Simulated Moving Bed Separation through Nonlinear Programming (#5729)

Two operation schemes to separate the mixture of three components in efficient and productive manner

Georgia Tech inventors suggested two operation schemes to separate the mixture of three components in efficient and productive manner. The inventors proposed and described Extended JO and Superstructure operating schemes to solve this problem. Both the Extended JO and Superstructure schemes consists of four columns connected to each other in a cycle divided into multiple number of zones by various inlet and outlet streams. The continuous, countercurrent motion of the stationary phase is simulated by switching both inlet and outlet streams in the direction of liquid flow. Hence, a cycle of SMB is repeated after four steps. The inventors compared the Extended JO and Superstructure operating schemes of SMB with existing ternary separation techniques showing that these operating schemes are more advantageous from an economic point of view and outperform various operating schemes considered in the literature.

Benefits/Advantages

- Extended JO and Superstructure operating schemes of SMB are especially applicable to ternary separation (3 component mixture) as opposed to binary separation techniques (2 component mixture)
- Highest amount of productivity was obtained compared to other existing ternary separation technologies
- New operating schemes can be applied for separating a variety of multi-component mixtures in different types of industries
- Increase the productivity of separation processes at lower cost and drive down the price of industrial manufacturing

Potential Commercial Applications

- Sugar, petrochemical and pharmaceutical separation

Background/Context for This Invention

In industrial manufacturing, the simulated moving bed (SMB) process is a highly engineered process used to separate one chemical compound, or class of chemical compounds, from one or more chemical compounds to provide significant quantities of the purified material at dramatically lower cost. The efficiency performance of an SMB system highly depends on the way it is operated. Although many different operating strategies have been proposed, such as PowerFeed and VARICOL, separation of a ternary mixture using SMB is still a major drawback.
Systematic optimization and experimental validation of ternary simulated moving bed chromatography systems, Journal of Chromatography A, 22 August 2014

Comparison of various ternary simulated moving bed separation schemes by multi-objective optimization, Journal of Chromatography A, 18 May 2012
For more information about this technology, please visit:
https://industry.gatech.edu/technology/simulated-moving-bed-separation-through-nonlinear-programming

Figure 2: SMB operating scheme for ternary separation.