

Abstract

The SUSTAIN-R project aims to introduce innovative approaches (tools, methodologies and devices) for the restoration of aquatic systems with nutrient cycling and reuse of excess and legacy N and P nutrients, preventing, minimising and remediating aquatic systems and fostering associated ecosystem services.

A variety of anthropogenic pressures from human activities including agricultural excess nutrients, Recirculation Aquaculture Systems (RAS), wastewater treatment plants, (livestock) result in nutrient pollution causing eutrophication due to nitrogenous and phosphate wastes. To evolve our countering technical proposals and methodologies in a controlled environment, RAS has been chosen to serve as a test-bench for proof-of-concept demonstration. RAS tail water includes particulate matter, ammonia, nitrate, nitrite, phosphate and other hazardous substances produced by the processing of feed to organism growth. Recovery of nitrogenous and phosphate waste from such systems will be achieved using capacitive deionization (CDI) technology producing resources for re-use as fertilizers or as precursors. Thus, nitrogenous matter can also be used for decentralized ammonia production for energy generation using electrocapacitive devices. In parallel, a pilot sequencing batch reactor (SBR) that uses controlled cycles between anoxic and aerobic conditions will be tested for removal of nitrogen and phosphorus from wastewater.

The project team has diverse background coordinated by the Functional NanoMaterials group at The Royal Institute of Technology (KTH), Sweden. KTH group has scaled a novel flow-through CDI design for water treatment and nutrient recovery and will design a novel membrane free device for transforming nitrates to ammonia and will be coordinating the project working closely with all the partners.

The Department of Hydraulics, Soil Science and Agricultural Engineering at Aristotle University of Thessaloniki (AUTH), Greece, specializes in water and soil research, focusing on hydrological and water quality modelling developing and applying methods for water resources management and environmental impact assessment. AUTH will simulate & test membrane-free electrocatalytic devices in Greek agricultural landscapes and highlight improvements in ecosystem services and aquatic ecosystem health. Aarhus university, Denmark, will advance CDI technology towards practical implementation in Recirculating Aquaculture Systems (RAS) where CDI will be optimised to remove ammonia as well as nitrite, nitrite and phosphate ions from feeding trout, improving water quality management and reducing the need for extensive purging processes.

AERIS, Spain, a spin-off of the Universitat Autònoma de Barcelona comprising experts from the GENOCOV research group founded in 2009, designs and builds automated pilot plants for research and industry. In SUSTAIN-R, Aeris will design, construct, and operate a pilot plant for biological N and P removal using synthetic and real water samples.

The project is relevant to Topic 2: Understanding and predicting multiple pressures (including anthropogenic pressures) -impact –response, covering subtopics 2.1, 2.3 & 2.4 of the Water4All 2023 Joint Transnational Call.



▶ Project coordinator

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▶ Project partners

- ARISTOTLE UNIVERSITY OF THESSALONIKI - GREECE
- AARHUS UNIVERSITY - DENMARK
- AERIS TECNOLOGIAS AMBIENTALES S.L - SPAIN

▶ Funding organisations

FORMAS (SWEDEN) / GSRI (GREECE) / IFD (DENMARK) / CDTI (SPAIN)

▶ Duration

3 years

▶ Contact

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