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

BioSE

Master's/ Semester Thesis

Optimization of Scale-Up Processes for Coated Magnetic Nanoparticles

Keywords: Magnetic Nanoparticles, Scale-Up, DOE, Synthesis, Biotechnology

Project Description

Magnetic nanoparticles (MNPs) are rapidly gaining significance in biotechnology, particularly for the separation and isolation of biomolecules such as proteins, DNA, and cellular components. Additionally, they are increasingly used in analytical assays. To enhance their stability and functionality, MNPs are often coated. With growing applications, there is a pressing need to scale up the production of these coated nanoparticles. In this project, the synthesis of coated MNPs was scaled up to a 50 L production process, involving four key steps:

(I) Synthesis of magnetic cores via co-precipitation
(II) Processing of MNPs to remove byproducts and impurities
(III) Coating of the magnetic cores for enhanced functionality and stability
(IV) Post-coating processing to eliminate excess coating material

During the scale-up, a critical quality attribute—hydrophobicity—was compromised. Your task will be to identify potential relationships between process parameters and the observed hydrophobicity loss, with the ultimate goal of optimizing the production process.

This project is part of a collaboration with a leading industrial partner. Supervision will be provided jointly by two PhD candidates from TUM and experts from the industrial partner. Please send your application along with your CV and current grade transcript to the email address below.

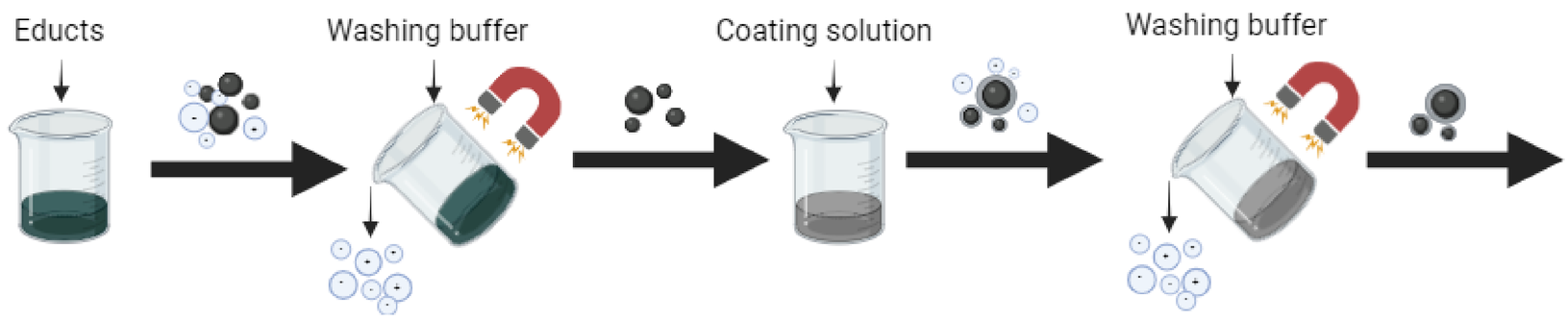
Research objectives

1. Literature review on coated magnetic nanoparticles and the relationship between synthesis parameters and hydrophobicity
2. DOE-based experimental studies
3. Characterization of MNPs (e.g. TEM, SQUID, DLS)
4. Implement synthesis optimization strategies

Profile

- Enrolled in Chemistry, Chemical Engineering, Process Engineering, Biotechnology, or a related field.
- Above-average academic performance
- Reliability, creativity
- Lab experience

Start: flexible



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