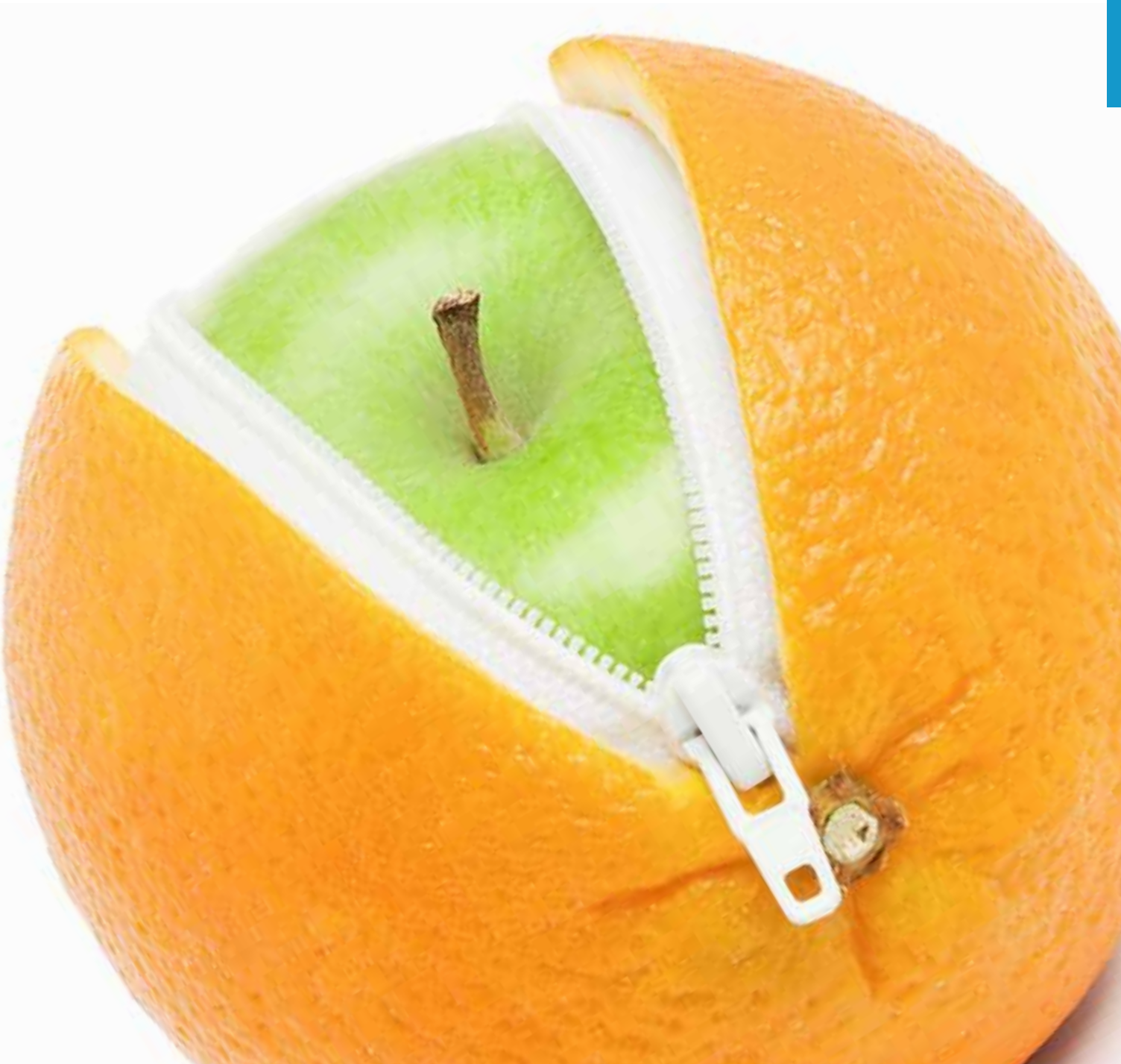
KNAUER

How do you maximize purity and yield?

► Continuous counter-current chromatography



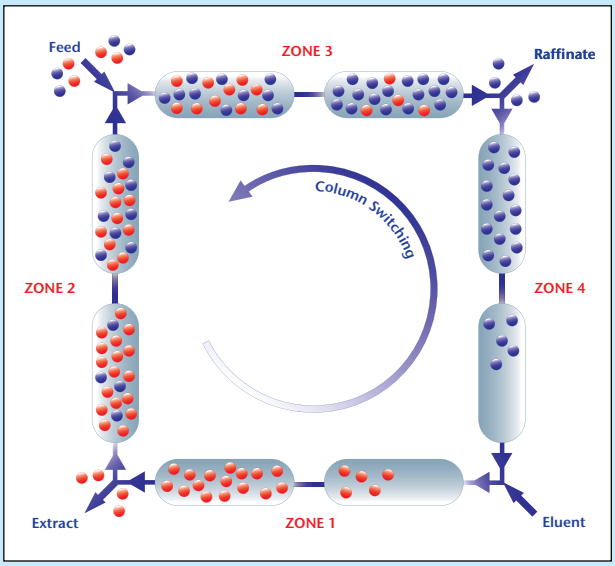
Get purity and yield!

In SMB processes you do not have to decide for either yield or purity – go for both! The high efficiency of SMB allows for > 99% yield and purity simultaneously.

Continuous counter-current chromatography, also known as Simulated Moving Bed Chromatography (SMB) is a highly efficient separation technique in the field of preparative chromatography. It enables binary or pseudo binary mixtures to be separated into pure substances or fractions with maximum yield and purity. In an SMB process, a movement of the solid phase in a counter-current direction to the movement of the liquid phase is simulated. In SMB processes the solid phase is distributed over a number of columns. These columns are connected to each other in a closed circuit with switchable column inlets and outlets.

The feed mixture that contains the two components to be separated is fed in the middle of these columns. The component that has the higher affinity towards the solid phase travels in the direction, the movement of the solid phase is simulated. The component that has the lower affinity towards the solid phase travels with the liquid phase. So you can withdraw the pure substances at the extract and raffinate ports. The movement of the solid is simulated by switching the columns counter-clockwise at defined timed intervals, creating a quasi-continuous process.

The SMB Principle



In the classical SMB process, as it is illustrated in the figure, the solid phase is divided into four separation zones by the use of the four inlets and outlets for feed, eluent, raffinate and extract. Zones 2 and 3 are the separation zones and zones 1 and 4 regenerate liquid and solid phase. The different adsorption and desorption events that lead to the separation of the components are controlled via the flow rates of the liquid phase in the four separation zones and the switching time of the columns. Depending on the application, normally 8, 12, or 16 columns are used.

What's the difference between batch LC and SMBC?

Batch LC	SMB Chromatography
Unlimited number of fractions	Two fractions, no waste
Recovery typically < 80%	Recovery up to 100%
EITHER high purity OR high yield	High purity AND high yield
Isocratic or gradient	Isocratic (step gradient possible)
Recycling possible in isocratic mode	Recycling is part of the process (up to 90%)
High solvent consumption	Can be as low as 1/10th of batch consumption
Strongly diluted product	Product concentration comparable with input concentration (Feed)
→ Versatile technique	**→ Highly efficient technique**

Multi-function valve for column switching

- Very small hold-up volume ✓
- Made of inert Hastelloy ✓
- Different valve seals for a wide range of applications ✓

What makes us attractive?

It's about the inner values.

KNAUER SMB chromatography systems are very reliable due to the use of high quality components and materials.

The modular design makes them adaptable to different tasks, while preseving your investment. The systems feature a very small hold-up volume for as little as possible losses of valuable product.

They come with user-friendly control software ChromGate® SMB. All KNAUER SMB systems can be equipped with the efficiency enhancement Modicon® which can boost high SMB productivity by up to 50%.

SMB System CSEP® C9812 Production Unit

The system is designed for the extraction of pure substances in the kilogram-scale.

Tubing 1/8", pressure up to 50 bar, supports up to 12 columns, heatable compartment with leak detection. SMB unit complete with control software and PC.

C9812

System specifications	
Max flow rate (ml/min)	500
Multi-function valve	1 x 48-Port
Available pump heads (ml/min)	100, 250, 500
Column dimensions (max.)	1 000 mm x 32 mm ID or 150 mm x 62 mm ID
Pressure rating	20 or 50 bar
Number of columns	4, 6, 8, or 12 columns
Total column weight max.	120 kg
Temperature control max.	60 °C
Pump Type	Smartline Pump 1800
Flow meter for flow rate monitoring	2 x Coriolis
Tubing, fittings and accessories	1/8“ stainless steel (PEEK upon request)
Application Area	Kilogram-scale production
Footprint	approx. 125 x 70 cm
Control system	PC with control software

C9116

System specifications	
Max flow rate (ml/min)	50
Multi-function valve	1 x 64-Port
Available pump heads (ml/min)	10, 50
Column dimensions (max.)	300 mm x 30 mm ID
Pressure rating	50 or 100 bar
Number of columns with inner diameter 16 mm	4, 8, 12, or 16 columns
Number of columns with inner diameter 30 mm	4 or 8 columns
Total column weight max.	20 kg
Temperature control max.	60 °C
Pump Type	Smartline Pump 100
Flow meter for flow monitoring	2 x Coriolis
Tubing, fittings and accessories	1/16" stainless steel (PEEK upon request)
Application Area	Process development, gram-scale production
Footprint	approx. 110 x 50 cm
Control system	PC with control software

Ordering information

Order No.	Software
A28701	CSEP® C9116, up to 16 columns, 16 mm ID
A28706	CSEP® C9812, up to 12 columns, 62 mm ID
A28703	ModiCon Option for CSEP C9116 SMB Systems includes the ModiCon license fee for 5 years, an update of ChromGate® control software, and a low pressure gradient unit for the feed pump
A28704	CSEP® C9812, ModiCon Option

Are you into bio downstream processing?

Biocompatible configurations are available for purification of peptides and proteins. Stainless steel is hereby replaced by titanium alloy and PEEK. Glass columns are available to complete the biocompatible setup.

We also offer non-standard systems on request. We design a tailor-made system according to your preference and purification task.

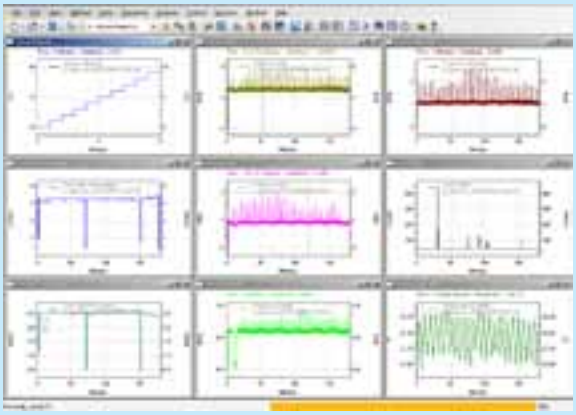
SMB System CSEP® C9116 Pilot Unit

The system is designed for the extraction of pure substances in the gram-scale.

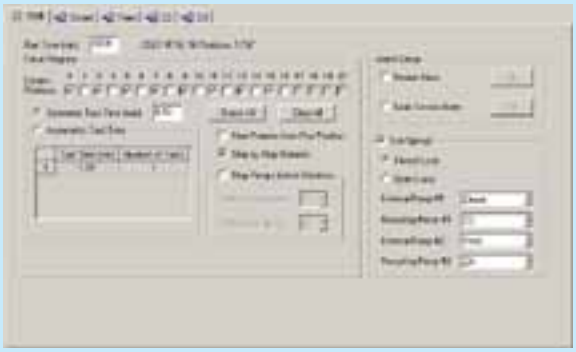
Tubing 1/16”, pressure up to 100 bar, supports up to 16 columns, heatable compartment with leak detection.
SMB unit complete with control software and PC.

System control

The KNAUER SMB systems can be controlled by ChromGate® SMB, which is based on the well-known EZChrom Elite kernel. Usage is as easy as with analytical and preparative HPLC systems. The integration into KNAUER’s ChromGate chromatography data system gives access to drivers for a wide range of additional instruments for individual setups.



Keep track of pressures, flow rates, temperature, leak events



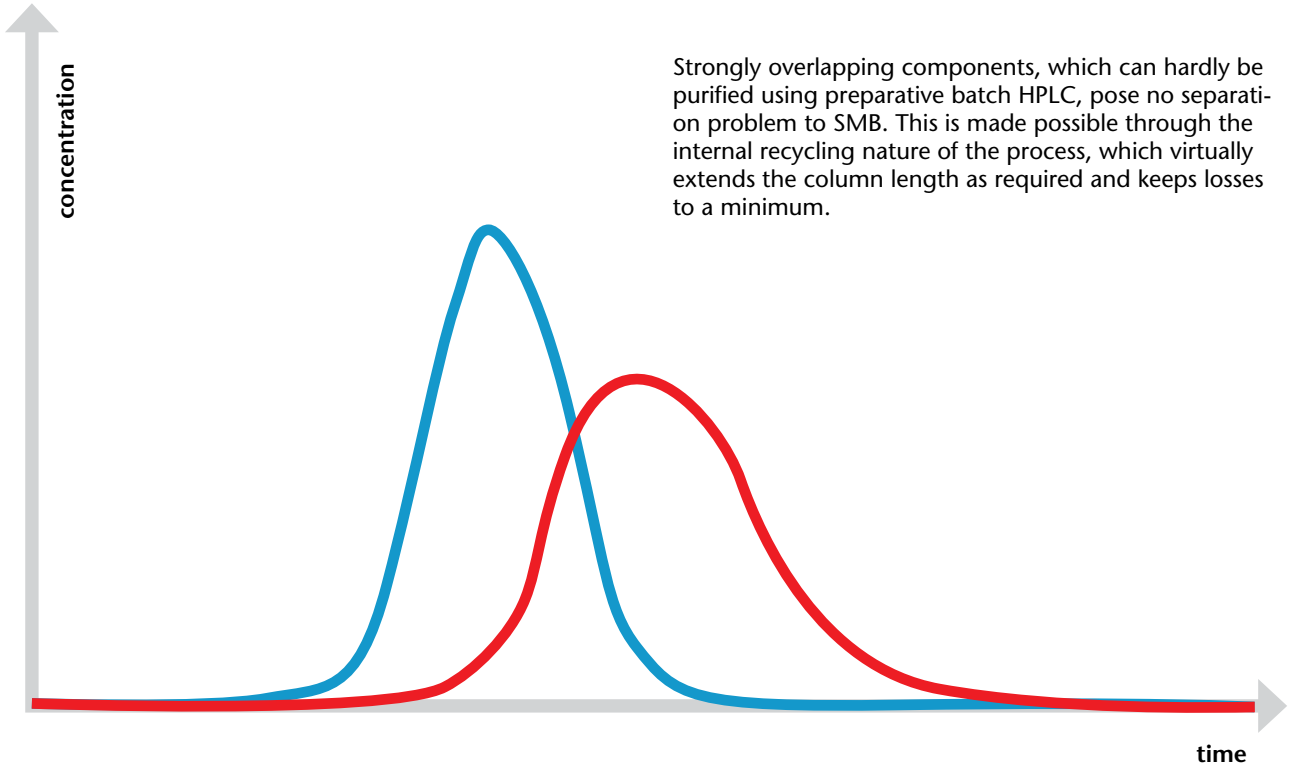
ChromGate® SMB: easy configuration and control of the SMB system

Why not boost SMB productivity even further?

In the classic SMB technique, the mixture to be separated is fed at a constant concentration. With the ModiCon technique, throughput and purity can be further increased by modulating the inlet concentration. Developed by the Max Planck Institute for Dynamics of Complex Technical Systems (Magdeburg, Germany), the ModiCon technique is being distributed exclusively by KNAUER. New systems as well as already existing ones can be equipped with the ModiCon option.

The Modicon feature is available for all KNAUER SMB systems. It optimizes feed concentration for up to 50% higher productivity and up to 25% less solvent use.

Separation impossible?



Strongly overlapping components, which can hardly be purified using preparative batch HPLC, pose no separation problem to SMB. This is made possible through the internal recycling nature of the process, which virtually extends the column length as required and keeps losses to a minimum.

How important are time, space, and operating costs for you?

Work faster

Due to the continuous “injection“ (feed) and separation in SMB there are no such things as “runs“ or “latency between runs“. In SMB “operation time“ equals “separation time“. The result is much higher productivity than possible with batch LC. Get your targeted amount of purified product in less time!

Use columns and space more efficiently

In SMB processes the stationary phase is used more efficiently than in batch LC. While in batch runs only 10–20% of the column bed are loaded, in SMB up to 100% of the bed in the separation regions are loaded with substance. This not only makes better use of packing material, but also enhances productivity. Instead of running multiple batch LC stations in parallel, one SMB does the job, which saves space.

Save up to 90% of solvent

In SMB, most of the solvent is regenerated and recycled inside the process. You can save up to 90% of the solvent compared to batch processes.

Get your undiluted product

Batch chromatography leads to strong dilution of the target component – a factor of 20 is typical. The chromatographic step usually needs to be followed by concentration steps. In SMB, outlet concentration can reach inlet concentration. Use SMB to gain undiluted products and minimize concentration efforts.

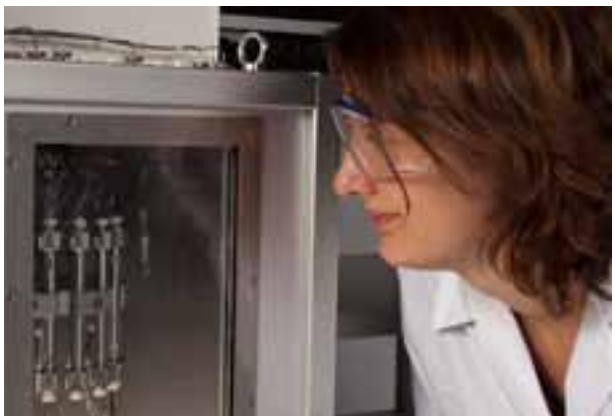
Why KNAUER SMB?

KNAUER SMB systems are characterized by their modular setup. This makes them flexible and allows for individual configurations.

Central element of the KNAUER CSEP® SMB system is the multifunction valve made of Hastelloy which connects the inlets and outlets of the columns with the pumps. Since only one valve is required for column switching, the KNAUER SMB system is particularly compact and uncluttered.

Flexible KNAUER SMB comes on a trolley rack and requires only standard power supply.

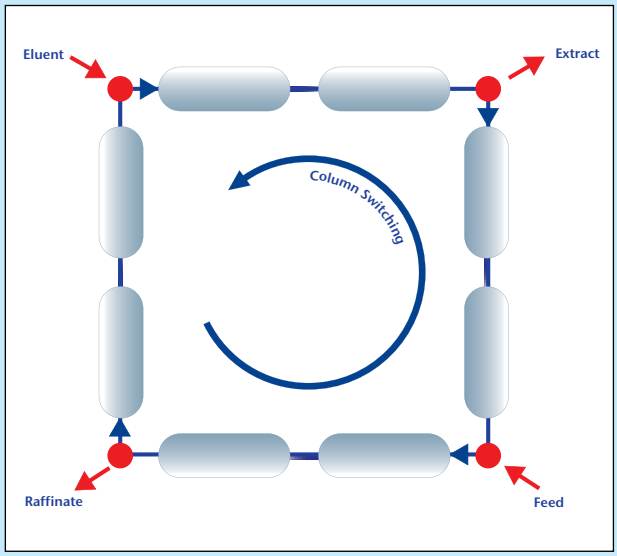
The system dead volume is significantly lower than that of systems with several valves. In addition, service expenses are also minimized. The multi-function valve and columns are positioned inside an oven, enabling operation of columns from room temperature up to 60°C.



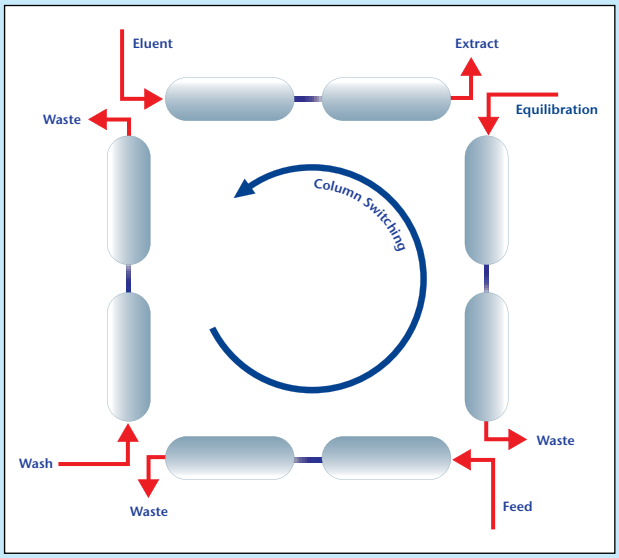
Column compartment of the CSEP® 9116 Unit

How adaptable should your SMB solution be?

The KNAUER SMB system can easily be modified to apply other cyclic purification processes involving multiple columns, e.g. multi-step cleaning.



Isocratic SMB Process



Cyclic multi-step processing

Looking for professionals?

KNAUER columns and method development service

With our experience in manufacturing analytical and preparative HPLC columns, we can supply sets of columns with outstanding similarity in a wide range of stationary phases. KNAUER's high pressure glass columns with adjustable bed length provide the user with the opportunity to change the resin quickly and are also ideal for separating biomolecules.

Our application lab offers the screening of stationary phases as well as detailed method development studies. These services reduce your effort in method development and ensure that you get optimized equipment for your separation.

Talk to our specialists
Call +49 30 809727-111

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Printed on paper awarded the EU Ecolabel
EU Ecolabel : FI/11/1