

Algae biomass for a sustainable future

In the beginning of September, the TransAlgae project has held its final seminar at SLU in Umeå. The event gathered many algae experts from Sweden, Finland, Norway, Portugal, Italy, Latvia, and representatives from the financing authority together with the other skilled participants from Sweden. They contributed to make it an interesting day. The already extensive network of TransAlgae was widened once again.

SEAWEEDS AND THE SEA FOR A SUSTAINABLE FUTURE



The first invited keynote speaker of the day was Fredrik Gröndahl, head of the Department for Sustainable Development, Environmental Science and Engineering at KTH in Stockholm. Fredrik shared his knowledge from the exciting project, Seafarm.se.

The potential of macroalgae

The Swedish Seafarm-way of cultivating algae – you don't get it more sustainable than this and you can see them grow. Among many results they can recognize a great energy balance and they have also conducted socio-economic studies for the blue economy.

Products from macroalgae:

biochemicals, biofertilizer, biogas, building material, colours, cosmetics, ethanol, feed, food, insulation in houses, methane inhibition, polymers, textiles

MICROALGAE



- A BIG HELP TO SOCIETY ISSUES

Luisa Gouveia, head of the Autotrophic Microalgae Group/Bioenergy Unit at the National Laboratory of Energy and Geology in Lisbon, Portugal, was the second keynote speaker. Luisa shared her experience of 30 years research and gave us an overview of algae projects and companies in Portugal. This presentation also confirmed that algae are amazing.

Algae for wastewater treatment

Wastewater reduce costs for production and her two examples of fertilizer obtained using wastewater from industry were brewery and piggyery.

Environment-friendly production:

not using freshwater, not competing with food production, marginal areas of the world, minimal environmental damages.

Products from microalgae:

biodiesel, bioethanol, biofertilizers, biofuels, biogas, biohydrogen, bioplastics, caviar, cosmetics, ethanol, feed, fertilizer, food mayonnaises, gasoline, hydrogen, minerals, nutraceuticals, pasta, plastics, pudding, proteins, sweet biscuits, syngas

An interesting example of Luisa's research is the use of stressed *Chlorella vulgaris* in fish feed to improve rainbow trout organoleptic properties.

ALGAE CULTIVATION AT HIGH LATITUDES: OBSTACLES AND OPPORTUNITIES

Francesco Gentili, SLU, Umeå



Opportunities

- 40 000 species of algae already identified
- grow on marginal land
- high level of lipids
- sunny region
- different types of wastewater
- collaboration between academia and industrial partners



Technical obstacles

- harvesting in an economical way
- resistance or tolerance to predators
- high ash content heavy metals and pharmaceuticals residues
- climate limitation
- match the industrial sector needs

The future

We need to clearly identify the products from wastewater and we need more system analysis and modelling.

ENVIRONMENTAL BENEFITS OF MICROALGAE BIOMASS PRODUCTION



Carolín Nuortila from University of Vaasa, School of Technology and Innovations, presented results from laboratory cultivation experiments with wastewater from Pätt, the municipal wastewater treatment facility in Vaasa.

Wastewater treatment

The nutrient concentrations of phosphorus and nitrogen in wastewater could be reduced with the help of microalgae also in temperatures between 8 and 16 °C. Even though microalgae may not replace the established chemical biological wastewater treatment process as it is today in Finland, microalgae could assist the wastewater treatment process, and thus aid in reducing eutrophication of the Baltic Sea.

Lipid and fatty acid production – biodiesel potential

When microalgae were cultivated in different fractions of wastewater they produced similar percentages of substances and profiles as biodiesel.

THE GREEN MACROALGA *ULVA FENESTRATA* AND ITS USE FOR A PRE-COMMERCIAL APPLICATION



Ralf Rautenberger from NIBIO in Norway presented factors influencing the biomass production in *Ulva fenestrata* from Norway.

Ulva a marine macroalgae

Ulva is a green marine macroalgae with a high nutritional quality and biotechnological potential. The high biomass production of *Ulva fenestrata* (formerly *Ulva lactuca*) from two locations in North Norway (Bodø and Dverberg) was studied in an indoor large-scale set up.

Algae for restaurants

The results helped the Norwegian industry partner, Arctic Seaweed-Aluwin, to develop its “Aqua-Gardening” concept for a land-based cultivation under controlled conditions to produce high quality biomass as garnish and side dishes for restaurants in Norway and the other European countries.

COFFEE AND EXHIBITION



During the coffee break, seminar participants could taste some macroalgae and read some of the posters that were produced by students during a course at the University of Vaasa. [See infosheet No 17](#)

A COMPUTER VISION AS A METHOD TO IDENTIFY ALGAE



Andrea Gambardella, Nattviken Invest AB, showed how to use artificial intelligence and computer vision to know what algae you have in your cultivation. The tool is useful to target specific species before harvesting. A second software tool helps controlling growing parameters for maximizing harvest yield.

Closed cascade cultivation

Nattviken Invest employs indoor cultivation in bags and two different ways of harvesting were presented.

CHARACTERISATION OF ALGAL BIOMASS



Calle Niemi, SLU, has been focusing on chemical composition. Calle has been analyzing algae total proteins, carbohydrates, lipids, fatty acids and fatty acid profile and developing different methods for this. Focus has also been flocculation methods for harvesting.

ALGAE HYDROTHERMAL LIQUEFACTION AND CARBONIZATION



Huihui Liu representing Mid Sweden University presented properties of natural microalgae, experiment procedure, hydrothermal behavior of natural microalgae, and effect ash on the hydrothermal behavior of natural microalgae.

FEASIBILITY OF ALGAE AS A SUBSTRATE FOR NORDIC BIOGAS PRODUCTION



Andreas Willfors, Novia UAS, Finland

The biogas output from the same species of macro- or microalgae can differ and makes it important to evaluate every case through tests.

Biogas from waste

In a biorefinery concept, the waste from extraction can be made into biogas – But according to our results, it is necessary to remove all of the extraction solvent to avoid inhibition. Another potential issue is heavy metals in the digestate, with too much arsenic in wild seaweed and cadmium in microalgae to use as fertilizer. Either the problems should be solved upstream or made use of.

Avoid pretreatment

Pretreatment of the microalgae is not recommended. The investigated scenario for microalgae cultivation for only biogas production does not seem feasible. Biogas output is too low, some increases can be made by co-digestion. However, macroalgae seems promising and produced more than expected and a cultivation scenario would be interesting to investigate.

AMAZING ALGAE AND THE ROAD AHEAD

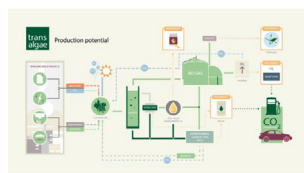
Petra Berg, University of Vaasa established that changes are coming and the small algae can be a big player. The algae are back in business with more new products and more projects. Algae have an enormous potential, but we need to develop systems around the algae; a new circular business model mapping tool.

Algae based business opportunities

Two courses were held at the University of Vaasa where sustainable business development challenges were approached by marketing and international engineering students. New business concepts include both microalgae and macro algae as future fuels, services and food. Through these activities, a lot of knowledge has been spread about algae based business opportunities to a large group of students.

INTERNAL AND EXTERNAL COMMUNICATION

Barbro Kalla from BioFuel Region talked about how to use communication as a tool to reach the project goals. The research results are presented in three levels; in pictures and films, infosheets and scientific reports. Follow the link below and find a video animation about the process in one Minute and a film, Amazing Algae where the participants are presenting their results. [Follow this link!](#)



TransAlgae - One Minute about our project

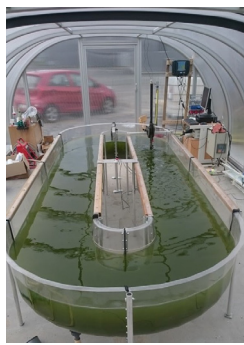


Amazing Algae - A film about the TransAlgae project

BUILDING A NETWORK

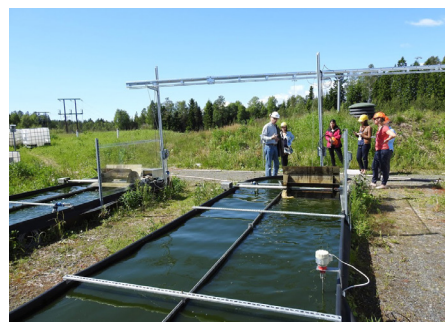


15 Algae experts in Umeå



Cultivation of microalgae in Umeå

Photobioreactor at Vakin and race way system at Umeå Energi



STUDY VISIT 5TH OF SEPTEMBER

The day after the conference we arranged half a day with study visits for our international guests and the TransAlgae project team.

Dåva, Umeå Energi

First, we visited DÅVA where we started with a guided tour of the CHP-plant of Umeå Energi. Then it was time to visit the algae raceway system positioned in the yard at Dåva. Our host Francesco Gentili explained in detail the cultivation and harvest system.

Pilot plant at Vakin

Next, the bus took us to the wastewater treatment facility Vakin, where we were able to look at the photobioreactor. Despite a lot of rain all day, we had happy people in the picture. After a lunch and a lot of discussions about algae we said goodbye to our European friends, until we meet again.

Project meeting

In the afternoon, the TransAlgae team had its last project meeting, during which we discussed administrative issues of the final project phase.

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