Master Thesis

Microsystems in Bioprocess Engineering, Institute of Process Engineering in Life Sciences
Karlsruhe Institute of Technology, Fritz-Haber-Weg 2, 76131 Karlsruhe, Germany

Flow fermentation: microsystems for whole-cell bioproduction processes

Motivation: The utilization of whole cells, whether prokaryotic or eukaryotic, for the production of value-added goods is a multibillion-dollar industry with a wide range of applications. Actual production typically takes place in industrial-scale bioreactors ranging from 5000 to >500 000 liters. The development of these industrial processes is a time- and cost-intensive workflow. Despite advanced process development strategies, the probability of successful scale-up remains quite low. As a result, society misses out on numerous products and industry misses out on potential revenues. Microsystems enable alternative pathways and possibilities for the development and realization of novel bioprocesses by means of the unique laws governing the microscale. They could thus be particularly complementary in areas where conventional systems have physical and/or engineering constraints restricting their range of application. The new field of flow fermentation is capitalizing on this, which, analogous to flow biocatalysis, exploits the advantages of microscale laws to enable and increase the bioproductivity of selected (niche) applications.

Project Aim: This project aims to systematically optimize a flow fermentation bioprocess in which siderophores are produced using the soil bacterium *Gordonia rubripertincta*. These are iron chelators, which are of particular interest as a product for the pharmaceutical industry. The process is product-inhibited and strongly dependent on nutrient concentrations, which makes it predestined for realization with flow fermentation. In this thesis, studies on process parameters such as flow rates and cell loading will be conducted to identify the optimal window of operation in terms of productivity. Based on this, the stability of the process will be investigated in long-term experiments, and possible design adjustments to the microsystem will be proposed and implemented.

Your Tasks:
- Sterile cultivation of bacteria in microsystems and shake flasks
- Product and metabolite quantification with HPLC and photometric assays
- Process characterization and optimization
- Depending on interests, the emphasis can be directed towards corresponding subject areas

Your Qualifications:
- Background in bioengineering, biotechnology, microsystems engineering or mechanical engineering
- Knowledge of sterile work and cultivation of bacterial cultures
- Interest in multidisciplinary research
- Good written and spoken English skills
- Structured, independent and meticulous working method
- High degree of initiative and personal responsibility

Contact:
Lina Hollmann
E-Mail: lina.hollmann@kit.edu

Further background: