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CFD application as a tool for designing industrial fermenters

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Industrial fermenters are commonly characterized by non-uniform substrate, oxygen and microorganism concentration profiles due to poor mixing which subsequently results in low yield reaction systems. The impeller and the baffles are two critical components for promoting the mixing inside fermenters.

The main goal of this work is to present computational fluid dynamics (CFD) as a potential tool to model and improve the design and the performance of fermenters. This new design strategy includes a shape optimization routine which couples the computational fluid dynamics (CFD) code (Ansys CFX®) to Matlab®. Ansys CFX® will perform the discretization of the fermenter into finite elements and its fluid dynamics analysis. Matlab® implements the optimization routine by making changes to the geometry of the impeller or baffles. The performance of the system will be evaluated by a cost function which will measure the optimal dispersion of substrate, air and microorganism concentrations

This approach will give the opportunity to identify the optimal process conditions, collect information regarding the flow characteristics which influence the mixing in the fermenters and even obtain the final optimal reactor design before performing experimental work.