

Master's Thesis

“Mechanistic Model-Oriented Experimental Design for Silica-Based Affinity Chromatography”

Keywords: chromatography, process design, protein purification, protein A, CADET, mechanistic model, Python, programming

Project Description

Due to its high mechanical strength and easy manufacturing, silica is often used as a stationary phase in chromatographic processes. To achieve high-purity protein purification, silica resins can be combined with silica-binding amino acid tags. A novel octapeptide (RH)₄ tag, the PosH-Tag, has been developed in our group. Purifying PosH-tagged proteins with low-cost silica resins enables an economical and efficient affinity chromatography process. The next step is to purify industry-relevant proteins (e.g., Protein A variants), which are currently produced through complex and expensive purification schemes.

Developing mechanistic models for silica-based affinity chromatography allows a deeper understanding of binding phenomena and provides predictive capabilities for process optimization. Using the CADET framework, adsorption and mass-transfer mechanisms can be described mathematically and validated with experimental data. These models will serve as a foundation for transferring the process from batch to continuous multi-column chromatography.

This project is of high industrial relevance, as the shift from empirical experimentation to mechanistic, model-driven process development is one of the key goals in modern bioprocess engineering. **The work involves performing the chromatographic experiments that provide the basis for the mechanistic model.**

Research objectives

- Generate experimental data on protein binding/elution in silica-based affinity chromatography.
- Characterize key process parameters relevant for model input.
- Support/validate mechanistic modeling by comparison between experimental results and CADET simulations.

Profile

- Background in IBT, Bioprocess-, Chemical Engineering, Biochemistry, etc.
- Prior experience with chromatography is of advantage.
- Team player and independent researcher.

Start information

- Start date: As soon as possible / flexible.
- Location: Garching.
- Spoken languages: English, German, Spanish.

„Imagination is more important than knowledge.“ - Albert Einstein

