

Modelling and optimization of the downstream processing of microalgal biomass to biodiesel

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Introduction

Microalgae are considered a promising source for biofuel. A large challenge lies in the downstream processing of the algae. The process steps to be considered are:

- Harvesting
- Dewatering
- Disruption
- Extraction
- Conversion
- Waste disposal

The aim of this project is to model different options for the production of biodiesel from microalgae and to optimize a system of these steps for energy and material use.

Model description

A mass balance approach is used to describe the downstream processing of microalgae to biodiesel. For every process step a mass and energy balance is set up.

As example the flocculation of microalgae by poly-glutamate is given. In this process a flocculant is added to the microalgae, which causes them to coagulate. The outgoing flows depend on the microalgae recovery and concentration factor. Figure 1 relates the concentration factor to the biomass and flocculant concentration.

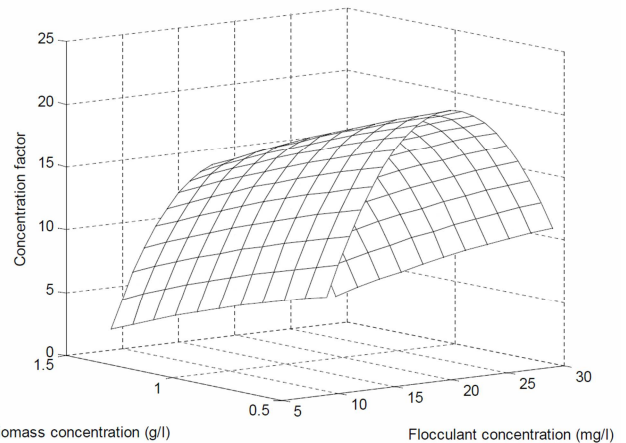


Figure 1: Microalgae recovery in a poly-glutamate flocculation as function of flocculant and biomass concentration.

Optimization

The goal of the project is to minimize the energy and material requirements. Therefore computer software is used to optimize the system for these variables.

First the production chain is optimized, while the process parameters, like the flocculant concentration, are constant. In the second procedure these variables are optimized and at the same time the best chain of process steps is selected.

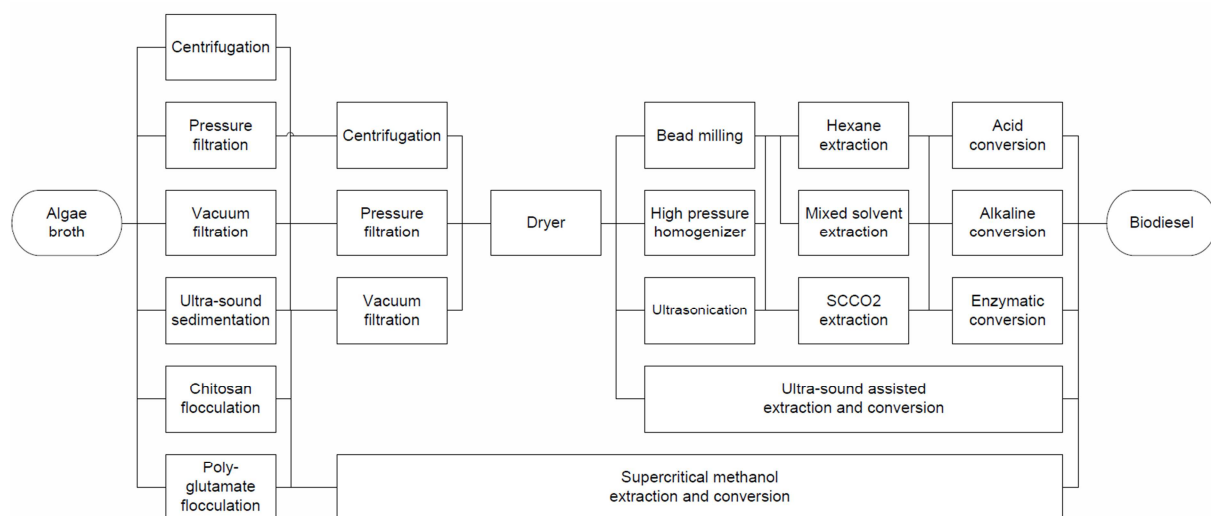


Figure 2: Options for each step in the downstream processing of microalgal biomass to biodiesel that are considered.