



SPE phases for pharmaceutical applications

Drug

- base material silica, pore size 60 Å, particle size 45 µm, specific surface 500 m²/g, pH stability 2 – 8
- special bifunctional modification

special silica phase for drug analysis

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

Application: 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:

We recommend HPLC with our column CC 250/2 NUCLEOSIL® 100-5 C₁₈ AB, Cat. No. 721663.20 (application LC-1024) or GC/MS after derivatisation with perfluoropropionic 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)

302020

Ordering information

	Volume	Adsorbent weight			Pack of
	CHROMABOND® Drug polypropylene columns				
			200 mg		
	3 ml	730168			50
	CHROMABOND® Drug glass columns				
		200 mg			
3 ml	730168 G			50	
	CHROMABOND® LV-Drug				
		100 mg	200 mg		
	15 ml	732167	732168		30
	CHROMAFIX® Drug cartridges				
		0.4 ml / 150 mg			
		731842			50
	CHROMABOND® MULTI 96 Drug				
		96 x 25 mg	96 x 50 mg	96 x 100 mg	
		738161.025M	738161.050M	738161.100M	
				1	



MN products for SPE

SPE phases for pharmaceutical applications

Tetracycline

special phase for enrichment of tetracyclines

- special phase for enrichment of tetracyclines from biological samples

- constant recovery rates for the title compounds
- every batch individually tested

Application: 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. 730 315

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 CC 250/4 NUCLEOSIL® 100-5 C₁₈ HD, Cat. No. 721850.40 (Application LC-1071)

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

302030

Crosslinks

special phase for enrichment of collagen crosslinks

- special phase for enrichment of collagen crosslinks in urine
Pyridinoline and deoxypyridinoline are collagen crosslinks occurring in bones and cartilage. If these sub-

stances are released, they can be detected in the urine. In cases of increased bone catabolism (e. g. during osteoporosis) the urine concentration of pyridinoline and deoxypyridinoline are increased.

Application: pyridinium crosslinks from urine

Compounds investigated: pyridinoline, deoxypyridinoline

Column type: CHROMABOND® Crosslinks
3 ml, 300 mg, Cat. No. 730 458

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) are added to the hydrolysate.

Column conditioning: 5 ml of the wash solution

Sample application: Force or aspirate the pretreated 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.

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Ordering information

	Volume	Adsorbent weight	Pack of
	CHROMABOND® Tetracycline polypropylene columns		
		500 mg	
	6 ml	730315	30
	CHROMABOND® Crosslinks polypropylene columns		
		300 mg	
	3 ml	730458	50



SPE phases for environmental analysis

CN/SiOH

PAHs from soil

- special combination phase for extraction of the 16 PAHs according to EPA from soil samples
- cyanopropyl phase for selective adsorption of polycyclic aromatics via π - π interactions

unmodified silica phase for removal of polar compounds

Application: 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

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

Recovery rates of PAHs from soil

Compound	Recovery [%]
Naphthalene	85
Acenaphthylene	92
Acenaphthene	89
Fluorene	87
Phenanthrene	83
Anthracene	88
Fluoranthene	87
Pyrene	90
Benz[a]anthracene	84
Chrysene	96
Benzo[b]fluoranthene	95
Benzo[k]fluoranthene	90
Benzo[a]pyrene	90
Dibenz[ah]anthracene	96
Benzo[ghi]perylene	87
Indeno[1,2,3-cd]pyrene	97

For further analysis we recommend HPLC, e. g. with column EC 250/3 NUCLEOSIL® 5 C₁₈ PAH, Cat. No. 720117.30

301310

Ordering information

	Volume	Adsorbent weight	Pack of
	CHROMABOND® CN/SiOH polypropylene columns		
		500/1000 mg	
	3 ml	730112	50
	6 ml	730135	30
	CHROMABOND® CN/SiOH glass columns		
		500/1000 mg	
	3 ml	730112 G	50
	6 ml	730135 G	30
	CHROMAFIX® CN/SiOH cartridges		
		300/600 mg	
	1.8 ml	731838	50



MN products for SPE

SPE phases for environmental analysis

C18 PAH

- 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 PAHs, not endcapped, carbon content 14 %

octadecyl silica for PAH analysis

- recommended application: PAHs from water

Application: PAHs from water

Column type: CHROMABOND® C18 PAH
6 ml / 2000 mg, 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)

302090

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

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

NH₂/C18

- special combination phase for extraction of PAHs from water containing humic acids

PAHs from water containing humic acids

aminopropyl phase for removal of interfering humic acids
octadecyl phase for enrichment of PAHs

Application: PAHs from water containing humic acids

Column type: CHROMABOND® NH₂/C18
6 ml, 500/1000 mg Glas, Cat. No. 730620 G

Sample pretreatment:

Mix 500 ml water sample with 25 ml 2-propanol

Column conditioning: 10 ml methylene chloride, 10 ml methanol, then 10 ml dist. water/2-propanol (9:1)

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

301260

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

Elution: with 4 x 0.5 ml methylene chloride (let percolate first 0.5 ml into the column packing without vacuum, then apply light vacuum), if necessary evaporate in a stream of nitrogen and fill up with a suitable solvent

Ordering information

	Volume	Adsorbent weight		Pack of
	CHROMABOND® C18 PAH polypropylene columns			
			2000 mg	
	6 ml		730166	30
	CHROMABOND® C18 PAH glass columns			
			2000 mg	
	6 ml		730166 G	30
CHROMABOND® C18 PAH adsorbent				
		730616	100 g	
	CHROMABOND® NH₂/C18 polypropylene columns			
		500/500 mg	500/1000 mg	
	6 ml	730618	730620	30
	CHROMABOND® NH₂/C18 glass columns			
		500/500 mg	500/1000 mg	
	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 for extraction of hydrocarbons from drinking, surface and waste waters

Application: 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 1 liter 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.

302090

SiOH-H⁺/SA

PCBs from oil

- special combination phase for extraction of PCBs from oil with reference to German industrial standard DIN 51527, part 1

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 benzenesulphonic acid modification for removal of ionic and sulphur-containing compounds

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

Application: PCBs in oil samples

determination with reference to German industrial standard DIN 51 527

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

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 sulphonisation. 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 of PCB from oil:

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

301380

Ordering information

	Volume	Adsorbent weight	Pack of
	CHROMABOND® Na₂SO₄ / Florisil® glass columns		
		2000/2000 mg	
	6 ml	730249 G	30
	CHROMABOND® SiOH-H⁺/SA polypropylene columns		
		500/500 mg	
	3 ml	730085	50
	CHROMABOND® SiOH-H⁺/SA glass columns		
		500/500 mg	
	3 ml	730085 G	50
	Kombi-Kit for extraction of PCBs from oil with reference to DIN 51527, part 1		
	25 columns each of CHROMABOND® SiOH-H ⁺ /SA and CHROMABOND® SiOH	730125	1 kit



MN products for SPE

SPE phases for environmental analysis

SA/SiOH

PCBs from waste oil

- special combination phase for extraction of PCBs from waste oil (hexane extract)
- SA: strongly acidic cation exchanger based on silica with benzenesulphonic acid modification
- SiOH: unmodified silica for removal of polar compounds

Application: PCBs 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

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 of PCBs from waste oil:

PCB 28 97%, PCB 52 96%, PCB 101 95%,
PCB 138 90%, PCB 153 95%, PCB 180 96%,
PCB 209 100%

301390

NAN

PCBs from sludge

- special combination phase of sodium sulphate and AgNO₃-impregnated silica for extraction of PCBs from sludge
- SiOH/AgNO₃ phase for removal of sulphur, sulphur-containing and polar compounds
- sodium sulphate for removal of trace water

PCBs 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 5 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 of PCBs from sludge

PCB 28 104%, PCB 52 100%, PCB 101 99%,
PCB 138 98%, PCB 153 101%, PCB 180 98%,
PCB 209 104%

301400

Ordering information

	Volume	Adsorbent weight	Pack of
	CHROMABOND® SA/SiOH polypropylene columns		
		500/500 mg	
	3 ml	730132	50
	CHROMABOND® SA/SiOH glass columns		
		500/500 mg	
	3 ml	730132 G	50
	CHROMAFIX® SA/SiOH cartridges		
		450/450 mg	
	1.8 ml	731837	50
	CHROMABOND® NAN polypropylene columns		
		400/1400/400 mg	700/2000/700 mg
	3 ml	730109	50
	6 ml	730149	30
	CHROMABOND® NAN glass columns		
		400/1400/400 mg	700/2000/700 mg
	3 ml	730109 G	50
	6 ml	730149 G	30



Other special cartridges

DNPH

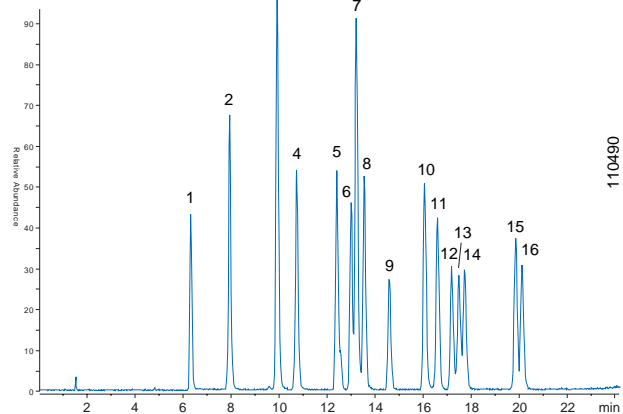
HPLC separation of aldehydes and ketones from air after enrichment on CHROMAFIX® DNPH

S. Kölliker, M. Oehme, Universität Basel, Switzerland, private communication
 HPLC column: CC 250/3 NUCLEOSIL® 100-5 C₁₈ HD, Cat. No. 721850.30

Peaks:

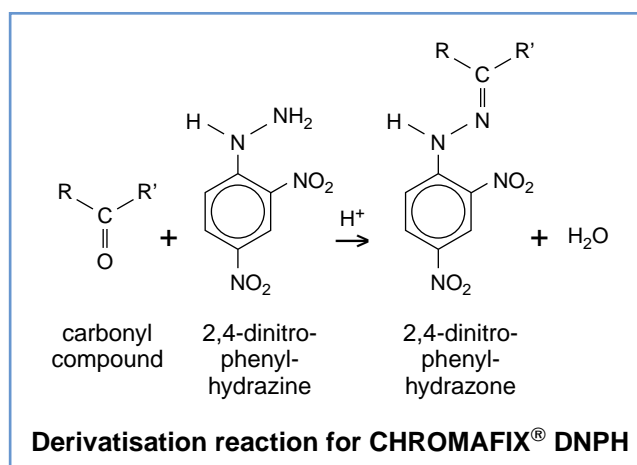
1 ng each of a standard of 16 carbonyl DNPHs (EPA TO11 + butanone + methacrolein)

- | | |
|----------------------|------------------------------|
| 1. Formaldehyde | 9. Benzaldehyde |
| 2. Acetaldehyde | 10. <i>i</i> -Pentanal |
| 3. Acetone | 11. <i>n</i> -Pentanal |
| 4. Propionaldehyde | 12. <i>o</i> -Tolualdehyde |
| 5. 2-Butenal | 13. <i>m</i> -Tolualdehyde |
| 6. Methacrolein | 14. <i>p</i> -Tolualdehyde |
| 7. Butanone | 15. <i>n</i> -Hexanal |
| 8. <i>n</i> -Butanal | 16. 2,5-Dimethylbenzaldehyde |



carbonyl compounds from air

- 2,4-dinitrophenylhydrazine (DNPH) impregnated silica for enrichment of aldehydes and ketones from air
- samples can be passed through the cartridge in both directions
- each cartridge is sealed in a laminated aluminium bag
- carbonyl compounds adsorbed as 2,4-dinitrophenylhydrazone derivatives (hydrazones) can be eluted from the cartridges with acetonitrile



Ordering information

		Adsorbent weight	Pack of
	CHROMAFIX® DNPH cartridges		
		0.8 ml / 400 mg	
		731855	20

Dry

- anhydrous high-purity sodium sulphate for removal of traces of water from organic solutions with water traces from the sample Na₂SO₄ forms Glauber's salt

Ordering information

		Adsorbent weight			Pack of
	CHROMAFIX® Dry cartridges				
		0.4 ml / 600 mg	0.8 ml / 1200 mg	1.8 ml / 2800 mg	
		731852	731853	731854	50

drying of organic samples

- for removal of larger quantities of water several cartridges can be combined in series



Methods of solid phase extraction

Handling of CHROMABOND® and CHROMAFIX® products

Handling of CHROMABOND® columns

For elution either apply pressure at the top of the column or apply vacuum at the column end. For this purpose several procedures are possible as shown in the adjacent figures.

The adaptor shown in fig. a) can be used for coupling of several CHROMABOND® columns of the same or different sizes.

- With the aid of a disposable syringe and an adaptor the eluent can be pressed through the CHROMABOND® column.
- For drawing the eluent through a column it can be placed on an aspirator bottle by means of a syringe needle, or it can be used on the vacuum manifold described below. CHROMABOND® columns can be used with all vacuum systems with Luer fitting.
- The same result can be obtained by using the column in a centrifuge tube.

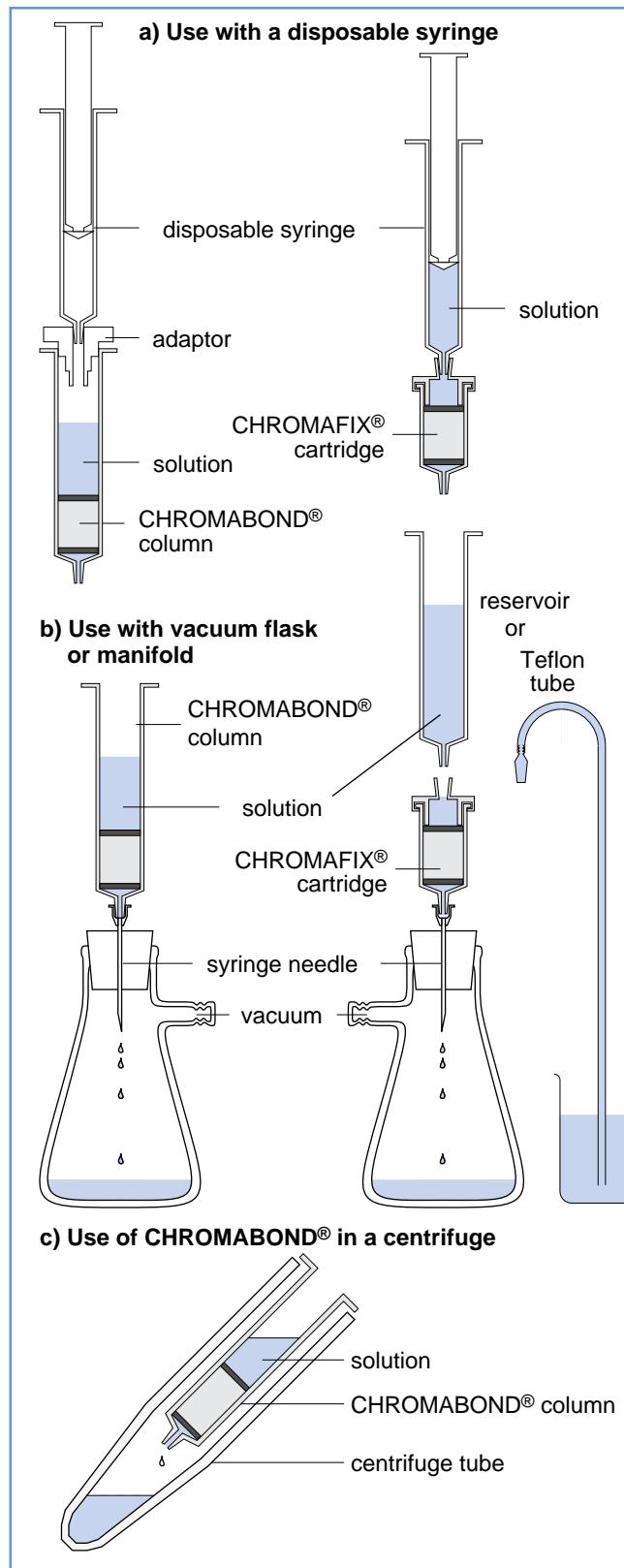
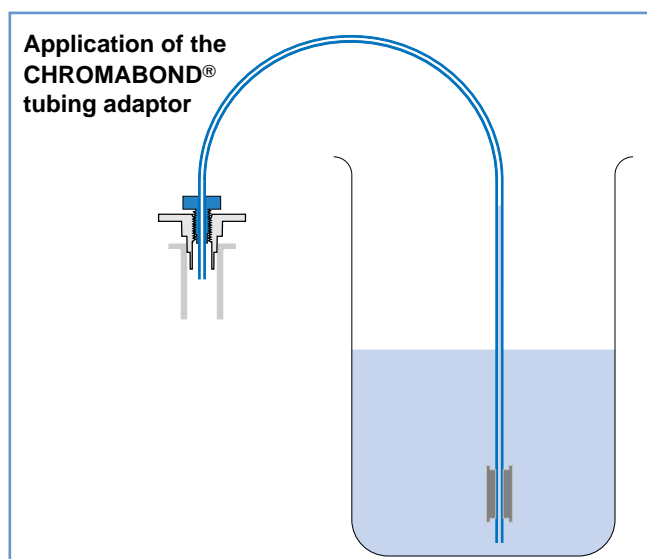
Handling of CHROMAFIX® cartridges

With the aid of a syringe the required solvents for conditioning, washing and elution as well as the sample itself can be easily pushed through the adsorbent without high pressures. Of course, CHROMAFIX® cartridges can be used with vacuum manifolds, the Luer tip of the cartridges fits directly into the Luer fittings of the vacuum manifold.

Handling of large sample volumes

For larger sample volumes MACHERY-NAGEL has developed the CHROMABOND® LV columns, which are available with three different adsorbent weights (100, 200 and 500 mg) and feature a funnel-shaped reservoir of 15 ml volume.

If very large sample volumes are to be extracted, we recommend the CHROMABOND® tubing adaptors, which consist of an adaptor for CHROMABOND® columns and 1 m coloured Teflon tubing with weight. The package contains 4 adaptors with tubes of different colours.



Methods of solid phase extraction



Handling of CHROMABOND® and CHROMAFIX® products

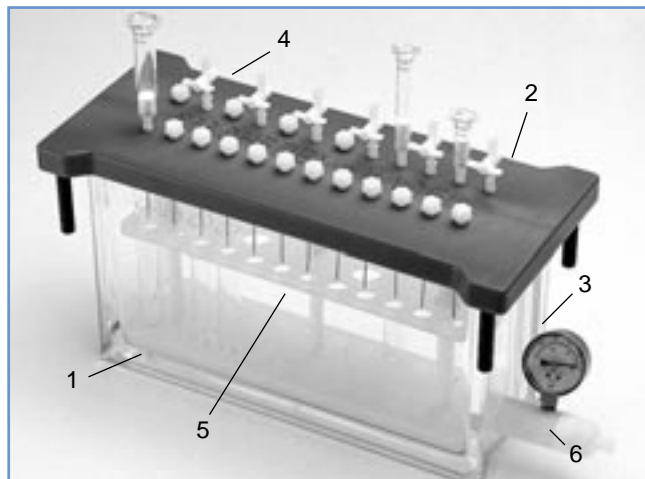


Figure 1: vacuum manifold for up to 24 columns

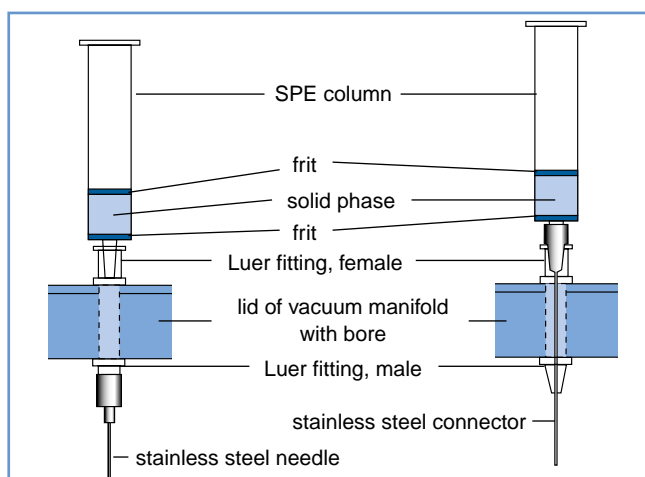


Figure 2: cross-contamination-free elution with stainless steel connectores (right) compared to the standard configuration (left)

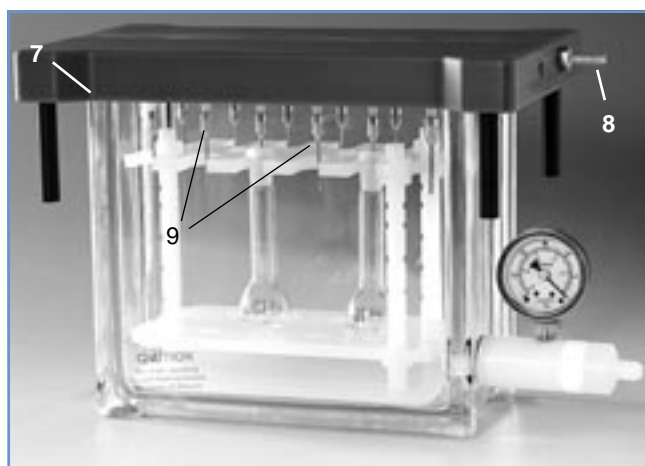


Figure 3: vacuum manifold with drying attachment

CHROMABOND® vacuum manifolds for simultaneous preparation of up to 12, 16 or 24 samples

If several samples are to be treated simultaneously, we recommend our vacuum manifolds.

We supply such manifolds (figure 1) for up to 12, 16 or 24 CHROMABOND® columns or CHROMAFIX® cartridges, respectively. The manifolds consist of rectangular glass cabinets (1) with vacuum gauge (3) and a polypropylene lid (2), which can hold the columns or cartridges. The replaceable valves (4) on the lid allow individual vacuum control for each solid phase extraction column, if required. The cabinet is fitted with a variable rack (5) with exchangeable partitions, which accept a wide variety of vessels like test tubes, measuring flasks, scintillation vials, autosampler vials, plastic vials and many more. With the control valve (6) the vacuum in the chamber can be adjusted and read from the gauge.

There are several possibilities for applying different sample volumes. Small samples can be applied directly to the CHROMABOND® column. For medium size samples we have developed our CHROMABOND® LV columns with 15 ml sample reservoir. Especially for this column type we offer a vacuum manifold with 16 positions, because with the manifold for 24 columns only every second position can be used. Alternatively, you may use the polypropylene sample reservoirs (30 or 70 ml) from our programme of SPE accessories, which can be fitted onto the CHROMABOND® column with the aid of an adaptor. Sample reservoirs fit directly onto the upper Luer fitting of the CHROMAFIX® cartridges. For large sample volumes we recommend our CHROMABOND® tubing adaptors, which fit onto the CHROMABOND® columns. The other end of the tubing is placed into the sample, which, by applying vacuum, is continuously drawn into the CHROMABOND® column.

For special applications, which require maximum protection from cross contamination we supply chrome-plated brass valves and stainless steel connectors, the application of which is shown in figure 2. These special stainless steel needles are fitted through the lid; thus the sample only has contact with the inert needle and can flow directly into the receptacle.

If the eluate has to be evaporated, this can be performed with the so-called drying attachment (7, see figure 3). This special lid has a gas connector on one side (8), from which the gas is fed simultaneously to the 12 or 24 stations (9). Thus 12 or 24 eluates can be evaporated simultaneously by just changing the lid and applying a stream of inert gas, e.g. nitrogen.



Methods of solid phase extraction

Accessories for solid phase extraction

Cat. No.	Description	Pack of
CHROMABOND® vacuum manifold and replacement parts		
730150	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 12 columns	1
730360	Vacuum manifold as described above, for 16 LV columns	1
730151	Vacuum manifold as described above, for 24 columns	1
730173	Glass cabinet without accessories, for 12 columns	1
730174	Glass cabinet without accessories, for 16 LV or 24 columns	1
730175	Lid with gasket, for 12 columns, including Luer fittings and valves	1
730365	Lid with gasket, for 16 LV columns, including Luer fittings and valves	1
730176	Lid with gasket, for 24 columns, including Luer fittings and valves	1
730177	Gaskets for lid, for 12 columns	2
730178	Gaskets for lid, for 24 columns	2
730183	Luer fitting for lid, female	1
730184	Luer fitting for lid, male	1
730187	Drying attachment, for 12 columns	1
730188	Drying attachment, for 24 columns	1
730157	Collecting rack for 12 columns	1
730366	Collecting rack for 16 LV columns	1
730153	Collecting rack for 24 columns	1
730179	Vacuum gauge, complete with accessories	1
730152	Stainless steel needles	12
730154	Polypropylene needles	12
730185	Valve, plastic	12
730189.1	Valve, brass, tarnished	1
730189.12	Valve, brass, tarnished	12
730106	Stainless steel connectors	12
730387	Tubing adaptor for application of large sample volumes to 1, 3 and 6 ml glass columns	4
730243	Tubing adaptor for application of large sample volumes to 1, 3 and 6 ml polypropylene columns	4
730386	Tubing adaptor for application of large sample volumes to 15, 45 and 70 ml polypropylene columns	4
CHROMABOND® MULTI 96 accessories for SPE microtiter plates		
738630.M	CHROMABOND® MULTI 96 vacuum manifold with reservoir tank, vacuum gauge, and control valve	1
738650	96-deep-well collecting plate (polypropylene) 96 x 2 ml	1
738651	96-well microtiter plate (polypropylene) 96 x 0.5 ml	10
738637	Collection rack with polypropylene tube strips (twelve 8-well strips) 96 x 1.0 ml	5
738652	Polypropylene tube strips (twelve 8-well strips) 96 x 1.0 ml	10
738639.M	Reservoir tank (polypropylene)	2
738638	8-well strip sealing caps for PP tube strips	30
738645	Butyl rubber pad, PTFE covered, 125 x 85 mm	1

For empty CHROMABOND® MULTI-96 and filter plates see page 235

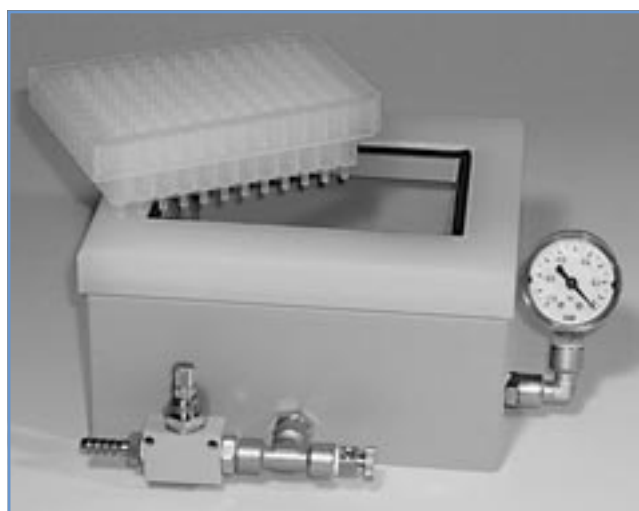


Handling of CHROMABOND® and CHROMAFIX® products

Handling of CHROMABOND® MULTI 96

The CHROMABOND® MULTI 96 are particularly designed for the use in all common robotic workstations or commercially available liquid handling systems. Alternatively, the use of multi-channel pipettors facilitates a manual liquid transfer. The extraction is carried out using our special 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 micro-titer 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.





Methods of solid phase extraction

Accessories for solid phase extraction

CHROMABOND® empty columns and accessories

Cat. No.	Description	Pack of
730170	Empty glass columns with glass fibre frits, 1 ml	100
730171	Empty glass columns with glass fibre frits, 3 ml	50
730172	Empty glass columns with glass fibre frits, 6 ml	30
730190	Glass fibre frits for glass columns 1 ml	250
730191	Glass fibre frits for glass columns 3 ml	250
730192	Glass fibre frits for glass columns 6 ml	250
730159	Empty polypropylene columns with PE frits, 1 ml	100
730160	Empty polypropylene columns with PE frits, 3 ml	50
730161	Empty polypropylene columns with PE frits, 6 ml	30
730230	Empty polypropylene columns with PE frits, 15 ml	20
730380	Empty polypropylene columns with PE frits, 30 ml	20
730355	Empty polypropylene columns with PE frits, 45 ml	20
730158	Empty polypropylene columns with PE frits, 70 ml	20
730474	Empty polypropylene columns with PE frits, 150 ml	20
730164	PE frits for polypropylene columns 1 ml	250
730162	PE frits for polypropylene columns 3 ml	250
730163	PE frits for polypropylene columns 6 ml	250
730351	PE frits for polypropylene columns 15 ml	250
730034	PE frits for polypropylene columns 30 ml	250
730356	PE frits for polypropylene columns 45 ml	250
730026	PE frits for polypropylene columns 70 ml	250
730475	PE frits for polypropylene columns 150 ml	250
732500	Empty LV polypropylene columns with PE frits, 15 ml, for 100 mg sorbent weight	50
732501	Empty LV polypropylene columns with PE frits, 15 ml, for 200/500 mg sorbent weight	50
732019	PE frits for LV polypropylene columns 15 ml for 100 mg sorbent weight	250
732020	PE frits for LV polypropylene columns 15 ml for 200/500 mg sorbent weight	250
730104	Adaptor for glass columns (1, 3 and 6 ml)	1
730105	Adaptors as above	10
730100	Adaptor for polypropylene columns (1, 3 and 6 ml)	1
730101	Adaptors as above	10
730350	Adaptor for polypropylene columns (15, 45, 70 ml)	1
730385	Adaptors as above	10
730102	Reservoir column 30 ml, polypropylene, with one adaptor for 1, 3, 6 ml CHROMABOND® polypropylene columns	1
730103	Reservoir columns 30 ml as above	10
730381	Reservoir column 70 ml, polypropylene, with one adaptor for 1, 3, 6 ml CHROMABOND® polypropylene columns	1
730382	Reservoir columns 70 ml as above	10
730388	Reservoir column 70 ml, polypropylene, with one adaptor for 15, 45, 70 ml CHROMABOND® polypropylene columns	1
730389	Reservoir columns 70 ml as above	10



CHROMABOND® XTR for liquid-liquid extraction

Liquid-liquid extractions

Liquid-liquid extractions with a separating funnel are often used to transfer analytes from the aqueous to an organic phase, or to clean up complex matrices before analysis. Especially if this has to be done regularly, the disadvantages of classical liquid-liquid extraction become evident:

– multiple extractions are required for high recovery rates

- formation of emulsions
- poor phase separation
- high solvent consumption
- adaptation to automated systems difficult
- organic solutions have to be dried subsequently

CHROMABOND® XTR

kieselguhr columns for efficient liquid-liquid extractions

CHROMABOND® XTR is a special kieselguhr material (also known as diatomaceous earth, hydromatrix, celite). Kieselguhr is a naturally occurring, amorphous silicic acid of fossil origin. The deposits found at many places on earth originated in the youngest geological history (quaternary and tertiary period). They were formed by dead diatomaceae, of which the silica acid shells sank to the seabed over a very long period of time and were deposited in a more or less stratum. After multiple purification steps this naturally occurring product can be used for chemical sample preparation, maintaining a constantly high batch-to-batch quality. CHROMABOND® XTR can be used in the pH range 1 – 13 and has a large pore size, with a high pore volume. This

again results in a high water loadability without any breakthrough of water during elution with organic solvents.

CHROMABOND® XTR is a fast, reproducible and economical alternative to liquid-liquid extractions, with the following benefits:

- simultaneous preparation of many 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

CHROMABOND® XTR and CHROMABOND® XTR eco

CHROMABOND® XTR is a coarse-grained kieselguhr material, which is especially useful for highly viscous aqueous solutions such as blood, plasma, and serum. Even with these solutions samples can be applied and analytes eluted without vacuum, as both can be carried out under hydrostatic pressure.

Besides this standard material, we offer, as an economical alternative, the more fine-grained CHROMABOND® XTR eco. Working with non-viscous solutions, such as water samples or urine, analytes can be applied and eluted under hydrostatic pressure from CHROMABOND® XTR eco, too. Highly viscous solutions need the help of vacuum.

Extraction of lipophilic analytes in the organic phase

Sample application: aqueous solutions are applied to the dry CHROMABOND® XTR adsorbent without previous conditioning. Solutions in a pH range of 1 – 13 can be applied. The aqueous phase is soaked up by the adsorbent within a few minutes and spreads over the surface of the kieselguhr material as a thin film. The listed volume capacities for each column should not be exceeded, as part of the aqueous solution will pass unchanged through the column.



Sample application on CHROMABOND® XTR



Spreading of the sample on CHROMABOND® XTR



Liquid-liquid extraction

CHROMABOND® XTR for liquid-liquid extraction

Elution: Lipophilic analytes now can be eluted with water-immiscible organic solvents. The aqueous phase remains on the CHROMABOND® XTR adsorbent. The eluted organic solution does not have to be dried and is free of emulsions. Depending on the concentration of the dissolved analytes these can be analysed immediately, or after evaporating the organic solvent. 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.

Any solvent used for classical liquid-liquid extractions can be used as eluent, e.g.:

- ✓ diethyl ether
- ✓ *tert*-butyl methyl ether
- ✓ ethyl acetate
- ✓ *n*-hexane
- ✓ cyclohexane

- ✓ toluene
- ✓ methylene chloride
- ✓ chloroform

Mixtures of such solvents can also be applied. If more polar analytes have to be eluted, small amounts of alcohols can be added to these solvents, e.g.:

- ✓ 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 / isopropanol (90/10, v/v)
- ✓ methylene chloride / isopropanol (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.

General column parameters:

CHROMABOND® XTR volume	amount of adsorbent	maximum 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

Elution of water-soluble analytes

Polar, water-soluble analytes, which remain in the aqueous phase on the CHROMABOND® XTR material can also be eluted, e.g. by applying a saturated NaCl solution. In the beginning, remains of the organic solvents will be eluted from the CHROMABOND® XTR, which have to be discarded.

Applications

There is a broad range of applications for kieselguhr materials for the extraction of physiological fluids, such as urine, blood, serum, plasma, or others, in clinical chemistry. Other applications are the analysis of dyes in textiles, environmental and food analysis. A fractionated elution of acidic and basic compounds can be applied in the analysis of pharmaceuticals and their metabolites. Because of the high water loadability the CHROMABOND® XTR is ideally suited for removing small amounts of water from solvents which are not miscible with water.





CHROMABOND® XTR for liquid-liquid extraction

Application: determination of azo dyes / aromatic amines in coloured textile materials

(following § 35 of the German law for food and consumer goods / LMBG)

Sample pretreatment: Weigh about 1 g of a cut-up textile sample (coloured textiles about 0.1 g) in a 100 ml threaded vial. Degrease leather samples before processing: cover sample with technically pure *n*-hexane and put the vial in an ultrasonic bath for 20 min. After decanting the *n*-hexane rinse with a small amount of *n*-hexane and dry sample by gently blowing in air or N₂. Add 250 µl IS (1.2 mg/ml tetramethylbenzidine in methanol/ethyl acetate 1:1), 17.0 ml citrate buffer (pH 6) (25.05 g citric acid and 12.64 g NaOH, filled up with deion. H₂O to 2 l) and heat 30 min to 70 °C. Then add 3 ml of a freshly prepared solution of 0.2 g/ml sodium dithionite in water and heat for exactly 30 min to 70 °C while shaking occasionally.

Sample application: Cool the solution immediately (put vial in water – stopping of reductive cleavage). After 5–10 min pour liquid onto the CHROMABOND® XTR column, 70 ml, 14.5 g, for max. 20 ml aqueous solution (squeeze textile remains).

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

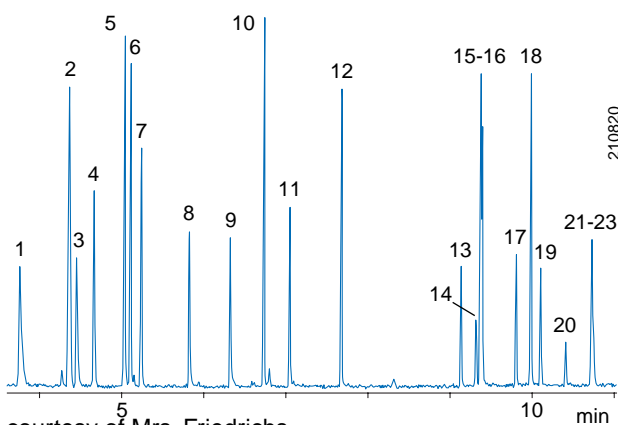
Recovery rates

Compound	Elution		Peak no. in	
	(C ₂ H ₅) ₂ O	(C ₂ H ₅) ₂ O/ EtOH 9:1	GC-1082	LC-1050
IS: Tetramethylbenzidine	112 %	66 %		
<i>o</i> -Toluidine	90 %	124 %	1)	8)
2,4- and 2,6-Xylidine	85 %	120 %	2)	
<i>o</i> -Anisidine	91 %	127 %	3)	7)
<i>p</i> -Chloroaniline	85 %	131 %	4)	10)
<i>p</i> -Cresidine	88 %	116 %	5)	12)
2,4,5-Trimethylaniline	85 %	48 %	6)	18)
4-Chloro- <i>o</i> -toluidine	85 %	124 %	7)	17)
2,4-Toluenediamine	17 %	30 %	8)	3)
2,4-Diaminoanisole	2 %	12 %	9)	2)
2-Naphtylamine	80 %	98 %	10)	16)
4-Aminobiphenyl	89 %	99 %	12)	20)
4,4'-Oxydianiline	90 %	81 %	14)	9)
4,4'-Diamino-diphenylmethane	97 %	76 %	15)	11)
Benzidine	90 %	66 %	16)	6)
4,4'-Diamino-3,3'-dimethylphenylmethane	86 %	80 %	18)	19)
3,3'-Dimethylbenzidine	85 %	80 %	19)	14)
4,4'-Thiodianiline	81 %	84 %	20)	15)
3,3'-Dimethoxybenzidine	91 %	71 %	21)	13)
4,4'-Methylene-bis-(2-chloroaniline)	89 %	102 %	22)	22)
3,3'-Dichlorobenzidine	85 %	92 %	23)	21)

Subsequent analysis

Analysis of azo dyes and aromatic amines by fast-GC in 11 min

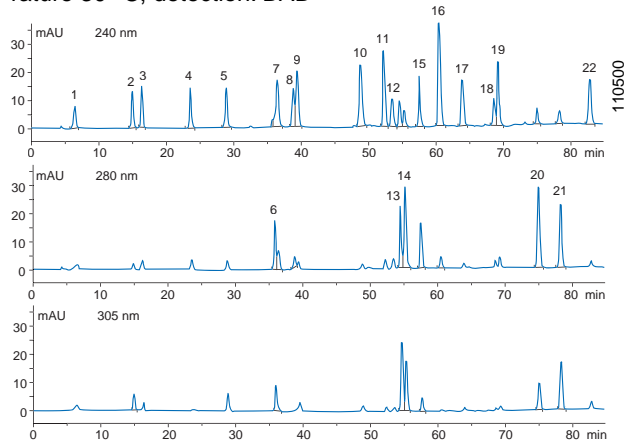
Column: OPTIMA® δ-3, length 10 m, ID 0.1 mm, 0.1 µm film, Cat. No. 726410.10, max. temp. 340/360 °C, injection: 1.0 µl, inj. temp. 250 °C; split: 2 min splitless, then 1:25, temperature: 50 °C (1min), → 280 °C, 25 °C/min, (5 min), pressure: 580 Kpa (1min), → 966 Kpa, 42 Kpa/min, (5 min), flow: 84 ml/min, detector: MS, 320 °C



courtesy of Mrs. Friedrichs,
Chem. research agency, Bielefeld, Germany

Determination of azo dyes and aromatic amines in textiles and leather

Column: CC 250/4.6 NUCLEOSIL® 100-5 C₁₈ HD, Cat. No. 721850.46, eluents: A) NH₄H₂PO₄ and Na₂HPO₄, 0.005 mol each; B) methanol, gradient: 10 – 62 % B in 75 min, flow: 0.67 ml/min, temperature 30 °C, detection: DAD



courtesy of Dr. Heusinger, M. Riebes,
Chem. research agency, Freiburg, Germany



Liquid-liquid extraction

CHROMABOND® XTR for liquid-liquid extraction

Extraction of alkaloids from aqueous solutions

Sample pretreatment: Add 1 ml of a spiked solution (10 mg each of codeine and quinine in 100 ml water) to 9 ml of an aqueous sample solution. Transfer 1 ml of this solution to 19 ml aqueous NH₃ solution (pH 9).

Sample application: Apply the ammoniacal sample solution to a CHROMABOND® XTR column, 70 ml, 14.5 g (for max. 20 ml aqueous solution) and allow the solution to be soaked up for 10 min.

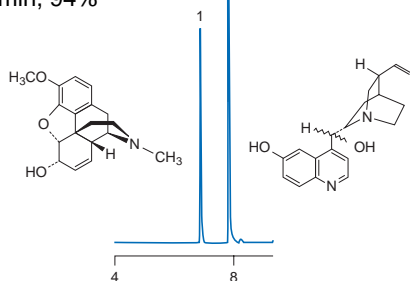
Elution: Elute with 30 ml dichloromethane / isopropanol 85:15 (v/v) and evaporate the eluate to dryness with a rotation evaporator. Rinse the flask four times with 250 µl acetonitrile / water 8:2 (v/v) each and transfer the combined solutions into a HPLC vial.

Subsequent analysis:

Column: CC 250/4 NUCLEOSIL® 100-5 C₁₈ HD,
Cat. No. 721850.40, injection: 250 µl
eluent: A) 50 mmol NaH₂PO₄, pH 2.5
B) acetonitrile / 50 mmol NaH₂PO₄,
pH 2.5, 60:40 (v/v)
gradient: 15 – 55 % B in 10 min,
55 – 100 % B in 20 min
flow: 1 ml/min
temperature: 25 °C
detection: UV, 280 nm

Peaks / recovery rates:

1. Codeine: 7.0 min, 92%
2. Quinine: 7.9 min, 94%



302110

Extraction of heterocyclic pharmaceuticals from aqueous solutions

Sample pretreatment: Add 1 ml of a spiked solution (10 mg chlorpromazine and methaqualone in 100 ml acetonitrile) to 9 ml of an aqueous sample solution. Transfer 1 ml of this solution to 19 ml aqueous NH₃ solution (pH 9).

Sample application: Apply the ammoniacal sample solution to a CHROMABOND® XTR column, 70 ml, 14.5 g (for max. 20 ml aqueous solution) and allow the solution to be soaked up for 10 min.

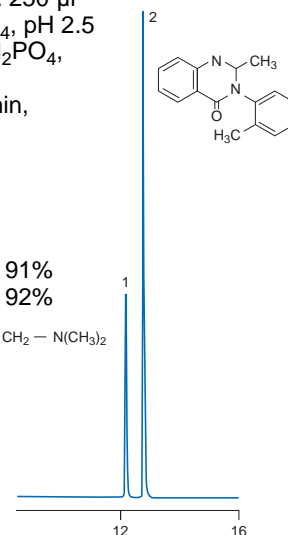
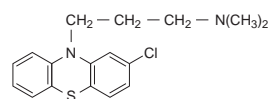
Elution: Elute with 30 ml dichloromethane / isopropanol 85:15 (v/v) and evaporate the eluate to dryness with a rotation evaporator. Rinse the flask with four times 125 µl acetonitrile each and transfer the combined solutions into a HPLC vial. Fill up with 500 µl phosphate buffer (50 mmol NaH₂PO₄, pH 2.5).

Subsequent analysis:

Column: CC 250/4 NUCLEOSIL® 100-5 C₁₈ HD,
Cat. No. 721850.40, injection: 250 µl
eluent: A) 50 mmol NaH₂PO₄, pH 2.5
B) acetonitrile / 50 mmol NaH₂PO₄,
pH 2.5, 60:40 (v/v)
gradient: 15 – 55 % B in 10 min,
55 – 100 % B in 20 min
flow: 1 ml/min
temperature: 25 °C
detection: UV, 280 nm

Peaks / recovery rates:

1. Chlorpromazine: 12.3 min, 91%
2. Methaqualone: 12.9 min, 92%



302120

Accessories and collection vials



If the volume of the CHROMABOND® XTR column is not sufficient for sample application or elution, a reservoir column can be put on top with the help of an adaptor. For the ordering information of our SPE accessories (reservoir columns, adaptors etc.) please refer to page 226.

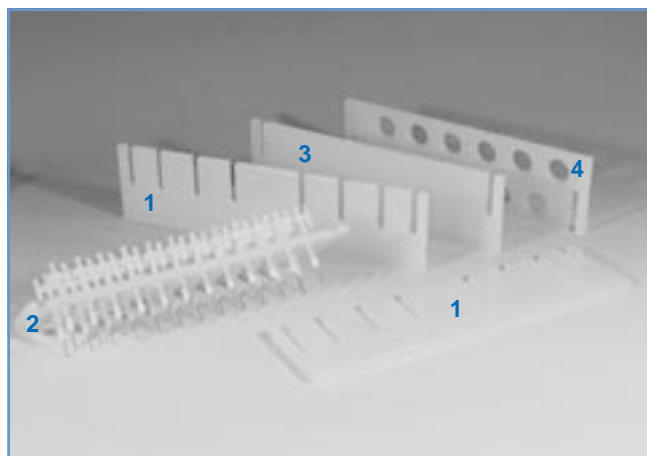
For collection of the sample, vessels such as vials, test tubes, round bottom or tapered flasks, can be used. For our programme of sample vials, please see the chapter "Vials and accessories" from page 236.



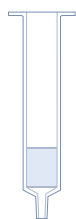
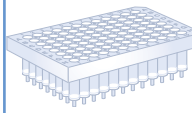
CHROMABOND® XTR for liquid-liquid extraction

Our programme of accessories for CHROMABOND® XTR columns includes a robust polypropylene rack (Cat. No. 730508), upon which up to 24 columns (size 1 – 150 ml) can be processed in parallel. It consists of two side walls (1), one middle part including stopcocks and needles (2), one bottom part (3) and one top part (4), which should be used to stabilise the 45 ml, 70 ml and 150 ml CHROMABOND® XTR columns.

This collection 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).



Ordering information

	column volume	1 ml	3 ml	6 ml	15 ml	30 ml	45 ml	70 ml	150 ml
	adsorbent weight	250 mg	500 mg	1 g	3 g	4.5 g	8.3 g	14.5 g	37.5 g
	max. vol. aq. sol.	0.25 ml	0.5 ml	1 ml	3 ml	5 ml	10 ml	20 ml	50 ml
	pack of	100	50	30	30	30	30	30	10
	polypropylene columns CHROMABOND®								
XTR	730501	730502	730487	730489	730505	730506	730507	730509	
XTR eco	730521	730522	730523	730524	730525	730526	730527	730529	
glass columns CHROMABOND®									
XTR	730501 G	730502 G	730487 G						
XTR eco	730521 G	730522 G	730523 G						
	CHROMABOND® MULTI 96								
	microtiter plates 96 x 150 mg , packs of 1 plate, for max. 96 x 0.2 ml aqueous solution								
	XTR	738131.150M							
XTR eco	738135.150M								
CHROMABOND® XTR adsorbent									
	50 bags of 14.5 g (for max. 20 ml aqueous solution each) for 70 ml PP columns *		500 g	1 kg	5 kg				
XTR	730585	730586	730595.500	730595.1000	730595.5000				
XTR eco	730580		730590.500	730590.1000	730590.5000				
* with 100 PE filter elements			** with 50 PE filter elements (diameter 10 mm)						



SPE custom column request form

CHROMABOND® SPE service for solid phase extraction

Inquiry to:
MACHERY-NAGEL GmbH & Co. KG
P. O. Box 10 13 52, D-52313 Düren, Germany
Tel. (02421) 969-0 · Fax (02421) 969 199

Name, First Name, Title
Company / Institute
Department
Street / P. O. Box
Postal Code / City / Country
Phone / Fax

CHROMABOND® special columns acc. to customers specifications

In order to handle the increasing requests for custom-made CHROMABOND® columns, MACHERY-NAGEL offers this special service. You can ask for an offer concerning SPE columns prepared according to your special needs (volume, sorbent weight) by simply copying this page, completing it and mailing or faxing it to us.

Type of SPE column (check appropriate box for material and volume)

available volume:	1 ml	3 ml	6 ml	15 ml	30 ml	45 ml	70 ml	150 ml
polypropylene column	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
glass column	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
maximum adsorbent weight (mg SiOH)	500	1 400	3 300	5 900	11 000	17 000	30 000	30 000

Column bed (upper bed for combinations): adsorbent: weight: mg

2. (lower) column bed (if desired): adsorbent: weight: mg

Frit material: glass fibre polyethylene

Required number: columns

Remarks (e. g. lot reservation, special requirements concerning packing or column, term of delivery required)

.....
.....

1 ml 3 ml 6 ml 15 ml 45 ml 70 ml 150 ml



CHROMAFIL[®] disposable filters for sample clarification

General

Disposable filters CHROMAFIL[®] are used for filtration of suspended matter from liquid samples. They feature

- **good pressure stability** – because they are ultrasonically sealed and not glued
- **high flow rates** and filtration in both directions (the liquid cannot bypass the filter membrane)
- **low dead volume** (~120 µl for 25 mm diameter, ~ 12 µl for 15 mm diameter and ~ 5 µl for 3 mm diameter).
- **very well suited for automation**, because the housing has been optimised for application in laboratory robots

With CHROMAFIL[®], rapid purification and removal of particles from liquid samples or gases is very simple: just place the filter on the syringe and you are ready for filtration. Special manipulations are not required. Contamination of sensitive instrumentation by solid impurities can be avoided, thus increasing the lifetime of chromatographic columns and equipment.

Application

CHROMAFIL[®] filters find numerous applications such as non-sterile filtrations during sample preparation in analytical chemistry, clinical chemistry, biology, cytology, radiochemistry, medicine, pharmacy, food and beverage industry and in environmental research.

Depending on your filtration problem you can choose filter membranes made from different materials:

- **Cellulose mixed esters (MV)** – this membrane is recommended for all filtrations in aqueous or polar media.
- **Cellulose acetate (CA)** – the disposable cellulose acetate filters from MACHEREY-NAGEL show a very low binding capacity for proteins. CA filters are available in a sterile and a non-sterile package. For sterile filtration and ultracleaning of liquids we recommend our CHROMAFIL[®] CA-20/25S. This filter guarantees a high efficiency even for filtration of media for cell and tissue cultures. For removal of particulate matter from liquids as well as for the microbial reduction filtration and particulate removal from dry air and gases we recommend our filters CHROMAFIL[®] CA-45/25S.
- **Regenerated cellulose (RC)** – this hydrophilic membrane features a very low adsorption; it is recommended for filtration of aqueous or organic / aqueous medium polar liquids
- **Polyamide (PA)** – this is a rather hydrophilic material; it is recommended for filtration of aqueous or organic / aqueous medium polar liquids.
- **Teflon[®] (PTFE)** – PTFE membranes are hydrophobic; thus they are ideal for the filtration of nonpolar liquids and gases. They are very resistant towards all kinds of solvents as well as with acids or bases. By flushing with alcohol, followed by water, the originally hydrophobic membrane can be made more hydrophilic.



- **Polyvinylidene difluoride (PVDF)** – this membrane features a stability and hydrophobic interactions similar to PTFE. We recommend it especially for filtration of water-soluble oligomers and polymers, e.g. protein solutions. It can also be used for the filtration of hydrophobic substances in different organic solvents.
- **Polyester (PET)** – this membrane features an outstanding chemical resistance and is suited for polar as well as nonpolar solvents. This allpurpose membrane is recommended for sterile filtration, filtration of aggressive media, for dust and aerosol analyses, ultrapurification of solvents etc. It is very well suited for TOC/DOC determination. The membrane is not cytotoxic and does not inhibit the growth of microorganisms and higher cells.
- **Glass fibre (GF)** – The nominal pore size of these filters is 1 µm. They can be used for solutions with high loads of particulate matter or for highly viscous solutions (e. g. soil samples, fermentation broths) either alone or combined with other CHROMAFIL[®] filters. When membrane filters are combined with glass fibre filters, they prevent plugging of the membrane. Used alone, glass fibre filters allow higher flow rates than e. g. a 0.45 µm filter.

CHROMAFIL[®] filters are available with pore diameters of 0.2 and 0.45 µm (exception: glass fibre filters with 1 µm and PET filters with 1.2 µm) and filter sizes of 25, 15 and 3 mm diameter. The small diameter filters are especially recommended for very small samples, which require extremely low dead volumes.

Recommended filter size depending on sample volume

sample volume	recommended filter diameter
≤ 1 ml	3 mm
1 – 10 ml	15 mm
10 – 100 ml	25 mm



Membrane filters

CHROMAFIL[®] disposable filters for sample clarification

Ordering information

Cat. No.	CHROMAFIL [®] type (housing material = PP)	Membrane		Pack of [filters]	Colour code		Recommended application
		pore dia. [µm]	dia. [mm]		top	bottom	
Cellulose mixed esters (MV)							
729006	A-20/25	0.20	25	100	yellow	yellow	filtration of polar sample solutions
729004	A-45/25	0.45	25	100	colourless	yellow	
Cellulose acetate (CA) – sterile and nonsterile							
729024	CA-20/25 S	0.20	25	50	yellow	red	sterile filtration
729025	CA-45/25 S	0.45	25	50	colourless	red	filtration of water-soluble oligomers and polymers, especially suited for biological macromolecules
729026	CA-20/25	0.20	25	100	yellow	red	
729027	CA-45/25	0.45	25	100	colourless	red	
Regenerated cellulose (RC)							
729030	RC-20/25	0.20	25	100	yellow	blue	filtration of polar and medium polar sample solutions
729031	RC-45/25	0.45	25	100	colourless	blue	
Polyamide (PA)							
729010	AO-20/3	0.20	3	100	yellowish	yellowish	filtration of medium polar sample solutions
729011	AO-45/3	0.45	3	100	yellowish	yellowish	
729012	AO-20/25	0.20	25	100	yellow	green	
729013	AO-45/25	0.45	25	100	colourless	green	
Polytetrafluoroethylene (PTFE)							
729014	O-20/3	0.20	3	100	colourless	colourless	filtration of nonpolar sample solutions flush with alcohol for polar sample solutions (MS = minispikes on filter exit)
729015	O-45/3	0.45	3	100	colourless	colourless	
729008	O-20/15 MS	0.20	15	100	yellow	colourless	
729009	O-45/15 MS	0.45	15	100	colourless	colourless	
729007	O-20/25	0.20	25	100	yellow	colourless	
729005	O-45/25	0.45	25	100	colourless	colourless	
Polyvinylidene difluoride (PVDF)							
729018	P-20/25	0.20	25	100	white	white	filtration of water-soluble oligomers and polymers, e.g. proteins, also applicable for polar and nonpolar solutions
729019	P-45/25	0.45	25	100	white	white	
Polyester (PET)							
729022	PET-20/15 MS	0.20	15	100	yellow	orange	“multipurpose membrane” for polar and non-polar solutions, especially suited for mixtures of water and organic solvents which are frequently used as eluents in HPLC (MS = minispikes on filter exit)
729023	PET-45/15 MS	0.45	15	100	colourless	orange	
729021	PET-20/25	0.20	25	100	yellow	orange	
729020	PET-45/25	0.45	25	100	colourless	orange	
729029	PET-120/25	1.2	25	100	colourless	black	
Glass fibre (GF)							
729028	GF-100/25	nominal 1.0	25	100	yellow	black	for solutions with a high load of particulate matter and highly viscous solutions, or as prefilter for other CHROMAFIL [®] filters
Glass fibre (GF) / Polyester (PET)							
729032	GF/PET-20/25	0.20	25	100	blue	orange	polyester filter with integrated glass fibre pre-filter, for solutions with a high load of particulate matter and highly viscous solutions
729033	GF/PET-45/25	0.45	25	100	black	orange	
Disposable syringes with Luer tip							
729100	2 ml sample volume			100			
729101	5 ml sample volume			100			
729102	10 ml sample volume			100			



CHROMAFIL® disposable filters for sample clarification

Technical data

The membrane housing consists of polypropylene (PP). This material is very resistant towards most solvents and has a very low content of extractable substances. Thus it can be used with almost all solvents, acids and bases (see table). The special thick rim of the housing is ideal for use of the filters in laboratory robots (e.g. Benchmate™).

Filter inlet and filter exit can be fitted to the CHROMABOND® columns for selective sample preparation with the aid of a special adaptor.

All filters can be autoclaved at 121 °C and 1.1 bar for 30 minutes.

Chemical compatibility of CHROMAFIL® materials

The following table lists the chemical compatibility of our CHROMAFIL® materials. The chemical compatibility depends on several parameters such as time, pressure, temperature, concentration.

In most cases CHROMAFIL® filters will have only short contact with a solvent. In these cases they may be used despite of limited compatibility. For example, a PTFE filter with PP housing does not liberate any UV detectable substances during filtration of 5 ml THF, although PP shows only limited resistance towards THF.

Data not guaranteed.

- + resistant, – not resistant, ○ limited resistance
- PP = polypropylene, MV = cellulose mixed esters,
- CA = cellulose acetate, PA = polyamide, PET = polyester,
- PVDF = polyvinylidene difluoride,
- PTFE = polytetrafluoroethylene (Teflon®), GF = glass fibre

Solvent	Material									
	MV	CA	RC	PA	PTFE	PVDF	PET	GF	PP	
Acetaldehyde	-	-	+	○	+	-	+	+	○	
Acetic acid, 100%	-	-	-	-	+	+	+	+	+	
Acetone	-	-	+	+	+	○	+	+	+	
Acetonitrile	-	-	+	+	+	○	+	+	+	
Ammonia, 25%	-	-	○	-	+	+	○	+	+	
Benzene	+	+	+	+	+	+	+	+	○	
n-Butanol	+	+	+	○	+	○	+	+	+	
Carbon tetrachloride	+	-	+	+	+	+	+	+	○	
Chloroform	+	-	+	-	+	+	+	+	-	
Cyclohexane	+	+	+	○	+	+	+	+	+	
Diethyl ether	○	○	○	+	+	○	+	+	○	
Dimethylformamide	-	-	+	+	+	+	+	+	+	
1,4-Dioxane	-	-	+	+	+	○	+	+	○	
Ethanol	-	+	+	+	+	+	+	+	+	
Ethyl acetate	-	-	+	+	+	○	+	+	○	
Ethylene glycol	○	○	+	+	+	+	+	+	+	
Formic acid, 100%	+	-	○	-	+	+	○	+	+	
Hydrochloric acid, 30%	-	-	-	-	+	+	-	+	+	
Methanol	-	-	+	+	+	+	+	+	+	
Methylene chloride	+	-	+	-	+	○	+	+	-	
Nitric acid, 65%	-	-	-	-	○	+	○	+	-	
Oxalic acid, 10% aqueous	+	-	+	-	+	+	+	+	+	
Petroleum ether	+	+	+	+	+	+	+	+	+	
Phosphoric acid, 80%	-	-	○	-	+	+	+	+	+	
Potassium hydroxide, 1 N	-	-	○	+	+	○	○	+	+	
2-Propanol	+	+	+	+	+	+	+	+	+	
Sodium hydroxide, 1 N	-	-	○	+	+	○	○	○	+	
Tetrahydrofuran	-	-	+	+	+	+	+	+	○	
Toluene	+	-	+	+	+	+	+	+	○	
Trichloroethylene	+	+	+	○	+	+	+	+	○	
Urea	+	+	+	+	+	+	+	+	+	
Water	+	+	+	+	+	+	+	+	+	
Xylene	+	+	+	+	+	+	+	+	-	



Microtiter plates CHROMABOND® MULTI 96 for efficient filtration in 96-well format

Cat. No.	Description	Pack of
738770.M	Microtiter plates with cellulose mixed ester filter elements (0.20 µm)	1
738771.M	Microtiter plates with cellulose mixed ester filter elements (0.45 µm)	1
738772.M	Microtiter plates with cellulose mixed ester filter elements (3.0 µm)	1
738656.M	Microtiter plates with RC filter elements (regenerated cellulose, 0.2 µm)	1
738657.M	Microtiter plates with RC filter elements (regenerated cellulose, 0.45 µm)	1
738660.M	Microtiter plates with PTFE filter elements (0.2 µm)	1
738661.M	Microtiter plates with PTFE filter elements (0.45 µm)	1
738662.M	Microtiter plates with PTFE filter elements (1.0 µm)	1
738663.M	Microtiter plates with PTFE filter elements (3.0 µm)	1
738655.M	Microtiter plates with PE filter elements (20 µm)	1
738659.M	Microtiter plates with PE filter elements (50 µm)	1
738655.2M	Microtiter plates with glass fibre filter elements (nominal 1 µm)	1
738658.M	Microtiter plates with glass fibre filter elements (nominal 3 µm)	1
738630.M	CHROMABOND® MULTI 96 vacuum manifold with reservoir tank, vacuum gauge, and control valve, required for filtration with microtiter plates	1