

Conceptual process design modelling for early evaluation of value chains

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Background

The MIRACLES project aims at developing **integrated, multi-product biorefinery** technologies for the production of **specialties from microalgae** for application in food, aquaculture and non-food products. We suggest to advance LCA results and the chain performance of algae biorefineries by using conceptual process simulation models. Such models allow analysing how choices in the design affect the chain performance [1-3].

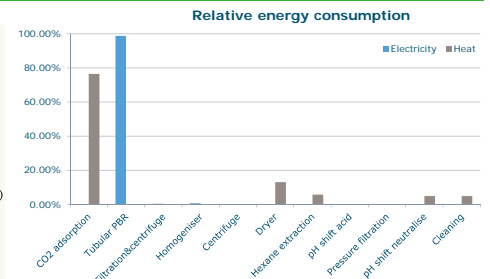
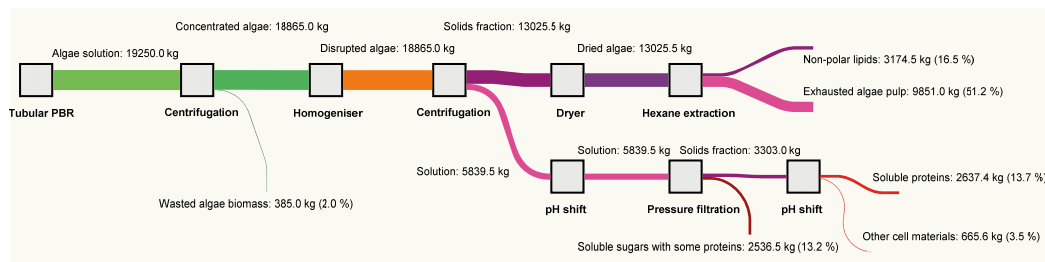
Conceptual process models

We **develop conceptual process models for both conventional algae process technologies and for each technology evaluated in the project**. The simulation models for each process unit are based on mass and energy balances. These are connected to simulate the performance of a processing chain. Experimental data are translated to larger scale production by engineering scaling rules.

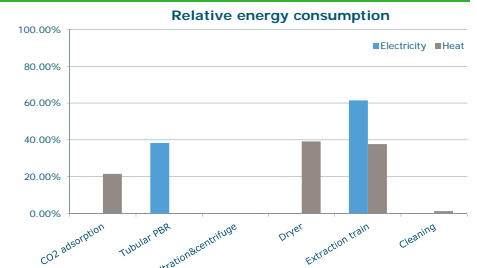
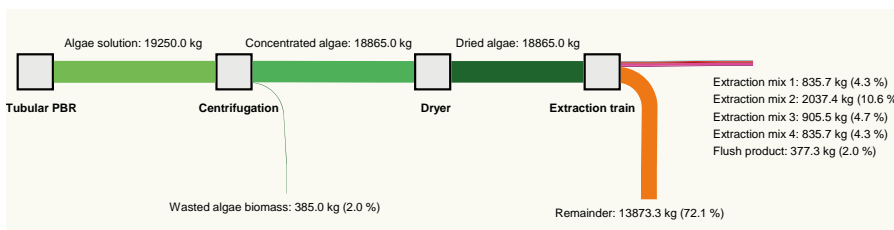
Preliminary chain analysis

Three benchmark value chain scenarios were quantitatively evaluated, to give a preliminary evaluation of the value chains, and to indicate bottlenecks in knowledge and performance at an early stage of the project. Results are shown below, for *Isochrysis galbana*.

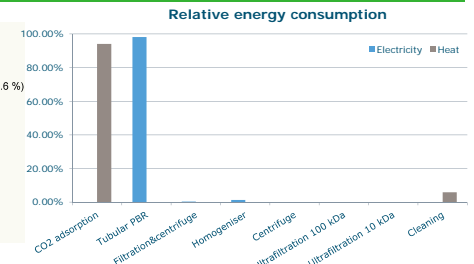
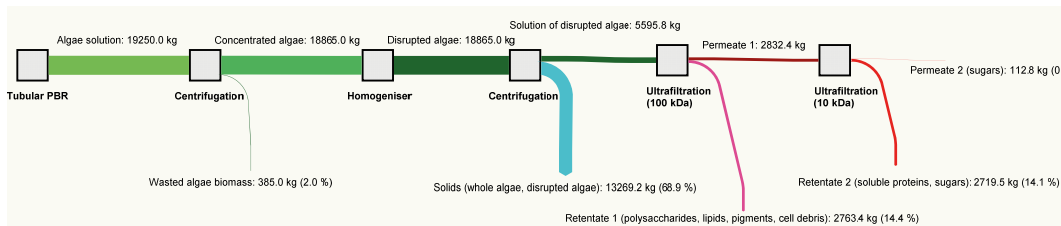
Scenario 1 - Conventional technologies - Main products: Non-polar lipids, soluble proteins, soluble sugars



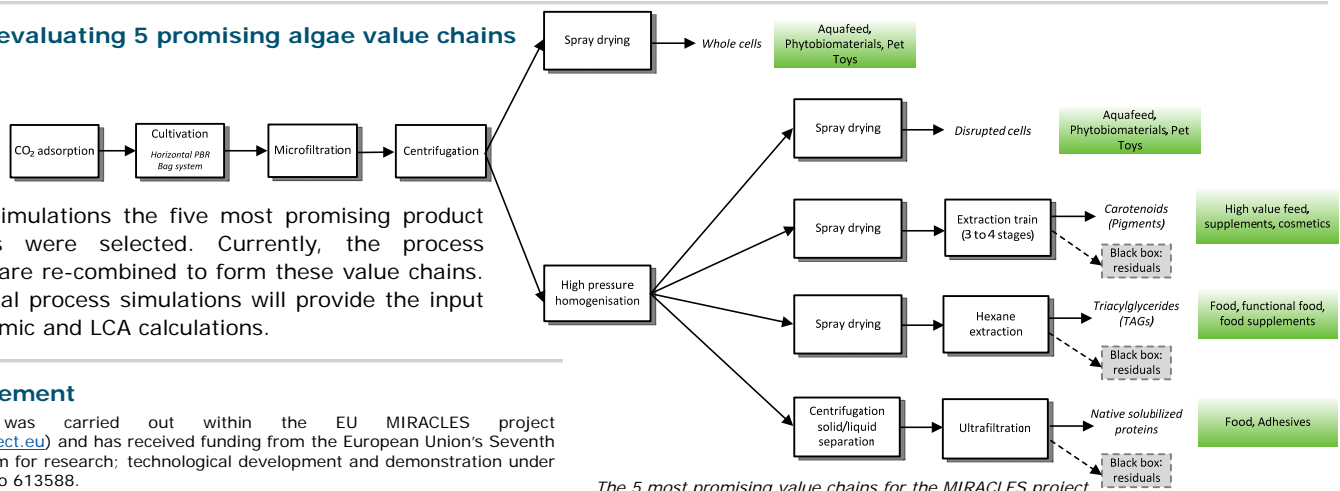
Scenario 2 - Innovative technology for 4 stage extraction - Main products: 4 extraction mixes rich in pigments & various lipids



Scenario 3 - Innovative technology for protein and sugar separation - Main products: soluble proteins, sugars



Next steps: evaluating 5 promising algae value chains



The 5 most promising value chains for the MIRACLES project

After these simulations the five most promising product value chains were selected. Currently, the process technologies are re-combined to form these value chains. The conceptual process simulations will provide the input for the economic and LCA calculations.

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