Engineering Conferences International
ECI Digital Archives

Integrated Continuous Biomanufacturing II | Proceedings

Fall 11-2-2015

Bioprocess economics and optimization of continuous and pre-packed disposable chromatography

Richard Allmendinger
University College London, r.allmendinger@ucl.ac.uk

Suzanne Farid
University College London

BIOPROCESS ECONOMICS AND OPTIMIZATION OF CONTINUOUS AND PRE-PACKED DISPOSABLE CHROMATOGRAPHY

Richard Allmendinger, Department of Biochemical Engineering, University College London, Gordon Street, London WC1H 0AH, UK
r.allmendinger@ucl.ac.uk
Suzanne S. Farid, Department of Biochemical Engineering, University College London, Gordon Street, London WC1H 0AH, UK

Key Words: continuous chromatography, pre-packed disposable, antibody purification, cost of goods, optimization

The biotech sector is facing increasing pressures to design more cost-efficient, robust and flexible manufacturing processes. Standard batch chromatography (BATCH) is an established but expensive approach to separate impurities related with both E.coli and mammalian cells expression systems. This study uses a computational framework to investigate if the application of continuous chromatography (CONTI) and disposable technologies can provide a competitive alternative to BATCH and reusable equipment. A set of general assumptions is presented on how some of the key downstream processing characteristics, such as chromatography operating conditions, resin properties and equipment requirements, vary as a function of the chromatography mode adopted, BATCH vs CONTI, and the column type used, self-packed glass (SP GLASS) vs pre-packed disposable (PP DISPO). These assumptions are then used within the framework, which comprises a detailed process economics model, to explore switching points between the two chromatography modes and column types for different upstream configurations and resin properties focusing on a single chromatography step. Following this, an evolutionary optimization algorithm is linked to the framework to optimize the setup of an entire antibody purification train consisting of multiple chromatography steps: Alongside the chromatography mode and column type, the framework optimized also critical decisions relating to the chromatography sequence, equipment sizing strategy and the operating conditions adopted for each chromatography step, subject to multiple demand and process-related (resin requirement) constraints. The framework is validated for different production scales including early phase, phase III, and commercial scale. To facilitate decision making, methods for visualizing the switching points and trade-offs exhibited by the optimal purification processes found by the framework are provided.