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

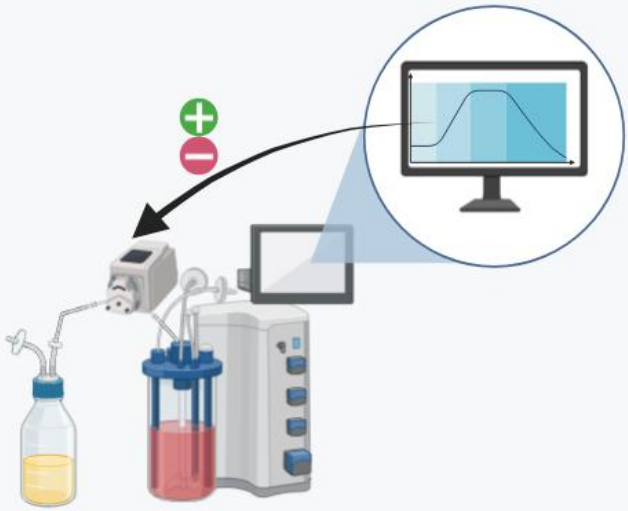
Towards Efficient Astaxanthin Production: A Biomass-Based Feeding Strategy

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:
Astaxanthin is a powerful antioxidant that is becoming increasingly relevant in the food, pharmaceutical and cosmetics industries due to its health benefits. Its biotechnological production using genetically modified *Corynebacterium glutamicum* provides a sustainable alternative to traditional methods. As astaxanthin is a membrane-bound intracellular product, achieving high cell densities is essential, making fed-batch fermentation a promising bioprocess operation mode. In this process, nutrients are added at regular intervals to support continuous growth while avoiding substrate inhibition. The success of this process depends on an optimal feeding strategy, which is traditionally based on technical parameters such as dissolved oxygen. This project explores the approach of controlling feeding directly through biomass concentration to enable a more biologically driven process and enhance astaxanthin production.

Your tasks:
- Cultivation of microorganisms (*C. glutamicum*) in stirred bioreactors
- Establishment of an online biomass measurement system integrated into the bioreactor control software
- Development of an optimal biomass-based feeding strategy
- Analyze astaxanthin production regarding yield and productivity
- Scientific discussion with the project team on a weekly basis
- Reporting of experiments and results

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



Contact:

David Nickel
Microbial biotechnology

E-Mail: david.nickel@kit.edu