Marie Skłodowska-Curie Doctoral Network "PROCRYSTAL" - 3 PhD positions on biomolecule crystallization

The 3 PhD projects are embedded in the Group of Biomass, Bioreactors and Bioproducts for industrial applications (B.factory) and the Food Innovation & Technology (FIT) research groups. The groups are part of the Centre of Biological Engineering at the Department of Biological Engineering of the University of Minho with expertise in bioreactors fundamentals and applications, specifically designing new reactors for process intensification, including protein crystallization, and the application of electric fields on proteins.

Projects

Downstream processing (DSP) of biopharmaceuticals is dominated by chromatographic steps which suffer from low throughput, poor scalability and elevated energy consumption, as well as high equipment and materials costs. The MSCA-DN PROCRYSTAL - "Crystallization towards efficient and sustainable biomanufacturing" vision is to establish crystallization as a simple, sustainable, cost-efficient and scalable alternative to current DSP techniques.

The 3 PhD projects are embedded in the Marie Skłodowska-Curie DN program "PROCRYSTAL", a training network for PhD students which is dedicated to biomolecule crystallization, biochemistry, chemical and process engineering as well as advanced modelling. The PROCRYSTAL training program for the involved PhDs has been framed with special attention to fundamental understanding of the underlying phenomena, from the molecular scale to process scale, and advanced experimental and modelling techniques specific to crystallization technology. The PhDs will also perform secondments at our academic and industrial partners.

DC 05 - Strategies for a fine-tuned control of biomolecules crystallisation

This project aims to achieve a comprehensive understanding of how electrical protocols can be designed to control the chemical and thermal environments during the biomolecule crystallisation process. Specific objectives:

1-Understand the mechanisms by which ohmic heating influence protein solubility, nucleation and crystal development using well characterised protein systems of biological or structural importance.

2-Evaluate the impact of electrochemical reactions and the presence of metal impurities during crystallisation.

3-Modelling crystallisation kinetics process (e.g. nucleation time) supported by ex situ and in-situ monitoring methods.

DC 06 - Monoclonal antibodies crystallisation in a modular oscillatory flow plate reactor

This project aims to deliver a unique platform for monoclonal antibodies (mAb) crystallisation based on a modular oscillatory flow plate reactor (MOFPR), with enhanced hydrodynamic and transport properties. Specific objectives:

1-Phase behaviour and solubility curve are assessed for the selected mAbs.

2-Implement design of experiments (DOE) and Response Surface Methodology to identify the process variables (i.e., oscillation conditions, supersaturation degree…) that affect most the performance of the system and system's outcomes (i.e., induction time, crystal size and shape). The study is completed by the assessment of the stability of the produced crystalline suspensions.

3-Implement optical microscopy and spectroscopy tools for in-line monitoring of solution and crystals' properties (CSD, shape).

4-A population balance (PB) model to describe CSD evolution and ML algorithms to develop models able to estimate values of unknown parameters or difficult to measure are developed.

DC 13 - Assessment of the viability of crystallisation as separation/purification and formulation step for biopharmaceuticals

This project aims to develop a technical process strategy decision methodology and assess energy consumption and environmental impact of the developed processes and compare against conventional industrial practise. Specific objectives:

1-Identify key process parameters that affect biomolecules crystallisation kinetics and crystals' properties.

2- Develop life-cycle assessment (LCA) methods. Initial effort will be based on available information from literature, industrial partners and market research. Further details will be provided by the DN researchers. The holistic analysis, from solvent and crystalliser design to full scale process operation, provides reliable prediction regarding the overall feasibility.

Profile

- Requirement: Master's degree in Chemical/Biological Engineering (or related) with strong overall marks.
- Strong interest and solid knowledge in the relevant fields as described;
- Knowledge of crystallization will be regarded as a plus.
- Adequate English (written and verbal communication) for scientific interactions required.
- Strong motivation is a must.
- Willingness to work at interdisciplinary boundaries.

Importantly, applicants must also meet the requirements of the Marie Skłodowska- Curie Conditions of Mobility of Researchers. Researchers can be of any nationality and are required to undertake transnational mobility. This means that researchers must not have resided in the country of their host beneficiary (Portugal) for more than 12 months in the past 3 years.

Offer

The successful candidates will be offered a PhD position to become part of our international team with global research links.

Contacts

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