Bachelor / Master Thesis

Karlsruhe Institute of Technology

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

Growth robustness characterization of AMP producing *C. glutamicum* strains under oscillating environmental conditions

About Us: The "Microsystems in Bioprocess Engineering" group is situated within the Chemical Engineering (CIW) Faculty of the KIT. Our goal is to bridge the gap between microfluidic technologies and bioprocess development. We develop novel microfluidic tools (*e.g.*, single-cell cultivation systems) and apply them to investigate research questions relevant to bioprocessing. Utilizing the acquired knowledge, our aim is to pioneer the development and establishment of new bioprocesses. Our work is conducted in a highly interdisciplinary manner, involving collaboration with experts in *e.g.* microbiology, physics, material and data science.

Background: Antibiotic resistance are one of the major challenges in our society today. Antimicrobial peptides (AMP) could be one solution. But their production in large scale bioreactors are challenging, because in industrial bioprocesses, gradients of multiple process parameters *e.g.* glucose concentration and pH values arise within a bioreactor due to inadequate mixing. These gradients have the potential to impact the performance of the cultivated microorganisms, leading, for instance, to a reduction in productivity, a decrease in life expectancy, and the promotion of cell heterogeneity. These aspects contribute to poor predictability and reproducibility during scale-up. Consequently, it is imperative to investigate the influence of multiple process relevant parameters on the growth behavior of AMP producing microorganisms and select the most robust that exhibit reduced susceptibility to environmental heterogeneity.

Project Aim: This project aims to systematically investigate the impact of oscillating cultivation conditions (*e.g.* pH and AMP concentration) on the single-cell growth behavior of AMP producing *Corynebacterium glutamicum* strains. To achieve this, advanced microfluidic cultivation systems, in conjunction with live-cell imaging technology, will be utilized to perform dynamic microfluidic single-cell cultivation (dMSCC) and systematically analyze the growth behavior at the single-cell level. Based on this results, the most robust strains should be selected.

Your Tasks:

- Fabrication of microfluidic single-cell cultivation devices
- Microfluidic single-cell cultivations experiments
- Analysis, evaluation and interpretation of single-cell imaging data
- Use of automated cell segmentation tools

Your Qualifications:

- Background in bioengineering, biotechnology or similar
- Knowledge of microbiological methods
- Interest in multidisciplinary research
- Structured, independent and meticulous working method

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