Chair of Bioseparation Engineering
TUM School of Engineering and Design
Technical University of Munich

BioSE

Bachelor-/ Master Thesis

Advanced Characterization and Modeling of Electro-Modulated Separation in Biotechnology

Keywords: Mechanistic Models, Electro-modulated separation, Process Optimization, Biotechnology

Project Description

We are working on developing an innovative electro-modulated separation system, eliminating the need for traditional chemical agents, with potential applications in various industrial sectors. This project focuses on enhancing mechanistic models to understand adsorption and desorption processes while validating simulations through experimental data. This research aims to deepen the mechanistic understanding of separation systems by combining experimental results with mathematical models. The collected data will be used to expand and refine these models, which will then be implemented in **COMSOL Multiphysics Software** to simulate physical interactions and optimize the process for industrial applications.

What you'll be doing:
Expanding mathematical models and running simulations in COMSOL. Collaborating with **MIT** (**Massachusetts Institute of Technology**) on model development and expansion as part of an international research partnership. Conducting experiments on the electro-modulated separation system. Collecting and analyzing experimental data to support modeling efforts.

Profile

- Structured and independent workflow
- Current student in mechanical engineering, process engineering, or a related field
- Interest in mathematical modeling, simulations, and process optimization
- Strong analytical and problem-solving skills
- Ideal, but not required: Lab experience, CAD, COMSOL-, MD- simulation, MatLab, or similar modeling tools

Research objectives

- Improve and broaden mechanistic models and simulation in COMSOL Multiphysics software
- Perform dynamic adsorption and desorption experiments (ÄKTA)
- Optimizing flow cell module design (Autodesk Inventor, 3D print)
- Testing conditions (buffer systems, potential, and flow)

Start: asap

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