Karlsruhe Institute of Technology

Thesis at the Chair of Electro biotechnology (BLT2) in collaboration with the Chair of Automation Technology (IRS)

Development of a non-invasive automated image analysis for morphological characterization of filamentous fungal pellets

Background:

Filamentous fungi produce a wide range of valuable compounds, including enzymes, organic acids, antibiotics, and immunosuppressants, and are also used for soil remediation and as biopesticides. In this work, the fungus *Aspergillus oryzae* DSM 1863 is investigated at the Chair of Electro biotechnology at the institute of Process Engineering in Life Sciences 2 (BLT2) to optimize malic acid production from renewable resources. These microorganisms grow as a densely branched network of hyphae known as mycelium. Depending on the fermentation conditions, mycelium aggregates into macroscopic fungal pellets that can be visualized photographically. The establishment of a non-invasive and automated image analysis of fungal pellets in collaboration with the Chair of Automation Technology at the institute of Control Systems (IRS) promises valuable insights into the bioprocessing potential of filamentous fungi, enabling reproducible and high-throughput evaluation.

Objective:

This work aims to develop a procedure for monitoring the growth and health of the fungus *Aspergillus oryzae* during industrial cultivation. For this, a non-invasive photographic imaging method using an industrial camera and an automated image analysis will be developed. Initially, a model system analogous to fungal pellets will be established by using spherical, abiotic substitute particles. In the subsequent step, the method developed from this model will be applied to fungal pellets in microbial fermentation. The focus will be on shape-descriptive parameters such as the specific area distribution and circularity of the spherical particles, as well as the suitability of particle density as an indicator of microbial growth trajectory.

This topic is intended for a Master's thesis project. This thesis, conducted at the Chair of Electro biotechnology in collaboration with the Chair of Automation Technology, combines microbiological production with filamentous fungi and electro-technical image analysis. The methodology developed in this project is intended for publication, offering a valuable opportunity to make a meaningful contribution to the scientific community.

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