

Master's/ Semester Thesis

Development of a Scalable High-Gradient Magnetic Separator (HGMS) for Lab-Scale Bioseparations

Keywords: Magnetic Separation, HGMS, COMSOL, CAD, Bioprocess Engineering

Project Description

High-gradient magnetic separation (HGMS) is a powerful technique for isolating magnetic particles from fluids. Recent studies have demonstrated its potential for purifying biomolecules and emphasized the need for optimized, non-traditional matrix geometries. To enable flexible lab-scale applications, miniaturized HGMS designs must be developed, simulated, and engineered for efficient particle capture.

The goal of this thesis is to conceptualize and design a downscaled HGMS system. The work begins with a thorough literature review to understand current technologies, system geometries, magnetic field configurations, and materials. Building on this foundation, novel geometries will be proposed, modeled in COMSOL Multiphysics, and evaluated in terms of magnetic field distribution and separation efficiency. The most promising designs will then be translated into CAD models to prepare for prototyping.

Tasks

- Literature review: State-of-the-art Magnetic Separation systems, geometries, and operational parameters
- Concept development: Propose scaled-down geometries tailored for lab use
- Simulation: Model and analyze magnetic fields and particle movement using COMSOL
- CAD Design: Construct 3D models of optimized designs

Profile

- Enrolled in a Master's program (Mechanical Engineering, Process Engineering, or a related discipline)
- Experience with COMSOL Multiphysics
- Experience with CAD tools (e.g., Autodesk Fusion, SolidWorks)
- Independent, structured, and creative work style

Start: Flexible

We look forward to your application. Please include a current transcript of your academic records.

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