

Algae cultivation – different techniques

Today, there are several techniques for the cultivation of both micro- and macroalgae. A certain technique is chosen depending on the purpose of algae cultivation. For example, a specific high-value added product needs the cultivation under controlled conditions. In addition, algae aiming for biogas and other bioenergy purposes need cheap and robust cultivation conditions. This InfoSheet has focused on the techniques utilized in the TransAlgae project.

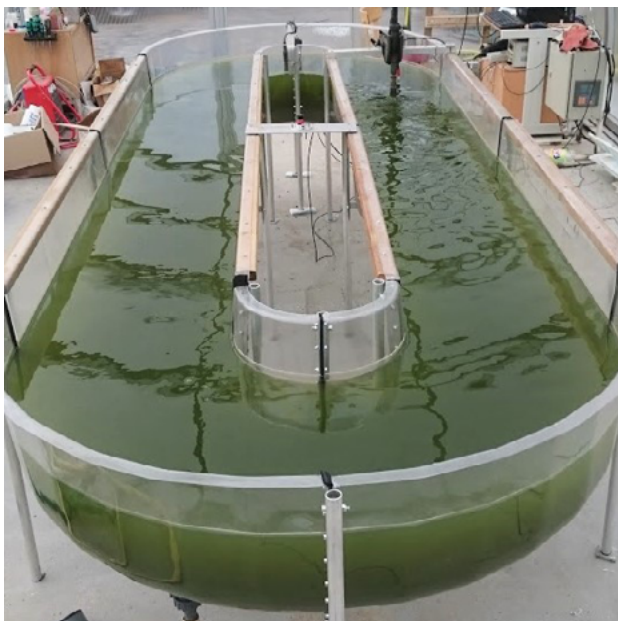
PHOTOBIOREACTOR

The most common purpose for using a photobioreactor is when the algae cultivation aims for high value added products.

In TransAlgae, an open photobioreactor is placed in the close connection to the municipal wastewater treatment plant (VAKIN) in Umeå and used by SLU. This is a pilot-scale unit with a volume of about 800 litres of water used for cultivation.

Main advantages and disadvantages – photobioreactor

- + possible to control all parameters
- + high algae productivity
- expensive
- limited scalability



Photobioreactor at VAKIN in Umeå

RACEWAY SYSTEM

The raceway system is sufficient to be used for the cleaning of wastewater by using algae.

Other names for raceway system include open pond and high rate algae pond (HRAT). In TransAlgae, a set of raceway ponds is placed at the Umeå Energy CHP-plant and used by SLU.

Main advantages and disadvantages – raceway system

- + well known and established system
- + simple and robust system
- + energy effective in operation
- diluted system with low concentration of biomass
- Hard to control different parameters during the cultivation
- Risk for particles, sand and other contaminations due to the open system



The raceway system at Umeå Energy

CASCADE CULTIVATION UNIT

In a closed cascade cultivation unit, the water is pumped through the system (recycled) and the microalgal suspension flows in a thin layer (about 6 mm) over a cascade of a sloping plane exposed to sunlight. The algae cultivated in a cascade system aim for high value added products. In TransAlgae project, this system is developed by Nattviken Invest in Härnösand.

Main advantages and disadvantages – cascade unit

- + robust and simple system
- + cheap
- + relatively high algae concentration
- + closed system, which enables monocultural cultivation under controlled conditions
- energy demanding for pumping the algae culture through the system.



The cascade cultivation unit at Nattviken Invest in Härnösand

CULTIVATION IN LABORATORY SCALE

The first experiments of new ideas are always done in a laboratory scale. In TransAlgae, the main cultivation in laboratory environment is performed by University of Vaasa.

Main advantages and disadvantages – laboratory scale

- + total control of all parameters
- + short time responds
- + best way for testing and changing different parameters too see the effects
- small scale and controlled conditions, which means that future larger scale experiment will act differently.



Cultivation in laboratory scale at University of Vaasa

TANK CULTIVATION SYSTEM FOR MACROALGAE

In TransAlgae, the cultivation of macroalgae (*Ulva* spp.) primarily for food consumption is done in Bodø at NIBIO in collaboration with the SME Arctic Seaweed. Indoor continuous flow-through tank cultivation systems with controlled temperature and light regime allow cultivation and harvesting of biomasses throughout the year.

In addition, the wild biomass of different macroalgal species is harvested for biogas and biofuel transformation.

Main advantages and disadvantages – tank system

- + total control of the optimal environmental parameters
- + year-round cultivation and harvesting of high food quality biomass
- + easy to harvest, compared to microalgae
- expensive maintenance of the cultivation system
- energy-demanding to maintain the optimal ambient temperatures.



Cultivation of macroalgae (*Ulva* spp.) at NIBIO in Bodø

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