Master Project

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

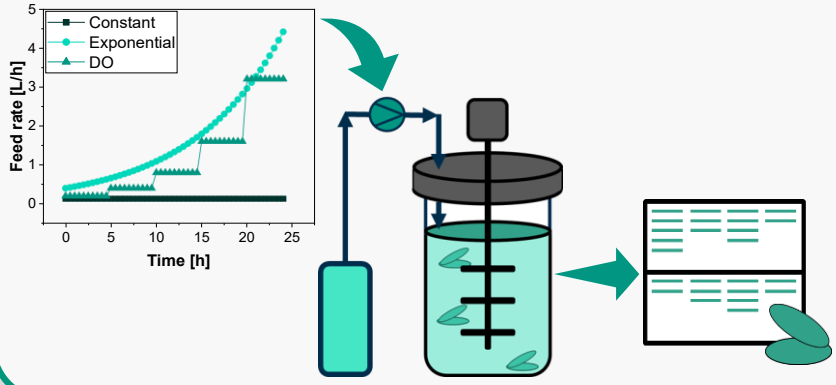
Linking Feeding Regimes to Gene Expression Dynamics in Microbial Fed-Batch Cultures

About Us:
The BIOSCALE group is situated within the Chemical Engineering (CIW) Faculty of the KIT. Our goal is to tackle challenges in bioprocess development with a novel and interdisciplinary approach involving bioprocess engineering, molecular biotechnology and data science. Our team envisions a biologically driven bioprocess development while applying cutting edge next generation sequencing technology and pioneering a harmonization of the molecular and technical nature of biotechnological processes. Utilizing the acquired knowledge, our aim is to improve bioprocess development and facilitate novel bioprocess innovations e.g. for the production of colorants and fragrances. Our group is collaborating with internal and external experts from academia and industry in *e.g.* bioinformatics, engineering and synthetic biologists.

Background:
Fed-batch fermentation is a widely used cultivation strategy in industrial biotechnology, enabling high cell densities and sustained product formation by supplying nutrients in a controlled manner. Classical feeding strategies such as constant, exponential, and dissolved oxygen-based (DO) profiles create distinct nutrient availability patterns that shape cellular physiology. While the effects of these factors on growth and productivity have been the subject of extensive research, comparatively little attention has been paid to their fundamental impact on gene expression and regulatory networks. Transcriptional analysis can provide a more profound understanding of the mechanisms by which cells adapt to glucose limitation or nutrient excess, thereby highlighting the mechanisms that influence productivity and stress response. The systematic characterization of these transcriptional responses across feeding strategies has the potential to contribute to the development of biologically driven feeding regimes, with the aim of enhancing the robustness and efficiency of bioprocesses.

Your tasks:
- Cultivation of microorganisms (*C. glutamicum*) in stirred bioreactors
- Comparison of different feeding strategies (e.g. constant, exponential and DO-based profiles)
- Sampling of bioreactor cultures and extraction of high-quality RNA for transcriptomic analysis
- Quantification of relevant metabolic products to link physiological states and transcriptional responses
- Scientific discussion with the project team on a weekly basis
- Reporting of experiments and results

Your qualification:
- Background in biotechnology, bioengineering or similar
- Knowledge and interest in bioengineering and microbial process monitoring
- Good communication and team member skills
- High motivation to explore the details and principles of bioprocesses



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