

Towards Versatility of Aquatic Production Platforms: Unlocking the Value of Nordic Bioresources (NordAqua)



Aims and objectives

NordAqua is a five-year (2017-2022) Nordic Centre of Excellence (NCoE) funded by NordForsk through the Nordic Bioeconomy Programme. NordAqua brings together 10 Nordic universities and research institutes along with 10 industrial and societal partners from Finland, Norway and Sweden. The University of Turku is a coordinator of the consortium. NordAqua aims at improvement and strengthening the algae-based blue bioeconomy, which in Nordic countries is still in its infancy. NordAqua focuses on the use of aquatic photosynthetic organisms to convert solar energy into energy-enriched carbon products with concomitant recycling of nutrients and removal of water pollutants. Main objectives of NordAqua are (i) to develop a value chain of activities for sustainable production by making use of the unique properties of aquatic photosynthetic organisms; (ii) to improve photosynthesis and develop synthetic biology tools for creating cell factories producing a diverse range of biofuels and fine chemicals; (iii) to create fruitful interactions with company partners to achieve efficient knowledge transfer to industry; (iv) interact with key players in society, including decision makers and the public to foster science-based decision making towards conceptual and solid frameworks for a blue bioeconomy.

Progress towards the objectives

The NordAqua consortium has established 5 interlinked clusters: Waste-water treatment, Algal biorefinery, Bioactive compounds (anticancer, antifungal), Synthetic Biology, Photosynthesis. The consortium develops integrative database for 3 culture collections including the HAMBI culture collection (University of Helsinki) and the Norwegian Culture Collection of Algae (NORCCA) and a culture collection owned and maintained by Umeå University. In total, the research teams have access to over 3000 strains of algae and cyanobacteria. Multi-disciplinary research in NordAqua provides comprehensive data on the Nordic strains indicating the suitability of strains in wastewater treatment and in the bioproduction of animal feed, and high-value pharma- and nutraceuticals including fatty acids, peptides, pigments and UV screens. Fundamental research on photosynthesis has been focused on understanding the role of auxiliary electron transport pathways in cyanobacteria and green algae, which guide the re-designing strategy of the photosynthetic light reactions to enhance product yields. NordAqua has been working on application of synthetic biotechnology tools to modify algae genetically, which enables to overcome the limitations of cell metabolism and the photosynthetic organisms to produce well-designed desired bio-product. NordAqua has developed a novel highly efficient innovative protocol for sustainable

H₂ photoproduction and provided a proof-of-concept for solid-state cell factories by utilizing cellulose nanofibrils, as tailored template for the immobilization of algae and cyanobacteria.

The NordAqua has initiated an 1st Nordic Algae Symposium in Helsinki (31 January 2018) where well known Nordic and European researchers presented current emerging research and industrial algal companies gave insight current state and future perspectives of large-scale projects. A high-level panel discussion draw attention to bottlenecks of industrial applications of photosynthetic organisms and highlighted the joint goal of promoting the advantages of blue bioproduction platforms.

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