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

Bachelor's/ Master's/ Semester Thesis

Material Optimization and Process Development for a Rapid Point-of-Care Detection System

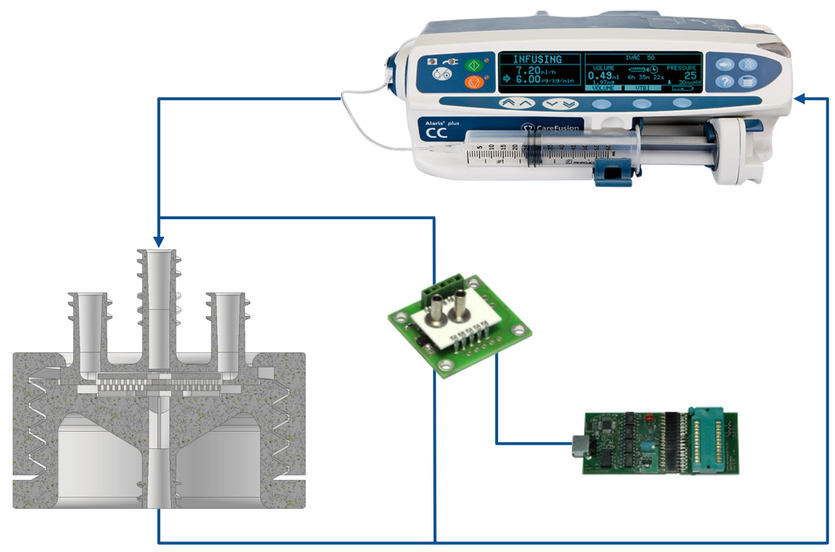
Keywords: Pathogen Detection, Process Development, Membrane Filtration, Material Optimization

Project Description

In 2020 around 26% of the global population still did not have access to safely managed drinking water, with over 770 million people not having basic access to drinking water. This results in over 1.2 million deaths per year.

Early and accessible detection of pathogens is crucial to prevent the spread of infectious diseases. We are developing a novel Point-of-Care detection system that promises to deliver results about the level of contamination in minutes, compared to days or weeks of competing concepts. Therefore, it needs a far higher-than-natural pathogen concentration.

One common way to enrich bacteria cheaply is membrane filtration — this work centres around finding the ideal membrane materials and around optimizing other process parameters to maximize pathogen enrichment.



top to bottom:

GFP producing E. coli on filter for fluorescence assay

Schematics of current test setup. It allows for cross-flow and dead-end filtration. A differential pressure sensor gives inferences to the trans membrane pressure

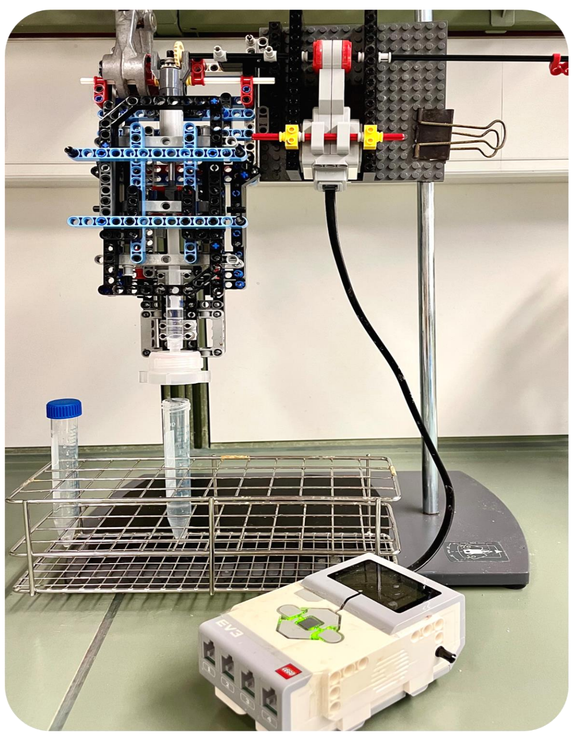
Profile

- Structured and independent work
- Maker spirit
- Chemical Engineering, Chemistry, Biotechnology, Bioprocess Engineering, Material Sciences, or similar

Ideal, but not required:

- Lab experience

A joint thesis is possible (e.g. mech. engineer focussing on CFD; chemical engineer on materials)



Earlier test setup

Currently undergoing rework to address several issues, that made it unsuitable for long-term use.

Tasks

1. Literature Review into existing solutions
2. Identification of further materials and process improvement potentials
3. Design of Experiment, and experimental verification of hypotheses
4. Design and model optimization & feedback

0.22 µm syringe filter

Those filters are typically used for sterile filtration, but are not useable for our use case.

Picture by Lilly_M @Wikimedia

Patrick Muschak | p.muschak@tum.de | Room MW2437