Chromatography

MACHEREY-NAGEL

CHROMABOND®
Flash cartridges

Solutions for preparative purifications

- Resolution
- Quality
- Safety

ADIS INTERNATIONAL

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MACHEREY-NAGEL products for flash chromatography

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Introduction

For decades flash chromatography has been the tool for the preparative purification of compound mixtures in the chemical and pharmaceutical industry. In chemistry labs glass columns have manually been packed with silica based adsorbents as stationary phase. The purified compounds were eluted with suitable solvents under low pressure. However column packing is time-consuming and labor-intensive. In order to speed up the whole purification process in chemistry labs MACHEREY-NAGEL offers ready-to-use prepacked polypropylene cartridges with high pressure stability. These can be used in combination with the common automated flash systems. The large portfolio of various CHROMABOND® cartridges enables professionals to choose the cartridge which suits best the individual needs.

The CHROMABOND® Flash cartridge portfolio offers:

Complete program of ready-to-use flash cartridges for

- Isco Companion® and other Teledyne Isco CombiFlash® systems
- Biotage® Isolera™, Biotage® FlashMaster™ or as stand-alone version for all pump / detector combinations, e.g., from Biotage®, Büchi
- Yamazen Smart Flash, Interchim® puriFlash® systems

Enhanced flexibility and reliable upscaling

- All common RP and NP phases available on request
- Adsorbent weights from 4 g up to 3000 g
- Spherical and irregular silica available

Increased analytical safety

- Organic solvent resistant, low bleed polypropylene cartridges, thick column walls, one piece body, optimized length-to-diameter ratio for high plate numbers and excellent separation efficiencies
- Distribution of eluent stream via highly porous filter elements; larger cartridges (≥ 40 g) also contain a distribution plate for optimal flow geometry
- Optimized polypropylene hardware for high pressure stability of up to 21 bar

High quality standard

- All flash cartridges and adsorbents undergo comprehensive during- and after-production quality assurance measures to ensure that the products comply with the specification.
- Tube material is made of pharmaceutical and food grade polypropylene

Outstanding price-performance ratio

Flash cartridge guide

Choose your CHROMABOND® Flash cartridge

CHROMABOND® cartridge	Mode	Silica type	Characteristics	Page
Flash RS SiOH 40–63 µm	NP		Resolution ●●● Loading capacity ●●● Performance ●●●	6
Flash RS SiOH 15–40 µm	NP		Resolution ●●●◖ Loading capacity ●●●◖ Performance ●●●◖	6
Flash RS C_{18} ec 40–63 µm	RP		Resolution ●●● Loading capacity ●●◖ Performance ●●●	7
Flash RS C_{18} ec 15–40 µm	RP		Resolution ●●●◖ Loading capacity ●●◖ Performance ●●●◖	7
Flash RS SPHERE SiOH 25 µm	NP		Resolution ●●●●◖ Loading capacity ●●●●◖ Performance ●●●●◖	8
Flash RS SPHERE SiOH 15 µm	NP		Resolution ●●●●● Loading capacity ●●●●● Performance ●●●●●	8
Flash BT SiOH 40–63 µm	NP		Resolution ●●● Loading capacity ●●● Performance ●●●	9

NP = normal phase, RP = reversed phase
▲ = irregular, ● = spherical

CHROMABOND® Flash RS series

Hardware

- Heavy-duty polypropylene cartridges designed for use in Teledyne Isco CombiFlash® systems (Companion®, R_f etc.) without additional connectors or capillaries; compatible with all other flash systems, e.g., Yamazen Smart Flash, Interchim® puriFlash®, etc.
- Optimized hardware with high pressure stability of up to 21 bar
- 4 g up to 3000 g adsorbent-packed cartridges from one of the leading companies in silica and TLC business for convenient operation and reliable upscaling
- Column connection: Cartridges up to RS 330: female Luer lock inlet and male Luer outlet; RS 800, RS 1600 and RS 3000: Maxi Luers
- Using the CHROMABOND® Flash Starter Kit, REF 730798 or the CHROMABOND® Flash Stand Alone Kit, REF 732903 (see page 19), CHROMABOND® RS cartridges can also be used as stand alone system with any pump / detector / fraction collector combination (except RS 800, RS 1600 and RS 3000 with Maxi Luers)

Adsorbents

- SiOH 40–63 µm
- SiOH 15–40 µm
- C_{18} ec 40–63 µm
- C_{18} ec 15–40 µm
- SPHERE SiOH 25 µm
- SPHERE SiOH 15 µm
- Other CHROMABOND® adsorbents available on request

CHROMABOND® Flash RS series

CHROMABOND® Flash RS SiOH

CHROMABOND® Flash RS SiOH are known for fast and economical chromatographic purifications in industry. The highly pure silica (acid washed) is available in two particle sizes. It shows a narrow particle size distribution, a low trace metal content and a low level of fines, which guarantees good resolution and peak shape for standard applications. The excellent price performance level, the extensive range of cartridges and particle sizes as well as available modifications make them a standard in industry.

Technical data

Irregular unmodified silica
Particle sizes: 40–63 µm or 15–40 µm
Specific surface area: 500 m^2/g
Pore size: 60 Å
pH stability: 2–8

Ordering information

Cartridge	Column length [cm]	ID [mm]	Adsorbent weight [g]	Loading capacity *	Typical flow rate [mL/min]	Max. pressure [bar / psi]	Pack of	REF
CHROMABOND® Flash RS SiOH 40–63 µm								
RS 4	9.8	12.4	4	4 mg–0.4 g	10–50	21 / 305	20	732800
RS 15	11.6	21.2	15	15 mg–1.5 g	25–70	21 / 305	20	732801
RS 25	16.5	21.2	25	25 mg–2.5 g	25–70	21 / 305	15	732802
RS 40	17.1	26.4	40	40 mg–4.0 g	35–80	21 / 305	15	732803
RS 80	24.0	30.8	80	80 mg–8.0 g	45–105	15 / 218	12	732804
RS 120	25.5	36.0	120	120 mg–12 g	55–155	15 / 218	10	732805
RS 200	20.0	60.0	200	200 mg–20 g	75–225	12 / 174	6	732806
RS 330	27.0	60.0	330	330 mg–33 g	75–225	12 / 174	4	732807
RS 800	38.5	82.0	800	800 mg–80 g	100–300	12 / 174	2	732808
RS 1600	43.0	104.0	1600	1.6 g–160 g	200–500	12 / 174	2	732809
RS 3000	51.0	127.5	3000	3 g–300 g	200–500	7 / 102	1	732850
CHROMABOND® Flash RS SiOH 15–40 µm								
RS 4	9.8	12.4	4	4 mg–0.6 g	10–50	21 / 305	20	732700
RS 15	11.6	21.2	15	15 mg–2.3 g	25–70	21 / 305	20	732701
RS 25	16.5	21.2	25	25 mg–3.8 g	25–70	21 / 305	15	732702
RS 40	17.1	26.4	40	40 mg–6.0 g	35–80	21 / 305	15	732703
RS 80	24.0	30.8	80	80 mg–12 g	45–105	15 / 218	12	732704
RS 120	25.5	36.0	120	120 mg–18 g	55–155	15 / 218	10	732705
RS 200	20.0	60.0	200	200 mg–30 g	75–225	12 / 174	6	732706
RS 330	27.0	60.0	330	330 mg–49 g	75–225	12 / 174	4	732707
RS 800	38.5	82.0	800	800 mg–120 g	100–300	12 / 174	2	732708
RS 1600	43.0	104.0	1600	1.6 g–240 g	200–500	12 / 174	2	732709

* Orientation value

Other CHROMABOND® adsorbents on request.

CHROMABOND® Flash RS series

CHROMABOND® Flash RS C_{18} ec

C_{18} ec modified silica is the phase of choice for the purification of very hydrophilic compounds that are irreversibly retained or react with unmodified silica, or of highly hydrophobic compounds which do not show retention. Here, aqueous-organic mobile phases are usually used. Thus, reversed phases provide the chemists with great options for the purification of a variety of compound mixtures. For decades MACHEREY-NAGEL has proven highest expertise in the modification of silica resulting in excellent adsorbent quality and reproducibility you profit from.

Technical data

Irregular endcapped octadecyl modified (C_{18} ec) silica
Particle sizes: 40–63 µm or 15–40 µm
Specific surface area: 500 m^2/g
Pore size: 60 Å
pH stability: 2–8

Ordering information

Cartridge	Column length [cm]	ID [mm]	Adsorbent weight [g]	Loading capacity *	Typical flow rate [mL/min]	Max. pressure [bar / psi]	Pack of	REF
CHROMABOND® Flash RS C_{18} ec 40–63 µm								
RS 4	9.8	12.4	4.3	4 mg–86 mg	10–25	21 / 305	2	732810
RS 15	11.6	21.2	16.4	16 mg–328 mg	15–35	21 / 305	1	732811
RS 25	16.5	21.2	26	26 mg–520 mg	15–35	21 / 305	1	732812
RS 40	17.1	26.4	43	55 mg–860 mg	20–45	21 / 305	1	732813
RS 80	24.0	30.8	86	86 mg–1.72 g	30–65	15 / 218	1	732814
RS 120	25.5	36.0	130	130 mg–2.6 g	40–85	15 / 218	1	732815
RS 200	20.0	60.0	220	220 mg–4.4 g	50–105	12 / 174	1	732816
RS 330	27.0	60.0	360	360 mg–7.2 g	50–105	12 / 174	1	732817
RS 800	38.5	82.0	880	880 mg–17.6 g	60–200	12 / 174	1	732818
RS 1600	43.0	104.0	1760	1.76 g–35.2 g	60–200	12 / 174	1	732819
CHROMABOND® Flash RS C_{18} ec 15–40 µm								
RS 4	9.8	12.4	4	4 mg–86 mg	10–25	21 / 305	2	732710
RS 15	11.6	21.2	16.4	16 mg–328 mg	15–35	21 / 305	1	732711
RS 25	16.5	21.2	26	26 mg–520 mg	15–35	21 / 305	1	732712
RS 40	17.1	26.4	43	55 mg–860 mg	20–45	21 / 305	1	732713
RS 80	24.0	30.8	86	86 mg–1.72 g	30–65	15 / 218	1	732714
RS 120	25.5	36.0	130	130 mg–2.6 g	40–85	15 / 218	1	732715
RS 200	20.0	60.0	220	220 mg–4.4 g	50–105	12 / 174	1	732716
RS 330	27.0	60.0	360	360 mg–7.2 g	50–105	12 / 174	1	732717
RS 800	38.5	82.0	880	880 mg–17.6 g	60–200	12 / 174	1	732718
RS 1600	43.0	104.0	1760	1.76 g–35.2 g	60–200	12 / 174	1	732719

* Orientation value

Other CHROMABOND® adsorbents on request.

CHROMABOND® Flash RS SPHERE SiOH

MACHEREY-NAGEL's CHROMABOND® Flash RS SPHERE SiOH product line was engineered to achieve highest performance in flash chromatography. The new 15 and 25 µm ultra-pure silica is characterized by its spherical particles and tight particle size distribution to obtain a uniform cartridge packing during production. This improves peak shape, minimizes band broadening and enables high flow rates without increasing the backpressure. Its optimized specific surface exceeds that of regular silica by 40 % which allows higher sample loading. The user benefits overall because smaller, cheaper cartridges can be used. Smaller cartridges require less solvent and allow faster separations.

Technical data

Spherical unmodified silica
Particle sizes: 15 µm or 25 µm
Specific surface area: 700 m^2/g
Pore size: 50 Å
pH stability: 2–8

Advantages of SPHERE silica over standard silica

- Superior resolution and performance
- Less backpressure due to a better packing of spherical particles and less fines
- Higher sample loading capacity of up to 40 %
- Smaller cartridges are required
- Less solvent is needed
- Faster separations

Ordering information

Cartridge	Column length [cm]	ID [mm]	Adsorbent weight [g]	Loading capacity *	Typical flow rate [mL/min] **	Max. pressure [bar / psi]	Pack of	REF
CHROMABOND® Flash RS SPHERE SiOH 25 µm								
RS 4	9.8	12.4	4	4 mg–1.2 g	10–40	21 / 305	20	732460
RS 15	11.6	21.2	12	12 mg–3.6 g	20–60	21 / 305	20	732461
RS 25	16.5	21.2	25	25 mg–7.5 g	20–70	21 / 305	15	732462
RS 40	17.1	26.4	40	40 mg–12 g	25–80	21 / 305	15	732463
RS 80	24.0	30.8	80	80 mg–24 g	35–90	15 / 218	12	732464
RS 120	25.5	36.0	120	120 mg–36 g	55–110	15 / 218	10	732465
RS 200	20.0	60.0	220	220 mg–66 g	75–170	12 / 174	6	732466
RS 330	27.0	60.0	330	330 mg–99 g	75–170	12 / 174	4	732467
CHROMABOND® Flash RS SPHERE SiOH 15 µm								
RS 4	9.8	12.4	4	4 mg–1.2 g	10–40	21 / 305	20	732760
RS 15	11.6	21.2	12	12 mg–3.6 g	20–60	21 / 305	20	732761
RS 25	16.5	21.2	25	25 mg–7.5 g	20–70	21 / 305	15	732762
RS 40	17.1	26.4	40	40 mg–12 g	25–80	21 / 305	15	732763
RS 80	24.0	30.8	80	80 mg–24 g	35–90	15 / 218	12	732764
RS 120	25.5	36.0	120	120 mg–36 g	55–110	15 / 218	10	732765
RS 200	20.0	60.0	220	220 mg–66 g	75–170	12 / 174	6	732766
RS 330	27.0	60.0	330	330 mg–99 g	75–170	12 / 174	4	732767

* Orientation value
** For column conditioning we recommend a maximum flow rate of 20–30 mL/min.

CHROMABOND® Flash BT series

CHROMABOND® Flash BT SiOH

Hardware

These heavy-duty polypropylene cartridges were designed for the use in Biotage® Isolera™ systems without additional connectors or capillaries.

- Optimized hardware with high pressure stability of up to 21 bar
- Column connection: female Luer lock inlet and male Luer lock outlet
- When used with the CHROMABOND® Flash Starter Kit, REF 730798 or the CHROMABOND® Flash Stand Alone Kit, REF 732903 (see page 19), CHROMABOND® Flash BT cartridges can also be operated as stand alone system with any pump / detector / fraction collector combination.

Technical data

Irregular unmodified silica
Particle size: 40–63 µm
Specific surface area: 500 m^2/g
Pore size: 60 Å
pH stability: 2–8

Ordering information

Cartridge	Column length [cm]	ID [mm]	Adsorbent weight [g]	Loading capacity *	Typical flow rate [mL/min]	Max. pressure [bar / psi]	Pack of	REF
CHROMABOND® Flash BT SiOH 40–63 µm								
BT 4	9.8	12.4	4	4 mg–0.4 g	10–50	21 / 305	20	732960
BT 15	11.6	21.2	15	15 mg–1.5 g	25–70	21 / 305	20	732961
BT 25	16.5	21.2	25	25 mg–2.5 g	25–70	21 / 305	15	732962
BT 40	17.1	26.4	40	40 mg–4.0 g	35–80	21 / 305	15	732963
BT 80	24.0	30.8	80	80 mg–8.0 g	45–105	15 / 218	12	732964
BT 120	25.5	36.0	120	120 mg–12 g	55–155	15 / 218	10	732965
BT 200	20.0	60.0	200	200 mg–20 g	75–225	12 / 174	6	732966
BT 330	27.0	60.0	330	330 mg–33 g	75–225	12 / 174	4	732967

* Orientation value

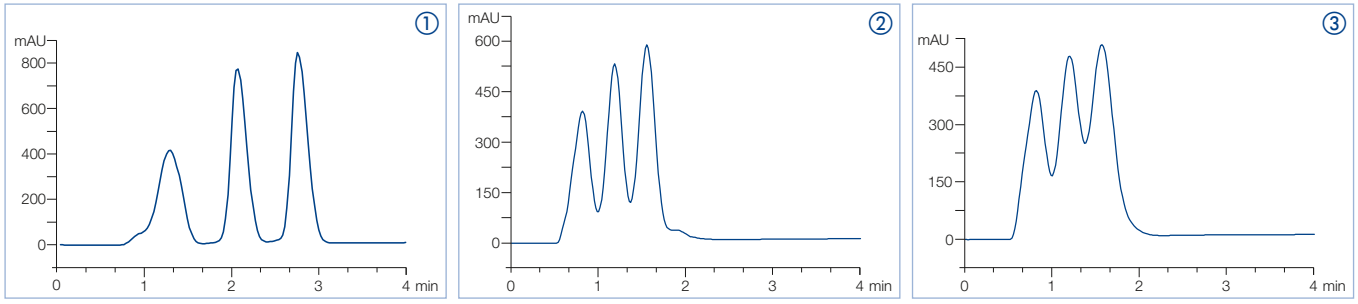
Resolution

Resolution (R_s) is influenced by three terms: selectivity, efficiency and retention. The most important parameter to improve resolution (and thereby loading capacity) is the selectivity. It can be altered by using a different type of stationary phase or by changing eluent properties. If this is not possible, efficiency can be increased by choosing smaller particles. The particle size is inversely proportional to the plate numbers and thus to the efficiency. Furthermore, spherical particles with a tight particle size distribution can be packed more uniformly into the cartridges than irregular particles. Those packings often show channeling or pockets, which causes band spreading and a decrease in resolution. SPHERE SiOH combines those advantages to provide superior resolution in comparison to irregular SiOH as demonstrated in the example chromatograms shown below.

$$R_s = \frac{\sqrt{N}}{4}\left(\frac{\alpha - 1}{\alpha}\right)\left(\frac{k'_i}{k'_i + 1}\right)$$

R_s = Resolution
α = Selectivity
k'_i = Retention
N = Theoretical plates $N \sim 1/d_P$
d_P = Particle size

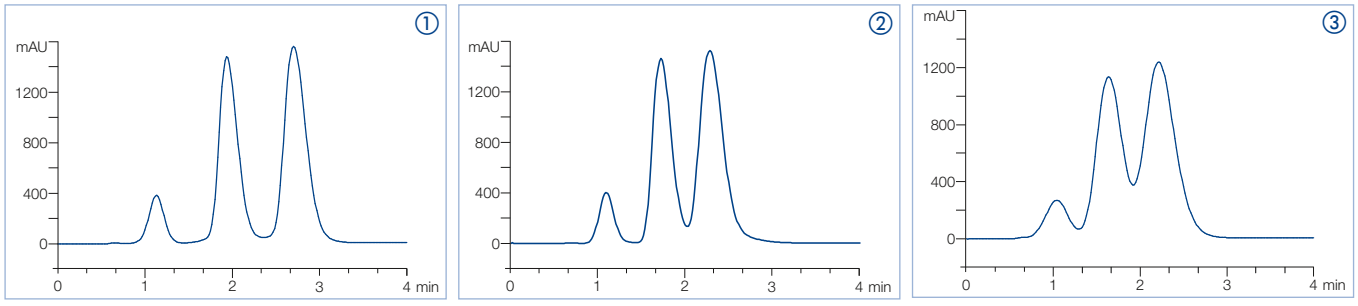
The separation of three structurally related phthalates was performed with three silica packed cartridges under identical conditions (chromatograms below). The use of SPHERE SiOH makes it possible to separate all three compounds within 2.1 min. The irregular silicas showed only incomplete separation.



Conditions
Substances: dibutyl phthalate, diethyl phthalate, dimethyl phthalate
Sample loading: 500 mg
Solvent A: cyclohexane
Solvent B: ethyl acetate
Gradient: 20 % B to 50 % B in 6 min
Flow: 80 mL/min

① CHROMABOND® Flash RS 40 SPHERE SiOH 25 µm
② CHROMABOND® Flash RS 40 SiOH 15–40 µm
③ CHROMABOND® Flash RS 40 SiOH 40–63 µm

Another example is the separation of two parabens and the structurally related 3,5-dibenzyloxyacetophenone. A SPHERE SiOH packed cartridge provided excellent separation within only 3.3 min. Under identical conditions a baseline separation was not possible with irregular silicas.



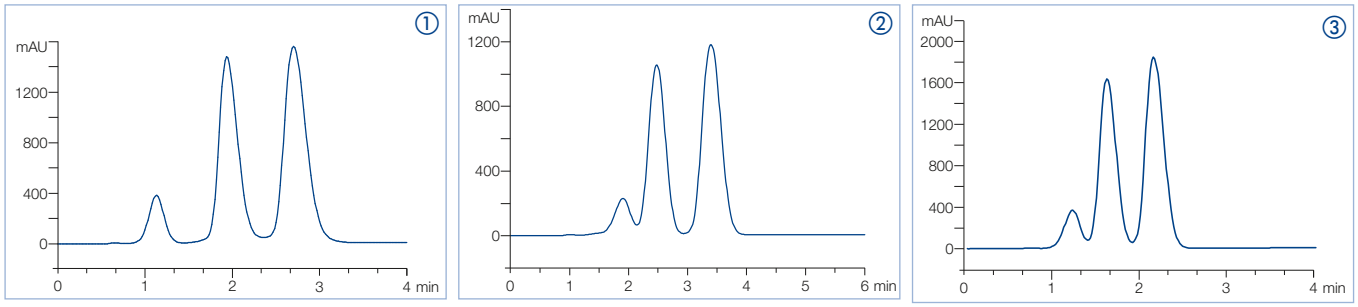
Conditions
Substances: 3,5-dibenzyloxyacetophenone, butylparaben, methylparaben
Sample loading: 165 mg
Solvent A: cyclohexane
Solvent B: ethyl acetate
Gradient: 20 % B to 80 % B in 4 min
Flow: 80 mL/min

① CHROMABOND® Flash RS 40 SPHERE SiOH 15 µm
② CHROMABOND® Flash RS 40 SiOH 15–40 µm
③ CHROMABOND® Flash RS 40 SiOH 40–63 µm

Background information CHROMABOND® SPHERE SiOH

Comparison to competitor cartridges

The properties of the high performance silica in combination with the innovative packing process provide the user with cartridges of superior performance. Three cartridges packed with spherical particles were compared regarding the separation of two parabens and the structurally related 3,5-dibenzyloxyacetophenone. The CHROMABOND® Flash RS SPHERE SiOH cartridge outperforms the competitor cartridges. All peaks were baseline-separated within only 3.3 min. The competitor cartridges failed to separate all peaks under identical conditions.

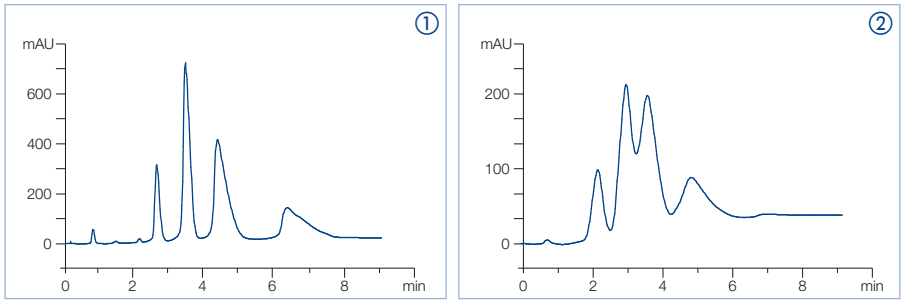


Conditions
Substances: 3,5-dibenzyloxyacetophenone, butylparaben, methylparaben
Sample loading: 165 mg
Solvent A: cyclohexane
Solvent B: ethyl acetate
Gradient: 20 % B to 80 % B in 4 min
Flow: 80 mL/min

① CHROMABOND® Flash RS 40 SPHERE SiOH 25 µm
② Competitor A: spherical SiOH, 25 µm, 50 g
③ Competitor B: spherical SiOH, 20–40 µm, 40 g

Loading capacity

In preparative chromatography loading capacity is a significant parameter. In case of SPHERE SiOH adsorbent, loading capacity can often be doubled in comparison to standard silica due to a 40 % larger specific surface and its spherical particle shape. As an example a mixture of four pyrazines should be separated with a 40 g silica cartridge (see chromatograms). The SPHERE SiOH 15 µm packed cartridge was able to baseline-separate 800 mg of the complex mixture. In contrast, a SiOH 40–63 µm packed cartridge was not able to separate 800 mg of the mixture.



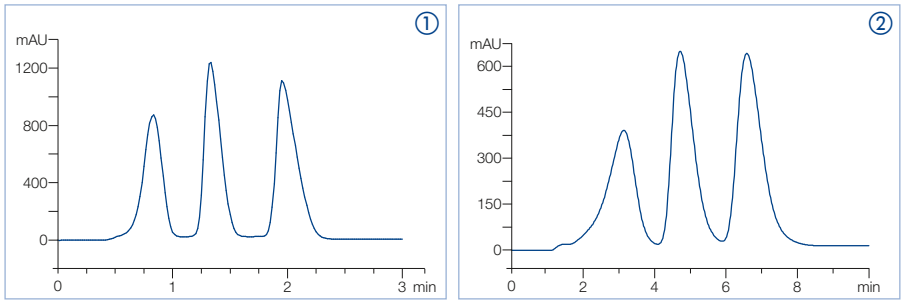
Conditions
Substances: 2,5-dimethylpyrazine, 2-acetylpyrazine, 2-ethylpyrazine, 2-methoxypyrazine
Sample loading: 800 mg
Solvent A: cyclohexane
Solvent B: ethyl acetate
Gradient: 10 % B to 80 % B in 6 min, 90 % B for 5 min
Flow: 80 mL/min

① CHROMABOND® Flash RS 40 SPHERE SiOH 15 µm
② CHROMABOND® Flash RS 40 SiOH 40–63 µm

Background information CHROMABOND® SPHERE SiOH

Performance

SPHERE SiOH provides the user with an overall superior performance to standard irregular SiOH. As an example the method for the separation of three phthalates (total of 1 g of sample) was optimized for a CHROMABOND® Flash RS 40 cartridge filled with SPHERE SiOH 15 µm and SiOH 40–63 µm respectively (see below). The separation with the SiOH 40–63 µm filled cartridge took 8.5 min and 340 mL of the solvent mixture were consumed. In contrast such separation with the SPHERE SiOH filled cartridge was achieved within 2.5 min using a total solvent volume of only 200 mL.



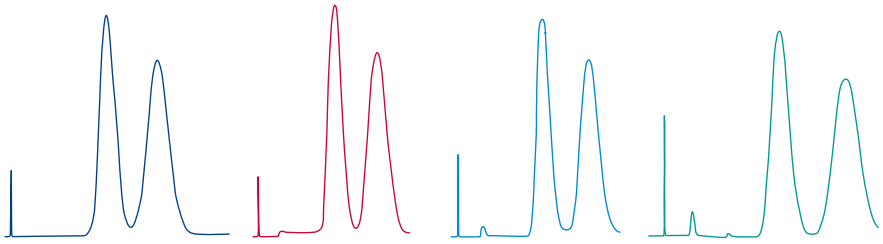
Conditions
Substances: dibutyl phthalate, diethyl phthalate, dimethyl phthalate
Sample loading: 1 g
Solvent A: cyclohexane
Solvent B: ethyl acetate
Gradient: ① 20 % B to 80 % B in 8 min; ② 5 % B to 30 % B in 10 min
Flow: ① 80 mL/min; ② 40 mL/min
Total solvent used: ① 200 mL; ② 340 mL

① CHROMABOND® Flash RS 40 SPHERE SiOH 15 µm
② CHROMABOND® Flash RS 40 SiOH 40–63 µm

Technical information and support

Separation efficiency and reproducibility

Our optimized 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). MACHEREY-NAGEL, as a manufacturer of silicas, has decades of experience in the production of first class separation phases and columns. This leads to highest separation efficiencies of the columns, a constant back pressure (via controlled narrow particle size distribution) and good reproducibility from cartridge to cartridge. The separation efficiency is in the first place not influenced by the dimension or the geometry of the flash cartridges. The chromatograms below show an identical resolution and peak shape for different column dimensions, when flow and sample amount are adjusted correctly. This is advantageous for optimization and upscaling experiments.



4 g SiOH: 0.25 mL sample, 10 mL/min | 15 g SiOH: 1 mL sample, 40 mL/min | 25 g SiOH: 1 mL sample, 80 mL/min | 40 g SiOH: 1 mL sample, 160 mL/min

Upscaling of the optimum flow rate and sample loading

Please note that the scale-up factor always depends on the individual separation problem and purification conditions.

To scale-up the sample loading weight the adsorbent weight needs to be adjusted by the scale-up factor (SF). The relation is linear as long as the other scale-up parameters are kept constant.

In case of switching between two cartridge sizes the flow rate needs to be corrected to obtain the same resolution. The scale up-factor for the flow rate (SF_{FR}) depends in the easiest case on the square root of the column inner diameter (see formula on the right). In other cases SF_{FR} can be calculated by linear velocity. During the upscaling process the linear velocity of the solvent through the columns should be kept at a constant rate.

$$SF_{FR} = \frac{(ID_{new})^2}{(ID_{old})^2}$$

Conditioning volumes for CHROMABOND® Flash RS / BT cartridges (normally 2–6 column volumes of the eluent)

Cartridge	Volume of eluent for conditioning
RS / BT 4	16–48 mL
RS / BT 15	60–180 mL
RS / BT 25	90–270 mL
RS / BT 40	150–450 mL
RS / BT 80	320–960 mL

Cartridge	Volume of eluent for conditioning
RS / BT 120	440–1320 mL
RS / BT 200	820–2460 mL
RS / BT 330	1200–3600 mL
RS 800	3590–10770 mL
RS 1600	6710–20130 mL

Back pressure of CHROMABOND® cartridges at typical flow rates

The back pressure always depends on the flow rate and viscosity of the eluent mixture, column length and diameter as well as on the particle size. The high performance CHROMABOND® Flash cartridges are stable up to 21 bar depending on their size. We recommend using a pressure guard because short time pressure peaks (viscosity of eluent or gradient changes) can exceed the pressure limit.

CHROMABOND® Flash SiOH 40–63 µm cartridges (eluent hexane – ethyl acetate 9:1 or 8:2)

Cartridge	20 mL/min	40 mL/min	80 ml/min	120 mL/min	160 mL/min	200 mL/min	240 mL/min
RS / BT 4	0.75 bar	1.5 bar					
RS / BT 15	0.25 bar	0.75 bar	1.5 bar	2.0 bar			
RS / BT 25	0.5 bar	1.0 bar	1.75 bar	3.0 bar	4.0 bar	5.0 bar	
RS / BT 40		0.75 bar	1.5 bar	2.25 bar	3.0 bar	3.25 bar	3.5 bar
RS / BT 80			1.5 bar	2.5 bar	3.0 bar	3.5 bar	4.0 bar
RS / BT 120			1.0 bar	1.5 bar	2.0 bar	2.5 bar	3.0 bar
RS / BT 200			1.0 bar	1.5 bar	2.0 bar	2.5 bar	3.0 bar
RS / BT 330			1.5 bar	2.25 bar	3.0 bar	3.5 bar	4.0 bar

CHROMABOND® Flash SPHERE SiOH cartridges (eluent cyclohexane – ethyl acetate 8:2)

Cartridge	20 mL/min	30 mL/min	40 mL/min	60 mL/min	80 mL/min	120 mL/min	160 mL/min	200 mL/min	240 mL/min
CHROMABOND® Flash RS SPHERE SiOH 15 µm									
RS 4	12 bar	20 bar							
RS 12	4 bar		8 bar		16 bar	18 bar			
RS 25	7 bar		15 bar						
RS 40	5 bar		9 bar		15 bar	16 bar	16 bar	18 bar	19 bar
RS 80	5 bar		10 bar	16 bar					
RS 120	4 bar		7 bar	12 bar	15 bar	20 bar			
RS 220					4 bar	7 bar	9 bar	11 bar	
RS 330			3 bar		6 bar	9 bar	12 bar	13 bar	14 bar
CHROMABOND® Flash RS SPHERE SiOH 25 µm									
RS 4	4 bar		8 bar		16 bar				
RS 12	1 bar		3 bar		7 bar	10 bar	14 bar	17 bar	19 bar
RS 25	2 bar		5 bar		10 bar	15 bar			
RS 40			3 bar		7 bar	10 bar	14 bar	17 bar	19 bar
RS 80			3 bar		7 bar	10 bar	14 bar		
RS 120			2 bar		5 bar	8 bar	11 bar	13 bar	
RS 220					2 bar	3 bar	4 bar	5 bar	7 bar
RS 330					3 bar	4 bar	6 bar	7 bar	9 bar

blank = no measurement conducted

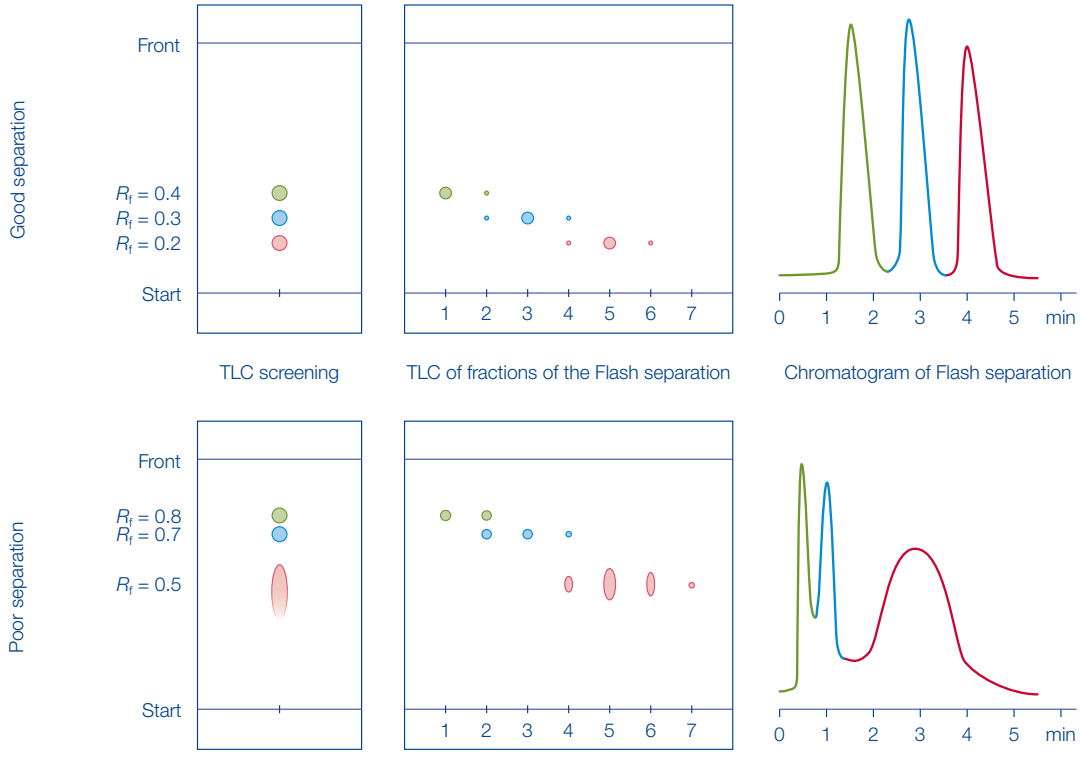
Method development from TLC to flash and scale-up

- Same selectivity and easy upscaling from TLC to flash separations
- Saving time and money because expensive optimizations are not required

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 SiOH cartridges. This is an important prerequisite for the reproducible transfer of a TLC separation to the flash column.

TLC screening

For TLC separation it is common to start with unmodified silica and a nonpolar eluent of low viscosity (e.g., mixtures of *n*-hexane – ethyl acetate or *n*-hexane – acetone). By changing the composition of the eluent the R_f value of the TLC separation is adjusted to approx. 0.15–0.4. Increasing polarity of the eluent increases the R_f values. The difference in R_f values between the substances to be separated should be at least 0.1 to allow a reliable separation in the subsequent flash chromatography. Variation of the eluent components (e.g., acetone, dichloromethane) can be used to enhance the separation by eluent-specific selectivity.



Technical information and support

In flash chromatography, retention is expressed in column volumes (CV) which is the volume of solvent required to elute a non-retained compound or to keep it simpler, the dead volume. To isocratically elute the compound of interest $1/R_f$ CV are required.

Even if the compounds have suitable R_f or CV values, respectively, the separation will not always be sufficient unless there is a suitable ΔCV. It is important to comprehend that the larger the ΔCV, the greater the loading for a particular mixture.

The higher ΔCV is, the easier is the separation and therefore the potential loadability. Please see the ordering information tables for suggested loadabilities of each column.

$$CV = \frac{1}{R_f}$$

$$\Delta CV = \frac{1}{R_{f2}} - \frac{1}{R_{f1}} \text{ or}$$

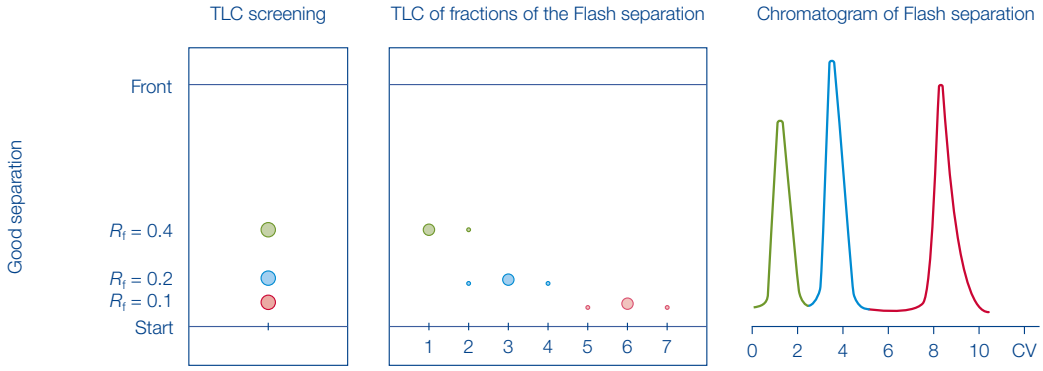
$$\Delta CV = CV1 - CV2$$

ΔCV	Separation	Loadability
> 4	Easy	High
1.5 to 4	Normal	Medium
< 1.5	Difficult	Low

Example: Compound 2 is of interest

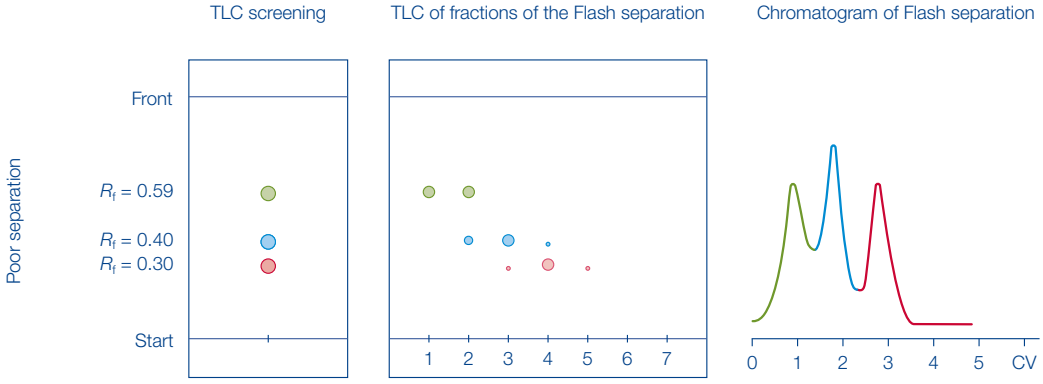
Run A: petrol ether:ethyl acetate = 5:1

Compound	Retention factor (R_f)	Column volumn (CV)	ΔCV
1	0.4	2.5	
			2.5
2	0.2	5.0	
			5.0
3	0.1	10	



Run B: petrol ether:ethyl acetate = 3:1

Compound	Retention factor (R_f)	Column volumn (CV)	ΔCV
1	0.59	1.7	
			0.8
2	0.40	2.5	
			0.8
3	0.30	3.3	



CHROMABOND® Flash DL

- Suitable as solid injection system
- For individual self-filling and packing of flash cartridges
- Column connection: female Luer lock inlet and male Luer lock outlet. Each cartridge comes with 3 filter elements: one already inserted, two more filters aside.

Options for solid injection

The sample is dissolved in a suitable solvent and adsorbed onto CHROMABOND® XTR (diatomaceous earth, see page 19). After removal / evaporation of the residual solvent, the adsorbent is put on top of a partly filled CHROMABOND® Flash BT cartridge or into an empty CHROMABOND® Flash DL cartridge.

Ordering information

Cartridge	Column length [cm]	ID [mm]	for adsorbent weight [g]		Volume [mL]	Empty columns		PE filter elements	
			SiOH	Kieselguhr		Pack of	REF	Pack of	REF
CHROMABOND® Flash DL Empty cartridges									
DL 4	9.8	12.4	4	3	8	50	732980	250	732980FE
DL 15	11.6	21.2	15	10	30	50	732981	250	732981FE
DL 25	16.5	21.2	25	15	45	50	732982	250	732982FE
DL 40	17.1	26.4	40	30	75	20	732983	250	732983FE
DL 80	24.0	30.8	80	60	160	20	732984	250	732984FE
DL 120	25.5	36.0	120	80	220	20	732985	250	732985FE
DL 200	20.0	60.0	200	150	410	10	732986	100	732986FE
DL 330	27.0	60.0	330	250	600	10	732987	100	732987FE

Accessories

Thin Layer Chromatography

Selection from our program of TLC plates

MACHEREY-NAGEL offers TLC glass plates, aluminum or polyester sheets coated with different coating materials. Mostly silica layers with or without fluorescent indicator are used.

Ordering information

Plate size [cm]	2.5 x 7.5	5 x 10	5 x 20	10 x 10	10 x 20	20 x 20	Thickness of layer	Fluores. indicator
Pack of [plates]	100	50	100	25	50	25		
SIL G · unmodified standard silica layers on glass plates								
SIL G-25		809017	809011		809012	809013	0.25 mm	-
SIL G-25 UV_{254}	809028.100	809027	809021	809020	809022	809023	0.25 mm	UV_{254}

Plate size [cm]	2.5 x 7.5	4 x 8	5 x 7.5	5 x 10	5 x 20	10 x 20	20 x 20	Thickness of layer	Fluores. indicator
Pack of [plates]	200	50	20	50	50	20	25		
ALUGRAM® Xtra · unmodified standard silica layers on aluminum sheets									
SIL G			818230.20	818261	818232		818233	0.20 mm	-
SIL G UV_{254}	818329	818331	818330.20	818260	818332	818362	818333	0.20 mm	UV_{254}

Plate size [cm]	2.5 x 7.5	4 x 8	5 x 20	20 x 20	Thickness of layer	Fluores. indicator
Pack of [plates]	200	50	50	25		
POLYGRAM® · unmodified standard silica layers on polyester sheets						
SIL G	805902	805032	805012	805013	0.20 mm	-
SIL G UV_{254}	805901	805021	805022	805023	0.20 mm	UV_{254}

Further dimensions and coating materials on request.

Additional TLC accessories · Ordering information

Description	REF
TLC simultaneous developing chamber for 5 plates 20 x 20 cm	814019
TLC simultaneous developing chamber for 2 plates 10 x 10 cm	814018
MN ALUGRAM® scissors, ground blade, black handle	818666

Accessories

CHROMABOND® XTR

Adsorbent for solid injection

- 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

Ordering information

Description	500 g	1 kg	5 kg
CHROMABOND® XTR adsorbent	730595.500	730595.1000	730595.5000

CHROMABOND® Flash connecting kits

CHROMABOND® Flash connecting kits allow to use CHROMABOND® Flash RS and BT cartridges as stand-alone system with any pump / detection / fraction collector combination.

Ordering information

Description	Pack of	REF
CHROMABOND® Flash Starter Kit		
consists of 1/8″ PTFE tubing, 1.5 mm ID, 3 m long; 5 x 1/4″-28 PP nuts; 5 x 1/8″ ETFE ferrules; 5 x 1/4″-28 nylon unions; 2 x 1/4″-28 PP Luer lock, female; 1 x 1/4″-28 PP Luer lock, male; 1 x 1/4″-28 PP Luer tip, male	1 kit	730798
CHROMABOND® Flash Stand Alone Kit, Luer		
consists of 1 x 1/4″-28 PP Luer lock, female; 1 x 1/4″-28 PP Luer lock, male; 2 x 1/8″ ETFE ferrules; 2 x 1/4″-28 nylon unions; 2 x 1/4″-28 PP nuts	1 kit	732903

Trademarks: CHROMABOND® (MACHEREY-NAGEL GmbH & Co. KG, Germany); Biotage®, Isolera™, FlashMaster™ (Biotage AB, Sweden); Isco®, Companion®, CombiFlash® (Teledyne Isco Inc., USA); Interchim®, puriFlash® (Interchim, France)

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