

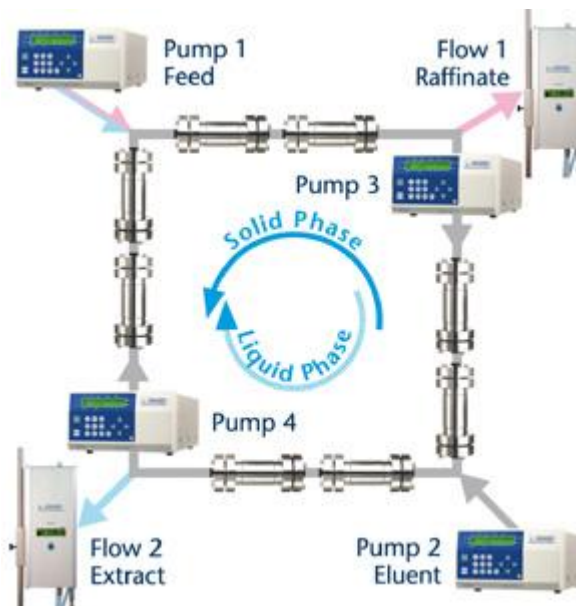
Simulated Moving Bed Systems

Overview

Why SMB?

Simulated Moving Bed is a process chromatography method that enables a mixture of substances to be **continuously** separated and extracted into two fractions. The Knauer SMB technology offers many advantages compared to classical batch chromatography

- The entire stationary phase is in use during the separation process resulting in much higher productivity.
- A 95% reduction in solvent consumption is possible due to solvent recycling.
- High plate counts or small particle sizes are no longer required, thus reducing packing material costs by 80%.
- Extract and raffinate are extracted in high concentrations, which makes it easier to remove solvent.
- The patented multi-function valve results in an extremely small dead volume for the overall system.
- Various software packages to allow optimisation of the application off-line.
- Pre-configured systems for practically all application requirements.



What is SMB?

The simulated counter-current process (Simulated Moving Bed - SMB) was developed in the early 1960's by the Universal Oil Products Company. It was mainly applied to industrial-scale separations, e.g. fructose-glucose separation.

In the SMB process a large column is effectively divided into a finite number of small sections. The withdrawal tubes are situated between two such sections as shown in the diagram. These tubes are connected in a cycle mode with the inlets and outlets via a special designed and patented rotary valve.

An observer sitting on the inlet or outlet sees an apparent movement of solid against the fluid flow at each switching process although the solid is actually fixed in the column. For this reason the process is known as Simulated Moving Bed.

Using a suitable combination of adsorbent and eluent, the feed stream is separated into two withdrawal streams containing the pure components of a binary or pseudo-binary mixture.

The diagram on this page shows a four-zone SMB system for 8 columns. The feed, eluent, extract and raffinate inlets and outlets, which divide the circle of columns into four sections, are clearly labelled.

Special valves allow liquid flow in one direction only. Inlets and outlets are arranged in a pre-defined manner and switched in the same direction as the fluid flow. This is the principle used by the Knauer CSEP SMB systems. In the zones II and III the binary mixture is separated and in the zones I and IV the solid and the liquid phases are cleaned.

Where can SMB separations be used?

The SMB principle of continuous extraction of pure substances on a preparative scale is successfully used in many areas of chemistry and biochemistry. The yearly production capability using the available systems is between 100 and 1,000 kg of pure substance.

Application Area	Typical Separation Examples
Pharmaceuticals	Chiral compounds (e.g. steroids, peptides, antibiotics)
Food chemistry	Fatty acids, carbohydrate mixtures
Biochemistry	Citric acid, phenylalanine
Petrochemistry	C8-Hydrocarbons (i.e. xylene/toluene)

When can SMB separations be used?

The successful application of an SMB process is linked to the following prerequisites:

Required component elutes first or last	Good solubility in the liquid phase
It must be possible to carry out an isocratic separation	Retention time of the substance below 20 minutes
Knowledge of the adsorption isotherms	Selectivity values between 1.2 and 2.0