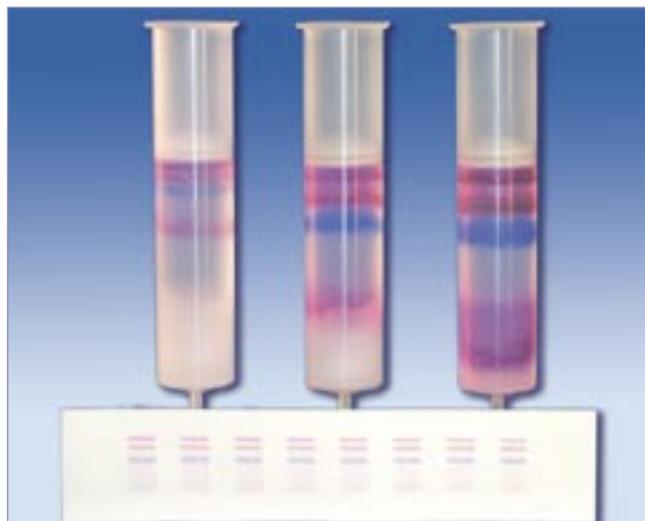
Additionally you can choose from our range of POLYGOPREP silica packings in particle sizes from 12 to 130 µm and pore sizes from 60 to 4000 Å (see page 162 - 163).

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 > 12 µm as listed on page 157)

For corresponding offers please contact your local MN distributor.

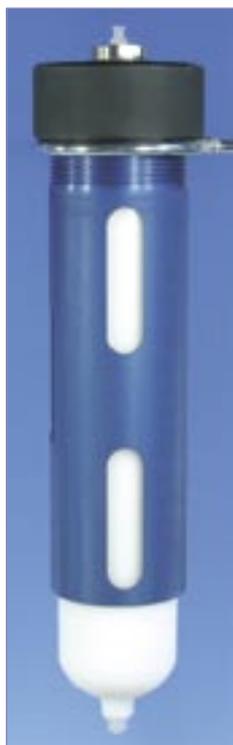
TLC is often used for the development of a selective and reproducible method in Flash chromatography, because it is often necessary to test a large number of eluent and/or adsorbent combinations.

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.



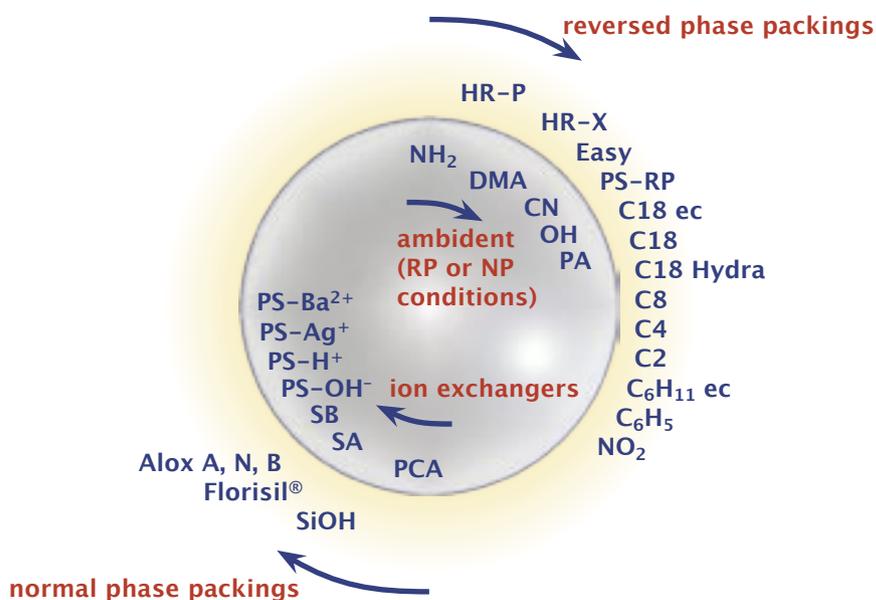
Transformation from a TLC separation to Flash columns

Flash Chromatography



Flash holder 750 with cartridge (65 mm ID)

Summary of possible phases and modifications





MN Flash Safety System

the challenge:

- 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

our solution:

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

connecting accessories available

meeting today's customers' demands



holders with cartridges
(40 mm ID)



holder with cartridge
(65 mm ID)

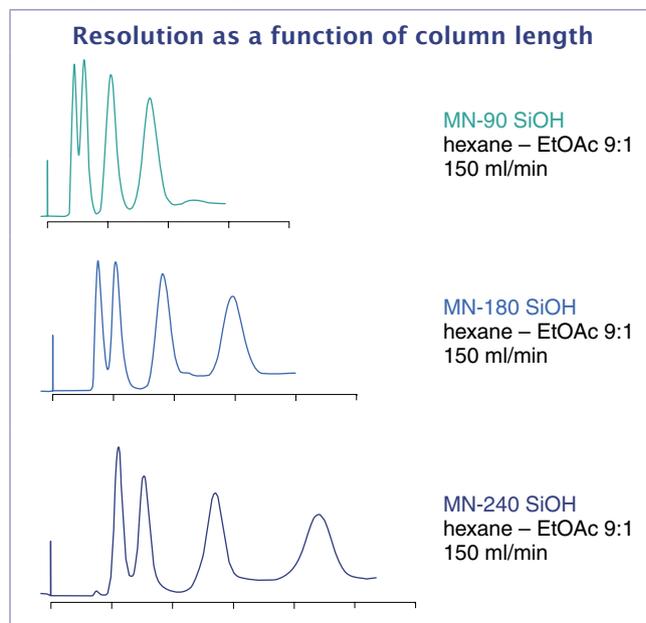
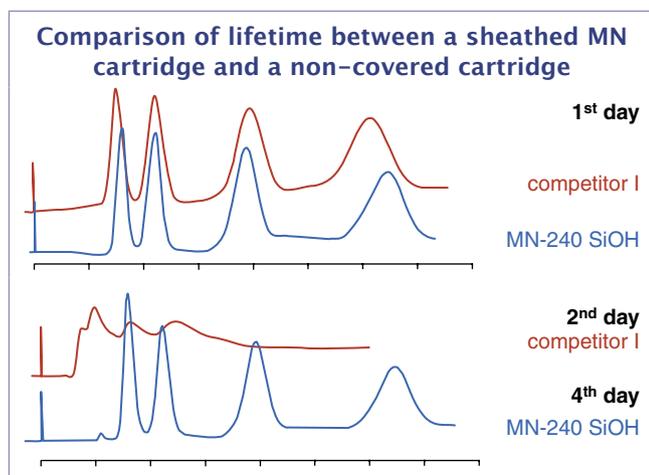
Safety and column lifetime

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.

Separation efficiency and reproducibility

Our optimised and 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 silica, 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 reproducibility from cartridge to cartridge.





CHROMABOND® Flash Safety System

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 %

Ease and flexibility of installation

We use common ¼"-28 fittings and luer locks for all connections. Thus compatibility with very different hardware systems is given, making daily work a lot easier.

Helpful in this respect is our complete CHROMABOND® Flash starter kit.



For ordering information of holders and accessories see next page.

Alternative injection systems and methods

- ◆ **liquid injection systems:** the sample is applied to the flash column e. g. via syringe and 3-way valve (left figure below) or with a VICI® medium pressure valve with sample loop
- ◆ **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 figure below)



Flash Chromatography

CHROMABOND® Flash cartridges with luer lock - Ordering information

Description	Dimensions		Adsorbent SiOH			Adsorbent C18 ec		
	length [mm]	ID [mm]	adsorbent weight [g]	pack of	Cat. No.	adsorbent weight [g]	pack of	Cat. No.
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 next page)



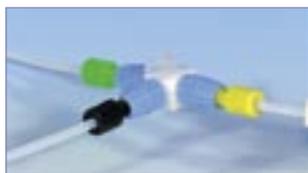
Ordering information

Description	Dimension	Pack of	Cat. No.
CHROMABOND® Flash starter kit			
CHROMABOND® Flash starter kit, consists of: 1/8" PTFE tubing, ID 1.5 mm, length 3 m; 5 x 1/4"-28 PP nuts; 5 x 1/8" tefzel 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	730798
 Holders and replacement parts			
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 casing 90	46 x 88 mm	1	730806
CHROMABOND® Flash casing 180	46 x 167 mm	1	730807
CHROMABOND® Flash casing 240	46 x 212 mm	1	730808
CHROMABOND® Flash casing 360	46 x 298 mm	1	730809
CHROMABOND® Flash cap (40 mm ID) with luer lock, female, incl. sealing ring	60 x 47 mm	1	730818
CHROMABOND® Flash replacement sealing ring (40 mm ID), for cap		1	730819
CHROMABOND® Flash replacement luer lock, female, for cap		1	730820
Accessories			
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
Solid injection system			
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
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



VALCO Cheminert® injection valve with sample loop



3-way adaptor with valve, fitted with tubing



solid injection adaptors



solid injection cartridges



CHROMABOND® Flash cartridges for Biotage® systems

CHROMABOND® Flash solutions for specific Flash instruments

- product range designed for use in Flash systems of Biotage AB (Flash 12i™ and FlashMaster™) and the Teledyne Isco Companion® 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)

Cartridges for Biotage® FlashMaster™



CHROMABOND® Flash FM columns, available in all current dimensions (other adsorbent weights than those listed below can be packed on request)

Cartridges for e.g. the Biotage® Flash 12i™



CHROMABOND® Flash BT columns

Flash Chromatography

Ordering information

Designation	Column length [cm]	ID [mm]	Adsorbent weight [g]	Pack of	Cat. No.
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 C18 ec	9.0	15.8	2.0	50	730890
CHROMABOND® Flash FM 25/5 C18 ec	10.0	20.5	5.0	20	730884
CHROMABOND® Flash FM 70/10 C18 ec	15.4	26.8	10.0	20	730886
CHROMABOND® Flash FM 150/50 C18 ec	17.0	38.2	50.0	10	730888
CHROMABOND® Flash FM 70/10 NH ₂	15.4	26.8	10.0	20	730768
CHROMABOND® Flash FM 70/20 NH ₂	15.4	26.8	20.0	20	730767
CHROMABOND® Flash columns for Biotage® systems					
CHROMABOND® Flash BT 12 S SiOH	10.3	12	4.5	20	730855
CHROMABOND® Flash BT 12 M SiOH	17.8	12	8.5	20	730857
CHROMABOND® Flash BT 12 S C18 ec	10.3	12	5.0	10	730856
CHROMABOND® Flash BT 12 M C18 ec	17.8	12	11.0	10	730858



Cartridges for the Teledyne Isco Companion®

All CHROMABOND® Flash RS types and 3 sizes of the CHROMABOND® Flash Safety System (C-90, C-180, C-240) with holder can be directly used in the Teledyne Isco Companion®



CHROMABOND® Flash RS columns



CHROMABOND® Flash C-90, C-180, C-240 cartridges with the corresponding Flash holders

Ordering information

Designation	Column length [cm]	ID [mm]	Adsorbent weight [g]	Pack of	Cat. No.
CHROMABOND® Flash RS columns for Teledyne Isco® systems					
CHROMABOND® Flash RS 6 SiOH	8.8	12.7	3.5	50	730870
CHROMABOND® Flash RS 30 SiOH	10.9	20.5	12.0	20	730872
CHROMABOND® Flash RS 70 SiOH	16.4	26.8	35.0	10	730869
CHROMABOND® Flash RS 6 C18 ec	8.8	12.7	4.5	10	730871
CHROMABOND® Flash RS 30 C18 ec	10.9	20.5	15.0	2	730873
CHROMABOND® Flash RS 70 C18 ec	16.4	26.8	42.0	2	730874
CHROMABOND® Flash RS 70 C8	16.4	26.8	42.0	2	730781
CHROMABOND® Flash RS 30 CN	10.9	20.5	15.0	2	730920
CHROMABOND® Flash RS 30 Diol	10.9	20.5	15.0	2	730922
CHROMABOND® Flash RS 30 NH ₂	10.9	20.5	15.0	2	730921
CHROMABOND® Flash RS 70 NH ₂	16.4	26.8	42.0	2	730779
CHROMABOND® Flash cartridges with luer tip for Teledyne Isco® systems*					
CHROMABOND® Flash C-90 SiOH	11.4	40	40	10	730787
CHROMABOND® Flash C-180 SiOH	19.4	40	90	10	730786
CHROMABOND® Flash C-240 SiOH	24.0	40	130	10	730812
CHROMABOND® Flash C-90 C18 ec	11.4	40	55	2	730793
CHROMABOND® Flash C-180 C18 ec	19.4	40	110	2	730794
CHROMABOND® Flash C-240 C18 ec	24.0	40	150	2	730783

* built-in operation, requires the corresponding holders (see page 49)



Low pressure Flash chromatography

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 µm (see page 164), however, you may also use our range of POLYGOPREP silica phases (see page 162 – 163). Particle sizes < 25 µm 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.

Flash Chromatography

Ordering information

	Designation	Pack of	Cat. No.
<p>2 different sizes of glass columns with eluent reservoir and pressure gauge</p>	Flash chromatography kits		
	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 µm), 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 µm), sea sand, silanised glass fibre wadding	1 kit	727451
	Flash chromatography columns		
	complete with adaptor and teflon® tap, fitted with a polypropylene 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
	Accessories for flash chromatography glass columns		
	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® 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

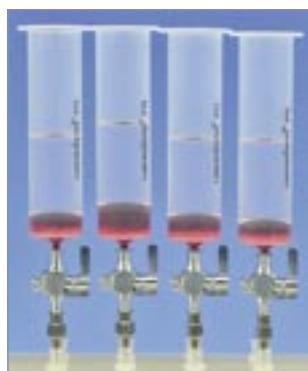
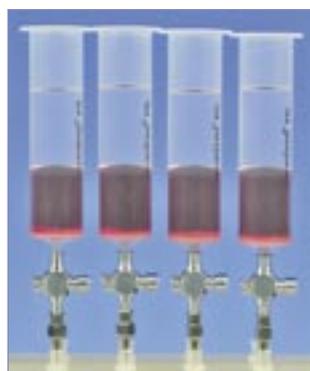
Ordering information

Column volume [ml]	Pack of [columns]	Cat. No.
CHROMABOND® PTS		
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
CHROMABOND® PTL		
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

Phase Separation



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



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

Extraction of analytes from an aqueous to an organic phase

Column conditioning: not required

Sample application: aqueous solutions are applied to the dry CHROMABOND® XTR adsorbent. They are soaked up by the solid within a few minutes and spread over the surface of the kieselguhr material as a thin film.

Never exceed the volume capacities listed for each column size!

Elution:

lipophilic analytes are eluted with water-immiscible organic solvents; the aqueous phase remains on the CHROMABOND® XTR adsorbent
polar, water-soluble analytes, which remain in the aqueous phase on the XTR adsorbent, can be eluted e.g. with saturated NaCl solution

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

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.

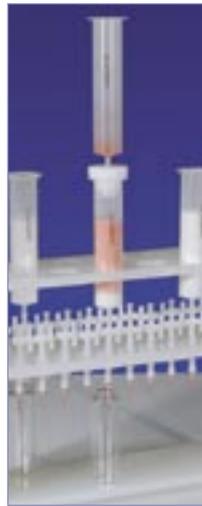
Solvents applicable for elution

- ✓ diethyl ether
- ✓ *tert*-butyl methyl ether
- ✓ ethyl acetate
- ✓ *n*-hexane
- ✓ cyclohexane
- ✓ toluene
- ✓ methylene chloride
- ✓ chloroform
- ✓ 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.



Sample application

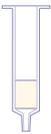


Spreading of the sample



Sample elution

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
	pack of	100	50	30	30	30	30	30	10
	CHROMABOND® XTR polypropylene columns								
		730501	730502	730487	730489	730505	730506	730507	730509
	CHROMABOND® XTR glass columns								
		730487 G							
	CHROMABOND® MULTI 96 XTR								
	96-well plates 96 x 150 mg, packs of 1 plate, for max. 96 x 0.2 ml aqueous solution								
		738131.150M							
	CHROMABOND® XTR adsorbent								
	50 bags of 14.5 g (for max. 20 ml aqueous solution each)								
		for 70 ml PP columns with 100 PE filter elements				for NT20 with 50 PE filter elements (dia. 10 mm)			
		730585				730586			
	Accessories for liquid-liquid extraction with CHROMABOND® XTR								
	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 Cat. No. 730508 consisting of

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

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 (Cat. No. 730185) and a polypropylene needle on the bottom (Cat. No. 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 64.

