



Katja Pulkkinen and Juhani Pirhonen
Department of Biological and Environmental Science
University of Jyväskylä



Recovering nutrients and carbon dioxide in algal biomass from recirculating aquaculture – project MIDAS

Next level process integration in microalgae biotechnology with digital applications

The sustainability of microalgal cultivation can be enhanced by using waste streams as nutrient and carbon sources; a direct example of the implementation of circular economy. MIDAS consortium aims at improving process integration and control in microalgae-based processes (Fig. 1).

The consortium is led by Dr. Pauliina Salmi from the Faculty of Information Technology at JYU, with the Department of Biological and Environmental science at JYU and the VTT Technical Research Centre of Finland as consortium parties.



Hydrogen
production
Spectroscopy

Data-based modelling,
optimization and process
control



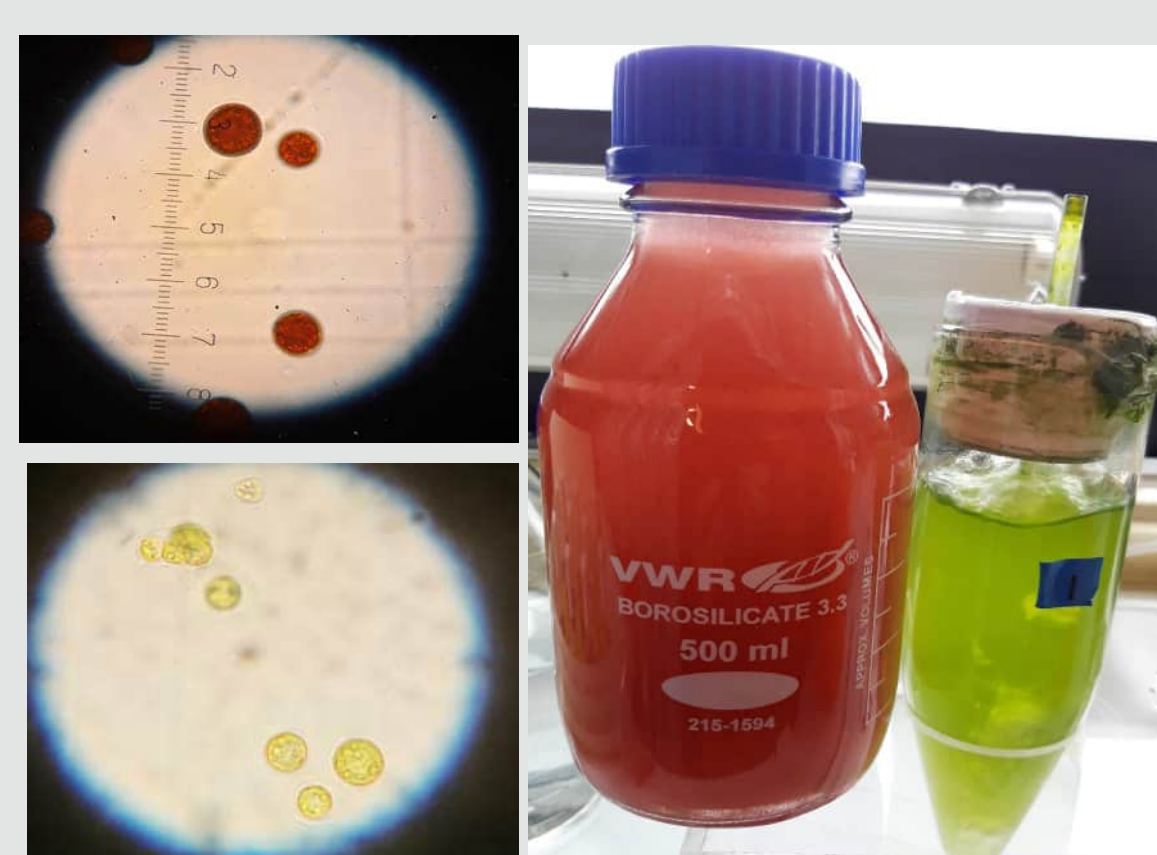
Nutrient and CO₂
sequestration into algal
biomass

Biomolecules, lipids,
pigments, biomass

Recovering nutrients
and CO₂ from RAS



Fig. 1. MIDAS-consortium aims at improving the efficiency of microalgal biomass cultivation in waste streams by process integration and advanced process monitoring and control.



Biomass
composition:
nutrients,
lipids,
amino acids,
carotenoids



CO₂ from fish and
microbes in the
RAS bioreactor

Nutrients:
Phosphorus, nitrogen,
other micronutrients



Fig. 2. Recirculation aquaculture systems (RAS) save water and concentrate nutrients.



Katja Pulkkinen



Juhani Pirhonen



Minna Hiltunen



Hemanta Timilsina

In the Department of Biological and Environmental Science at JYU, we investigate the use of effluent from a recirculating aquaculture system (RAS) in microalgae cultivation (Fig. 2). The RAS technology saves water as compared to the traditional flow-through culture, and thus accumulates the nutrients that microalgae need to grow. We also study the use of carbon dioxide emissions from the system for enhancing biomass production, and how this affects the production of different biomolecules in the microalgae.

Pirhonen J., Koukka S. and Pulkkinen K. 2023: Supplementing air with CO₂ stripped from recirculating aquaculture improves growth of two green microalgae in aquaculture wastewater. *Aquaculture* 567: 739242. <https://doi.org/10.1016/j.aquaculture.2023.739242>