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Report on the Workshop
Advancing Research and Innovation and Promoting Cooperation in Circular Economy Solutions Using Algal Biotechnology

WORKSHOP
Advancing Research and Innovation and Promoting Cooperation in Circular Economy Solutions Using Algal Biotechnology
February 10th – 11th, 2025, Zagreb, Croatia

From February 10 to 11, 2025, the international workshop *Advancing Research and Innovation and Promoting Cooperation in Circular Economy Solutions Using Algal Biotechnology* was held at the University of Zagreb Faculty of Chemical Engineering and Technology (UniZg FCET). The workshop was organized as part of a bilateral project between the Norwegian Institute for Water Research (NIVA) and the University of Zagreb Faculty of Chemical Engineering and Technology, funded through the Croatia Innovation Norway Grants (HRV-NORWAY 1158). The project leader is NIVA, and FCET is a project partner. The project is valued at €80,040 and runs from November 1, 2024, to February 20, 2025. The project leaders are Luka Šupraha, PhD (NIVA) and Assoc. Prof. Dajana Kučić Grgić, PhD (UniZg FCET).

The workshop was officially opened by the Vice-Rector for Business and Digitalization at the University of Zagreb, Prof. Tomislav Bolanča, PhD, who highlighted the importance of interdisciplinary collaboration in advancing sustainable innovations. On behalf of FCET, Vice Dean for Finance and Administration, Prof. Ernest Meštrović, PhD, welcomed the participants and emphasized the Faculty's commitment to supporting research initiatives that contribute to both scientific progress and economic growth.

Bringing together scientists, industry experts, and business representatives, the workshop served as a vibrant forum for exploring the potential of algal biotechnology in driving sustainable and circular economic solutions. Designed as an interactive platform for knowledge exchange and interdisciplinary collaboration, it provided a unique opportunity for researchers and industry stakeholders to engage in discussions, share expertise, and forge new partnerships aimed at pioneering innovative applications of algal biotechnology. A central goal of the workshop was to bridge the gap between academia and industry, fostering stronger connections that enable real-world implementation of cutting-edge research. By integrating expertise from diverse fields, the workshop aimed to identify and promote practical applications of algal biotechnology, with a particular emphasis on biofuel production, wastewater treatment, high-value biochemical extraction and production of bioplastics. These areas hold immense potential in addressing global sustainability challenges, making the workshop a crucial step toward the development of scalable, eco-friendly solutions.

Fig. 1 – Project team NIVA-FCET

Participants had the opportunity to attend inspiring lectures by renowned experts:

- **João Navalho** (*Necton S.A. and Allmicroalgae S.A., Portugal*)
  "Day by Day Life in a Microalgae Production Company: From the Cell to Products Sales"
- **Luka Šupraha**, PhD (*NIVA*)
  "Norwegian Culture Collection of Algae (NORCCA): Applied Algal Research from Lab- to Pilot-Scale"
- **Margarida Costa**, PhD (*NIVA*)
  "Microalgal Biotechnology Research – Unraveling the Full Potential of an Algae Culture Collection"
- Prof. **Stela Jokić**, PhD (*Faculty of Food Technology Osijek*)
  "Biologically Active Molecules from Adriatic Sea Macroalgae – Extraction, Characterization, and Potential Applications"
- Assoc. Prof. **Fabio Faraguna**, PhD (*UniZg FCET*)
  "The Role of Microalgae in Biofuel Production, with a Focus on Biodiesel Production and Characterization"

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Fig. 2 – Workshop at CWT

Fig. 3 – Workshop at CWT

Fig. 4 – Workshop at CWT

Fig. 5 – Assoc. Prof. Fabio Faraguna, PhD, Workshop lecturer

- Assoc. Prof. **Dajana Kučić Grgić**, PhD (*UniZg FCET*)
  "Microalgal Biomass and Agroindustrial Waste:
  Sustainable Feedstocks for Bacterial PHA Production"
- **Robert Reinhardt** (*AlgEn, Slovenia*)
  "Algal Bioremediation in Circular Economy"
- **Sanja Babić Brčić**, PhD (*Ruđer Bošković Institute, Croatia*)
  "Adriatic Sea Macroalgae:
  A New Horizon in Bioactive Compound Research"
- **Egli Ilić** (*Innovation Norway*), "Innovation Norway Grants"
- **Lucija Konjević** (*Adriatic Biodiesel*)
  "Adriatic Biodiesel – The Only Second-generation Biodiesel Plant in Croatia"
- **Dubravko Škare** (*Madox d.o.o.*)
  "Production of Freshwater Microalgae in Open-type Ponds and the Potential of Algae in Final Products"
- Prof. **Marko Petek**, PhD (*Faculty of Agriculture, Croatia*)
  "Enhancing Agricultural Resilience to Climate Change by Improving Crop Nutritional Status Using Biostimulants"
- **Maria Blažina**, PhD (*Ruđer Bošković Institute, Croatia*)
  "Assessment of the Adriatic Algae Cogeneration Potential in Toxic Industrial Wastewater Phycoremediation"

Beyond the insightful lectures, the workshop placed strong emphasis on practical applications and skill-building. Participants engaged in two specialized workshops, where they gained first-hand experience in cutting-edge analytical techniques and experimental procedures.

1. *Chemical Characterization of Water Used for Production of Microalgae* – led by Asst. Prof. Matija Cvetnić, PhD

- Analyses performed: Participants conducted in-depth water quality analyses, including pH, dissolved oxygen, conductivity, alkalinity, inorganic and organic contaminants, heavy metals, pesticides, and hydrocarbons. Advanced techniques such as Ionic Chromatography, ICP-MS, and GC-MS were demonstrated, equipping attendees with practical skills in water characterization.
- Site visits: As part of the workshop, participants visited the spin-off company Comprehensive Water Technology and the Department of Industrial Ecology, where they explored advanced water treatment technologies and learned about methods used for assessing biodegradability and compostability of biobased materials.

2. *What do We Want from Our Biodiesel and How to Make It?* – led by Assoc. Prof. Fabio Faraguna, PhD

- Biodiesel synthesis and characterization: Participants took part in hands-on biodiesel production, exploring optimization strategies to improve fuel quality. The session covered various process variables affecting biodiesel yield and performance.
- Demonstration of laboratory equipment: The workshop provided an in-depth look at advanced analytical instrumentation used in biodiesel research, including Gas Chromatography (GC), Thermogravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Scanning Electron Microscopy (SEM), and other cutting-edge techniques.

These workshops significantly enriched participants' understanding of real-world applications of algal biotechnology, giving them practical experience that can be directly translated into industrial and research settings.

The workshop gathered more than 50 participants from various fields, including medicine, biotechnology, microbiology, chemical engineering, chemistry, economics, civil engineering, and agronomy. Attendees included graduate students and early-career researchers to experienced industry professionals, creating a dynamic environment for knowledge exchange and collaboration. A key highlight of the event was the strong industrial presence, with representatives from Podravka d.d., Necton S.A., Allmicroalgae S.A., and AlgEn actively participating. Their engagement emphasized the strategic importance of connecting scientific research with business applications, ensuring that innovative solutions in algal biotechnology can be effectively translated into commercial and environmental benefits. Several industry stakeholders expressed interest in further collaborations, particularly in the fields of microalgal bioremediation, bioactive compound extraction,

Fig. 6 – Workshop participants

Fig. 7 – Part of project team NIVA-FCET in front of Workshop banners

and biofuel production, paving the way for future joint projects and commercialization efforts.

The workshop yielded several key outcomes that emphasize the importance of collaboration, innovation, and sustainable development in algal biotechnology.

- **Strengthened Collaboration** – The workshop fostered stronger ties between academia and industry, leading to the establishment of new research partnerships. These collaborations aim to drive innovation and enhance the practical applications of research findings.
- **Increased Commercial Awareness** – Participants gained a deeper understanding of the commercial viability of algal biotechnology. This awareness is expected to encourage further investment and industrial application in critical areas such as biofuels, wastewater treatment, and high-value biochemical production.
- **Identification of Funding Opportunities** – The workshop facilitated the identification of potential funding sources to support joint research initiatives. Access to these financial resources will play a crucial role in advancing sustainable technologies and fostering long-term projects.
- **Knowledge Transfer and International Cooperation** – The exchange of knowledge between international experts and local researchers contributed to improving technical expertise and fostering interdisciplinary cooperation. This knowledge-sharing initiative is expected to strengthen collaborations across Croatia, Norway, and other participating countries, enhancing research outcomes and technological advancements.

In conclusion, the workshop successfully laid the groundwork for future collaborations, investments, and research developments in algal biotechnology, reinforcing its potential for sustainable and commercial applications.

ACKNOWLEDGMENT

We extend our gratitude to Innovation Norway for supporting the organization of this workshop, which facilitated stronger collaboration between industry and scientists. We also thank the University of Zagreb Faculty of Chemical Engineering and Technology for hosting the event and all speakers and participants who contributed to its success.

We are excited about the opportunities ahead and look forward to fostering strong collaborations as we continue our work on groundbreaking innovations in algal biotechnology and the circular economy. Together, we can drive sustainable solutions, create meaningful impact, and shape a greener future for generations to come!

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