RHE-MEDiation

Responsive hub for long term governance to destress the Mediterranean Sea from chemical pollution

RHE-MEDiation Technology Basket for Validation and Replication

1. The Microalgae based Photobioreactor

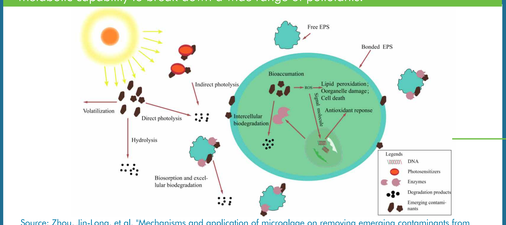
Microalgae are photosynthetic microorganisms able to grow with nutrients present in wastewater. Additionally, they can accumulate toxic metals and persistent organic pollutants (e.g., pharmaceuticals, pesticides, etc.) removing them from the wastewater and decreasing the pollution of the receiving water bodies. The produced microalgal biomass, depending on its degree of contamination by the removed pollutants, can still be upgraded to produce biofuels, biofertilizers or to extract added-value compounds.

The microalgae based photobioreactor proposed in the RHE-MEDiation project, GREEN DUNE® (international patent pending), is designed and supplied by Bluemater. It is a highly efficient biological remediation technology when integrated into water and wastewater treatment plant (WWTP) systems, capable of removing excess nutrients and priority pollutants. It has low installation and operating costs.

Its prismatic shape is designed to optimize the treated volume in smaller spaces and maximize sun exposure.

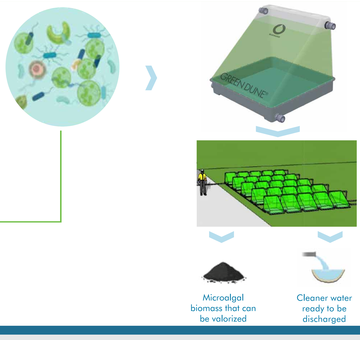
Depending on the species, microalgae are able to detoxify their environment by a process called Bioremediation.

Bioremediation is a process of contaminants removal from water using microorganisms. The contaminants can be ccumulated or degraded using the microorganisms metabolic capability to break down a wide range of pollutants.



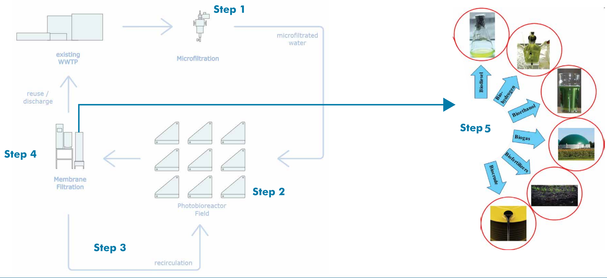
Source: Zhou, Jin-Long, et al. "Mechanisms and application of microalgae on removing emerging contaminants from wastewater: A review." Bioresource Technology (2022): 128049. 1

Inside the GREEN DUNE photobioreactors, a natural consortia of microorganisms will form and grow differently depending on the season climate conditions and water composition.



The water entering the Microalgae based Photobioreactor will go through the following steps:

Step 1 - **Microfiltration** - Water coming from the secondary treatment tanks will be microfiltrated.
Step 2 - **Microalgae treatment** - The microfiltrated water will pass through the photobioreactors, where natural microalgal blooms will remove excess nutrients and pollutants.
Step 3 - **Recirculation** - Water coming from the photo-bioreactors will be filtrated by a membrane system and part will return to the photobioreactors.
Step 4 - **Reuse / discharge** - Part of the recirculated water is discharged or reused for washing and irrigation.
Step 5 - **Biomass reuse** - The microalgal biomass produced in the photobioreactors will be reused and upgraded.



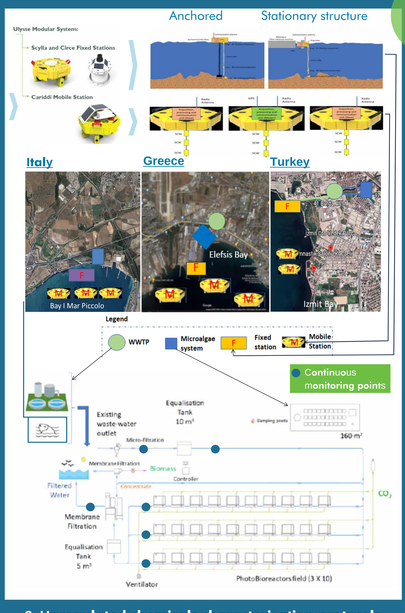
2. Development of smart integrated measurement points for monitoring of real chemical pollution cases

Multi-sensor microsystem

Designed and supplied by **SENSICHIPS SRL**, the micro-sensor based technology allows for real-time identification of a wide range of chemical contaminants

Chemical substances monitoring

MDM TEAM SRL design and develops integrated arrays of chemical measurement stations (fixed and mobile) with autonomous and cooperative capabilities.



3. Unregulated chemicals characterization protocols for replication purposes

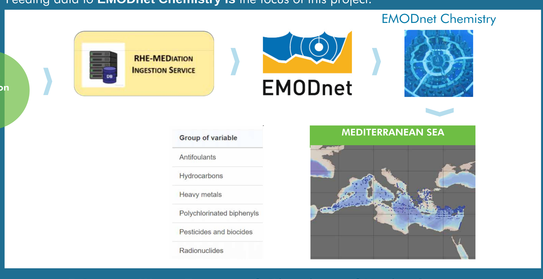
Establish the level of accuracy of chemical characterisation protocols based on the discrimination capacity achievable by the measurements ensing technology tested and validated at the demo-sites.

Maximise exploitation of accuracy of chemical characterisation protocols to optimise the design of microalgae-based packages for replication purposes.

4. Data Integration with ocean and water digital twins

The European Marine Observation and Data Network (EMODnet)

EMODnet is a network of organisations supported by the EU's integrated maritime policy to observe the sea, process the data according to international standards and make that information freely available as interoperable data layers and data products.These are all relevant for the implementation of EU marine policies such as MSFD, WFD, and Maritime Spatial Planning Directive (MSPD).
Feeding data to **EMODnet Chemistry is** the focus of this project.



5. Input to Water Framework Directive and Marine Strategy Framework Directive

Water Framework Directive (WFD)

The key objectives of the WFD is supporting inland, transitional and coastal surface waters as well as groundwaters of Europe reach Good Status Conditions with both their chemical and ecological parameters adhering to the following key approaches:

Marine Strategy Framework Directive (MSFD)

The EU's main tool to protect and conserve the health of our coasts, seas and ocean is the MSFD. It consists of legally-binding and operational principles for managing the EU's entire marine environment. The MSFD is a cyclical process that includes the following key processes:

Funded by the European Union

Funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

EU MISSIONS RESTORE OUR OCEAN & WATERS