

## Pilot study to Evaluate Macroalgae Bioremediation combined with Carbon Footprint Tokenization in port waters of Alicante (Spain)

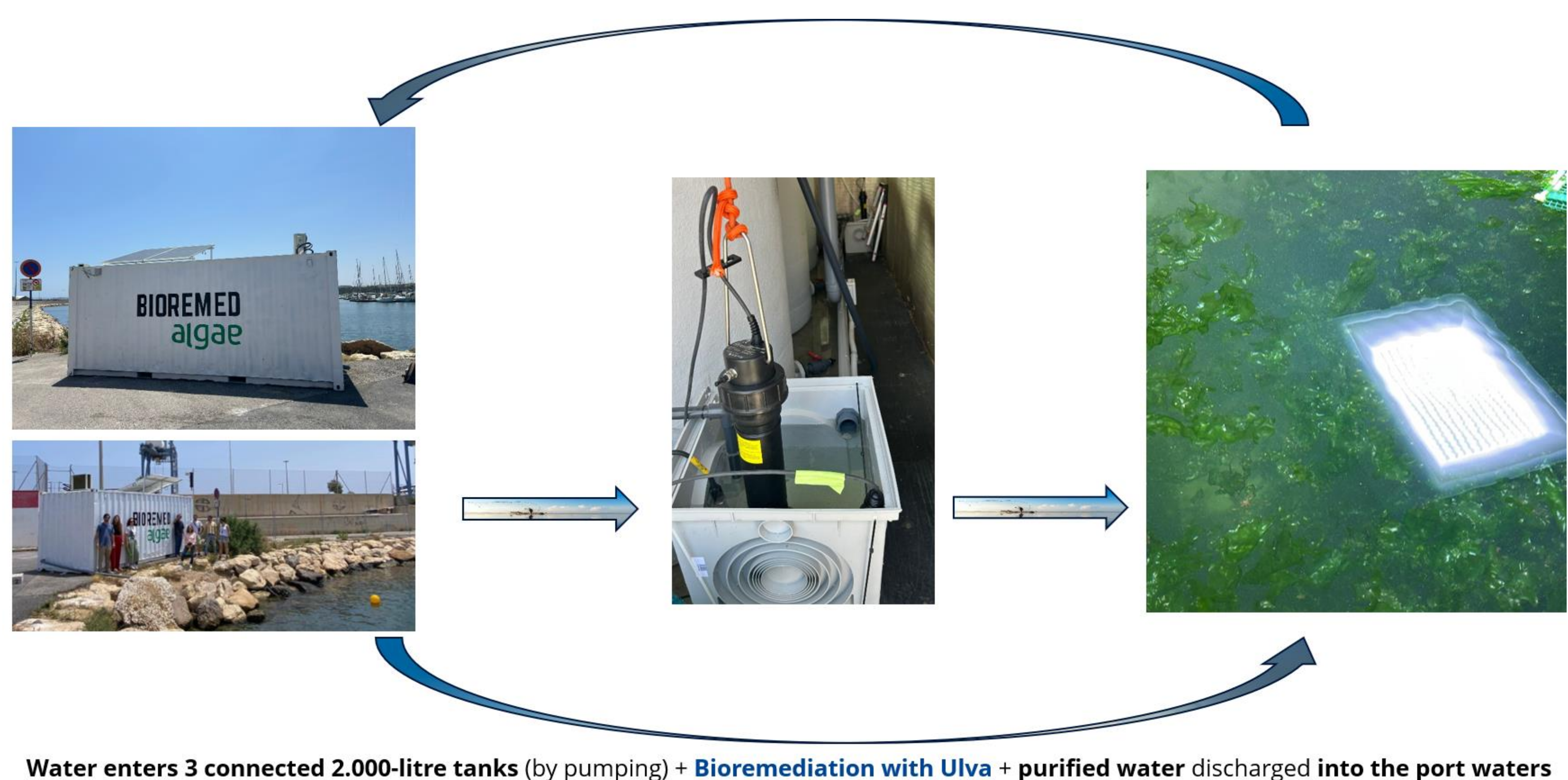
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**Introduction:** The removal of heavy metals and nutrients from port waters remains a critical environmental challenge. In this line, macroalgae bioremediation has demonstrated potential to enhance water quality and support biodiversity. Moreover, when integrated with ICT tools, such as carbon footprint tokenization, blockchain and IoT monitoring, it also generates economic incentives for sustainable practices. However, broader implementation still demands evaluation of regulatory, economic and operational feasibility.

**Pilot Study:** This pilot study, conducted at the Port of Alicante in collaboration with Mediterranean Algae, tests the use of *Ulva* sp. cultivation combined with ICT tools for port water treatment. The system uses circulating tanks to grow macroalgae while monitoring environmental parameters. It aims to enhance water quality and address climate change impacts by providing Blue Carbon Credits.

**Pilot Desing:** The pilot consists of tree 2000L tanks where *Ulva* sp. is cultivated to treat port water through continuous circulation and bioremediation in a closed system. IoT sensors monitor key parameters, while a digital platform enables real-time system optimization. CO<sub>2</sub> absorption is tracked via blockchain to generate carbon credits, creating economic incentives. *Ulva* sp. is analyzed for contaminants and explored for reuse, linking bioremediation with waste valorization and scalability.



### Expected Outcomes:

The pilot will integrate macroalgae and digital technologies to improve water bioremediation and promote circular economy models through Blue Carbon Credits generation. It will identify native algae potential, develop new algae-based products and enhance public-private collaboration. A replicable protocol will be developed to support future implementation and scalability in other regions.

#### Strengthening collaboration between public and private organisations in R+D+I



#### Real-Time Monitoring and Control



**Filtration of port water** = removal of heavy metals (Cu and As) + continuous consumption of Nitrogen and Phosphorus = prevention of eutrophication and improvement of water quality in the port

#### Circular Economy

Water treatment  
Integration of macroalgae in the integral water cycle

#### Active compounds derived from macroalgae



#### TOKENCO2: Carbon footprint tokenisation system

Automated system to measure CO<sub>2</sub> emissions generated by maritime activities and calculate them in a virtual platform to automatically manage carbon footprint offsetting.

The economic benefits obtained could be allocated to climate change mitigation projects (such as BIORREMEDALGAE).

#### Blue Credits



#### Performance Indicators

Reduction in Nutrient Emissions

Water Quality Enhancement

CO<sub>2</sub> Sequestration Efficiency

Biodiversity Enhancement

Nutrient Removal Efficiency

Biomass Production Output

Number of new products marketable