Miniaturization of continuous bioprocess for biopharmaceuticals production

Proposers

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Introduction

Continuous manufacturing in bio-industry has been recognized as the biggest opportunity for further optimization of production of biopharmaceuticals, which will consequently drastically decrease the production costs and enable accessibility of biologics to much wider human population, including third world countries. Particularly, continuous downstream processing has not been implemented in bio-industry yet, since it represents a completely new approach to product recovery. The significant reduction of process footprint by scale-down of operation units would allow the manufacturing process to be performed in a small space, such as container, that can be mobilized to any world-wide location. Miniaturization and scale-down of unit operations and process design and development of integrated continuous downstream processes, based on microfluidic devices, will be the basis for setting up the fundamentals of continuous downstream processing of biologics.

Partner 1 Speciality

The group at iBB has a vast experience in the downstream processing of biopharmaceuticals, namely in the purification of antibodies, using different methodologies. The iBB group has been developing integrated/intensified bioprocesses based in liquid-liquid extraction using aqueous two-phase systems (ATPS), aiming at cell removal and target product concentration and purification in one step.

Partner 2 Specialty

The INESC-MN team has extensive experience using developing microfluidic structures for biosensing devices, microreactors and cell-chips. The team also works on optical, mechanical and electrical sensors and transducers.

Project outline/goal

This project aims to develop a miniaturized continuous bioprocess for production and purification of biopharmaceuticals. An integrated lab-on-a-chip microfluidic device for antibody production and purification from a complex medium, comprising cell separation and antibody purification will be designed. A miniaturized reactor for CHO cell cultivation will be developed and combined with a continuous extraction process of the antibody based on aqueous two-phase systems (ATPS). ATPS will promote a selective extraction and concentration of the antibody, enabling process integration and intensification in a continuous mode. Further purification can be achieved by a back-extraction step or by combination of several chromatographic steps. The application of microfluidics to ATPS has the potential of combining the process efficiency of ATPS with the reduced times and volumes associated with microfluidics, as well as the possibility to multiplex and parallel process.

Student profile

Profile sought: preference, but not limited, to students with a background in Biological Engineering and Biotechnology with an interest in combining production and downstream of biologicals with microfluidics.