

OPTFERM – A Computational Platform for the Optimization of Fermentation Processes

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Abstract

Numerous products such as antibiotics, proteins, amino-acids and other chemicals are produced using fermentation processes. These systems are affected by biochemical and chemical phenomena as well as environmental conditions. Consequently, several computational tools have been designed and implemented for modeling, simulation and optimization, sharing a common purpose: increase the production yield of the final product.

We present OptFerm, a computational platform for the simulation and optimization of fermentation processes. The aim of this project is to offer a platform-independent, user-friendly, open-source and extensible environment for the improvement of Bioengineering processes. This tool is focused in optimizing a feeding trajectory to be fed into a fed-batch bioreactor and to calculate the best concentration of nutrients to initiate the fermentation. Furthermore, a module for the estimation of kinetic and yield parameters has been developed, allowing the use of experimental data obtained from batch or fed-batch fermentations to reach the best possible model setup. The features present in this tool allow the users to analyze the robustness of a fed-batch model, compare simulated with experimental data, determine unknown parameters and optimize feeding profiles.

The software was built using a component-based modular development methodology, using Java as the programming language. AIBench, a Model-View-Control based Java application framework was used as the basis to implement the different data objects and operations, as well as their graphical user interfaces. Moreover, this allows the tool to be easily extended with new modules, which are currently being developed.

Keywords: Fermentation processes, open-source software tools, process simulation and optimization.

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