288b Assessment of Smb Performance Using a Single-Column Setup

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We demonstrate that the periodic state of the simulated-moving-bed (SMB) process is reproduced by an ideal single-column chromatographic model in which the part of its outlet stream that is not recovered as product is recycled to the column with a lag of (N-1)*tau time units, where N is the number of columns of the equivalent SMB unit and tau is the switching time.

This model is the basis for an experimental setup and procedure to experimentally reproduce the periodic state of the SMB with just one column (1/Nth of the amount of stationary phase employed in the equivalent SMB process) and minimum solute and solvent consumptions.

The experimental setup requires four HPLC pumps, which feed the column at variable flow rate with four solutions with different solute concentration: (1) pure solvent, (2) pure solute 1 at feed concentration, (3) pure solute 2 at feed concentration, and (4) normal feed. The four flow rates are continuously manipulated so that the concentration and flow rate of the combined inlet stream mimic those of the ideal single-column chromatographic process.

During the first (N-1)*tau time units of process operation the solute concentration in the feed stream of the column is pre-computed by process simulation; at later times it is determined from online concentration measurements of the outlet stream taken at (N-1)*tau time units before.

By judiciously selecting the step within the cycle where the process is started, it is shown that the periodic state can be achieved in just one or two cycles (each overall cycle has a duration of N*tau time unites). Therefore, the solvent and solute consumptions required to experimentally reproduce the periodic state of the SMB process are reduced by a factor of at least 20.