

REWATER

Sustainable and safe water management in agriculture: increasing the efficiency of water reuse for crop growth while protecting ecosystems, services and citizens' welfare

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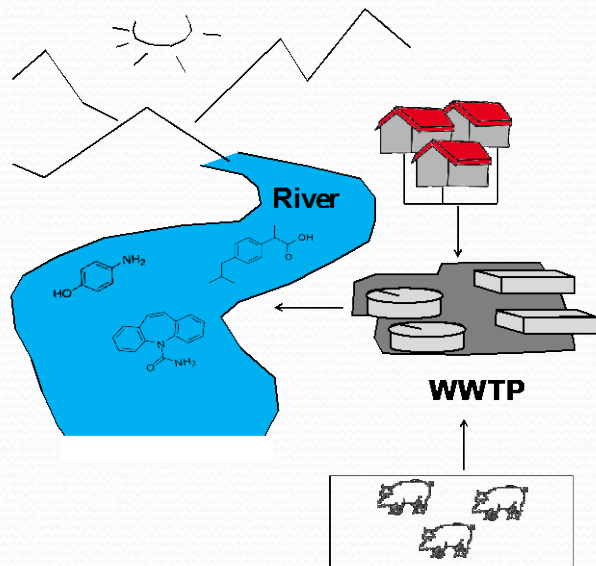
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Water JPI
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MOTIVATION



- **Wastewater irrigation** offers some attractive environmental and socioeconomic benefits
- Active release of man-made chemicals, have been driving to water depletion and a **loss of quality**
- Emerging contaminants such as specific Micropollutants and their corresponding Metabolites and/or Degradation products (MMDs) **have reduced removal rates** by conventional treatments in WWTP
- This may lead to **contamination** of receiving surface waters, which could be **extended** to soils, crops and, in a last instance, to human beings

RELEVANCE

REWATER intends to develop research and application of **technologies** producing a **final integrated solution for reuse of WW for agricultural purposes**, and their economic and environmental evaluation with a LCA. This will minimize potential negative impacts of WW reuse in the environment, decreasing the undesirable introduction of MMDs in agriculture and aquatic systems, and reducing their spread within the food chain.

Model compounds are two categories of MMDs - pesticides and pharmaceuticals - either included in the Watch List, or selected because of their reported low efficiency removal in WWTPs and high environmental persistence.

GENERAL OBJECTIVES

- Reinforce a network of expertise building on on-going research activities at EU level, establishing strong bases for future collaborations and scientific activities, thus enduring beyond project lifespan;
- Enhance cooperation and exchange of expertise between scientific and industrial partners;
- Promotion of research activities of the consortium to potential stakeholders;
- Provide monitoring guidelines, education and training;
- Contribute to policy objectives regarding chemical and effects-based monitoring of pollution in EU surface

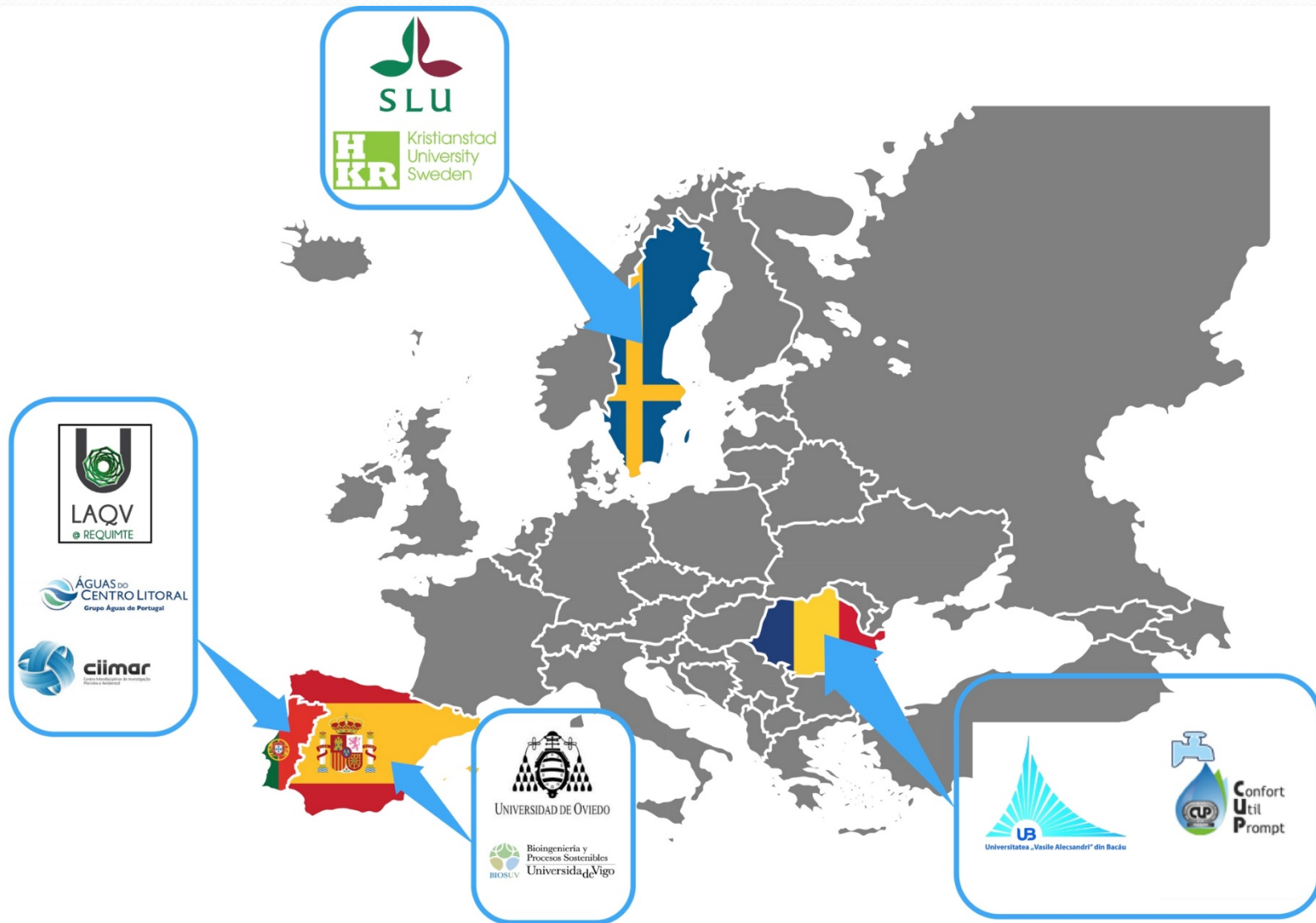
waters.

SCIENTIFIC/TECHNOLOGICAL OBJECTIVES

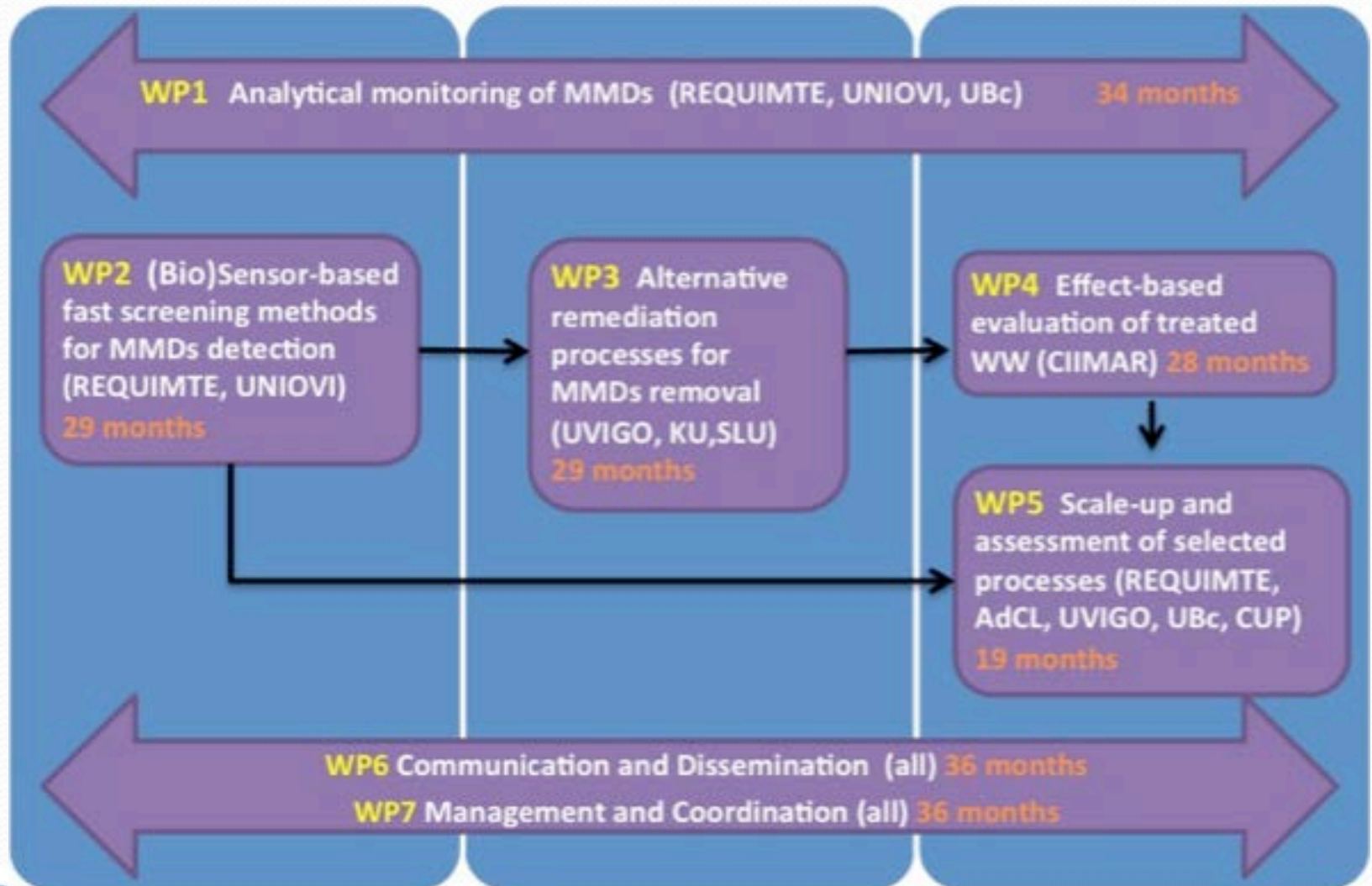
Apart from chemical monitoring of selected target MMDs in WW, work programme will include tuned improvement or development of:

- 1) biosensors for in-field rapid and selective detection of MMDs;
- 2) costly-balanced alternative tertiary treatments for contaminated WW (through biological and electrochemical processes);
- 3) ecotoxicological tools to evaluate treated water for reuse and develop expeditious surveillance;
- 4) analytical monitoring, scaling-up and environmental/economic assessment.

CONSORTIUM

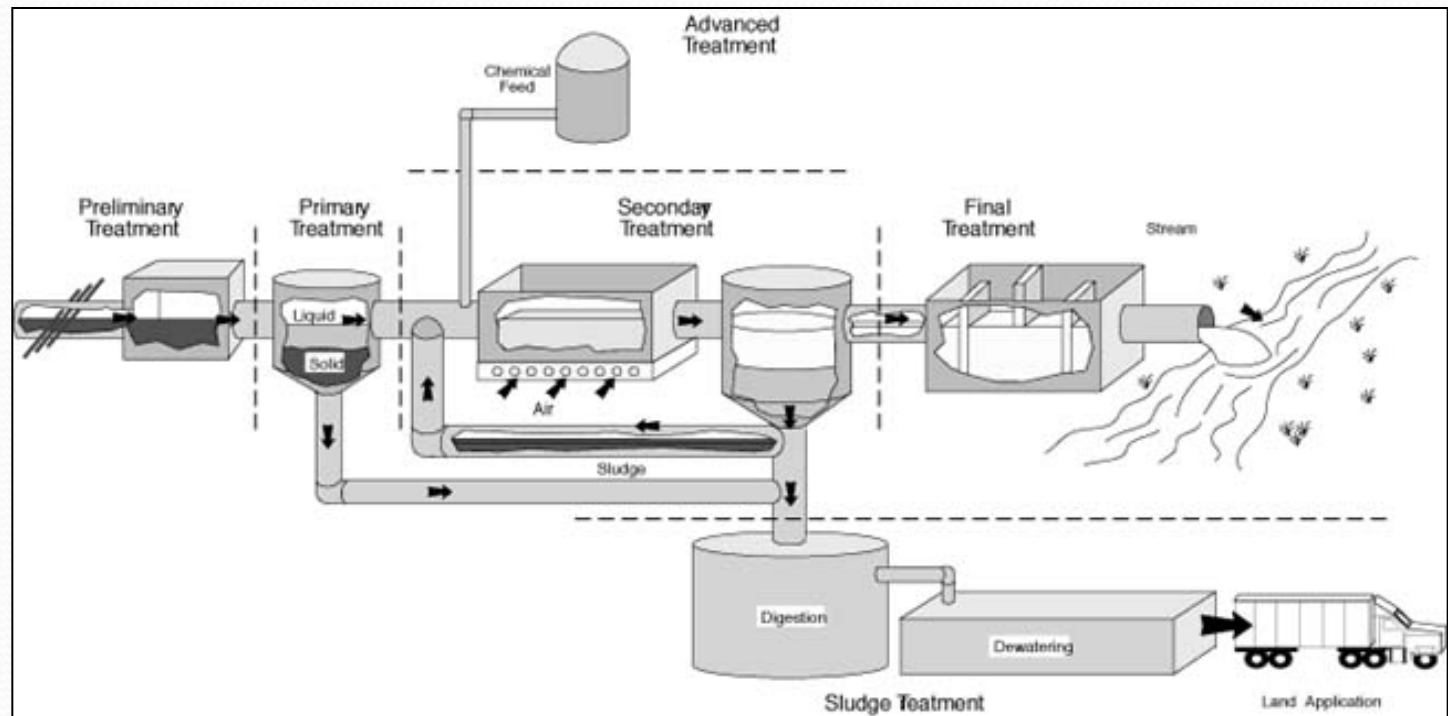


APPROACH



Analytical monitoring of Micropollutants and their corresponding Metabolites and/or Degradation products (MMDs)

- Development of analytical tools to detect and quantify MMDs in different matrices (wastewaters, sludge and aquatic organisms)
- Analytical monitoring



WP2

(Bio)Sensor-based fast screening methods for MMDs detection

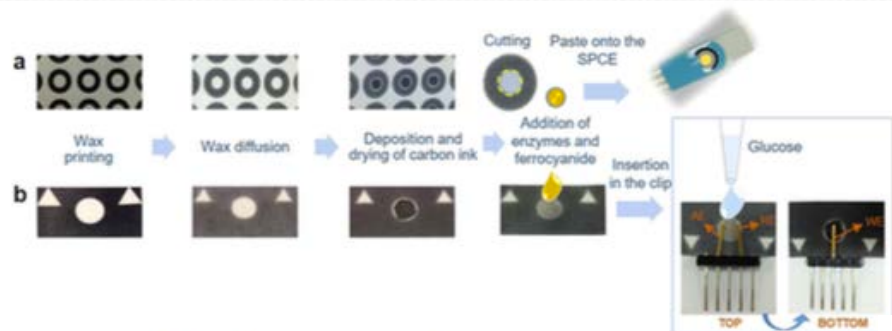
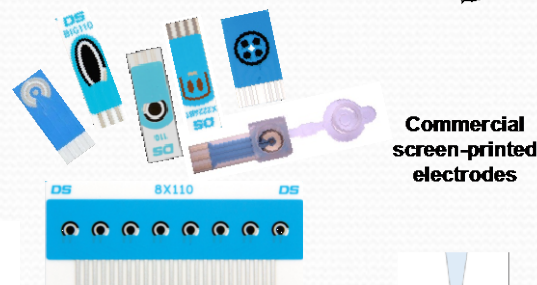
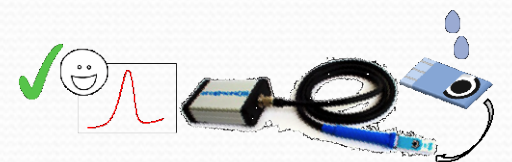
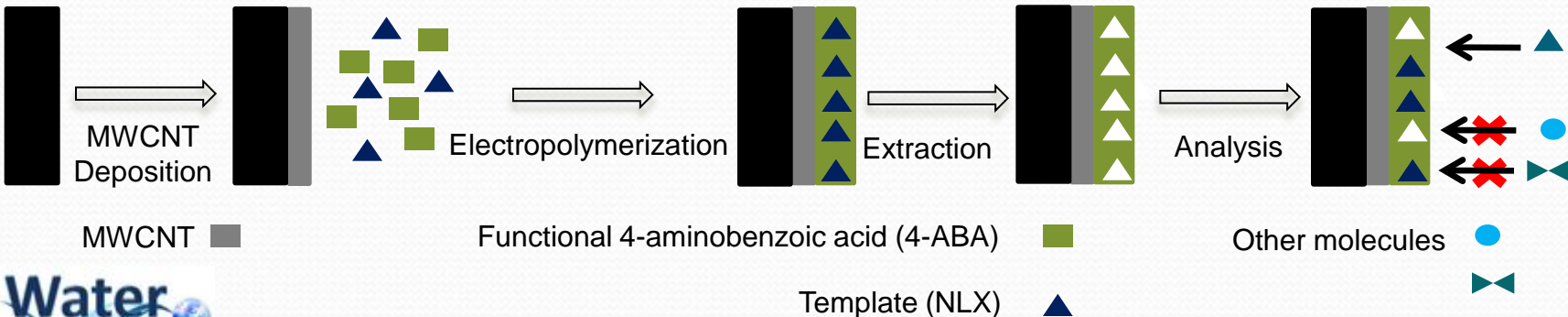
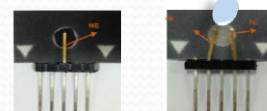


Fig. 1. Scheme of the preparation of electrochemical cells: a) based on SPCEs and b) using gold-plated connector headers.



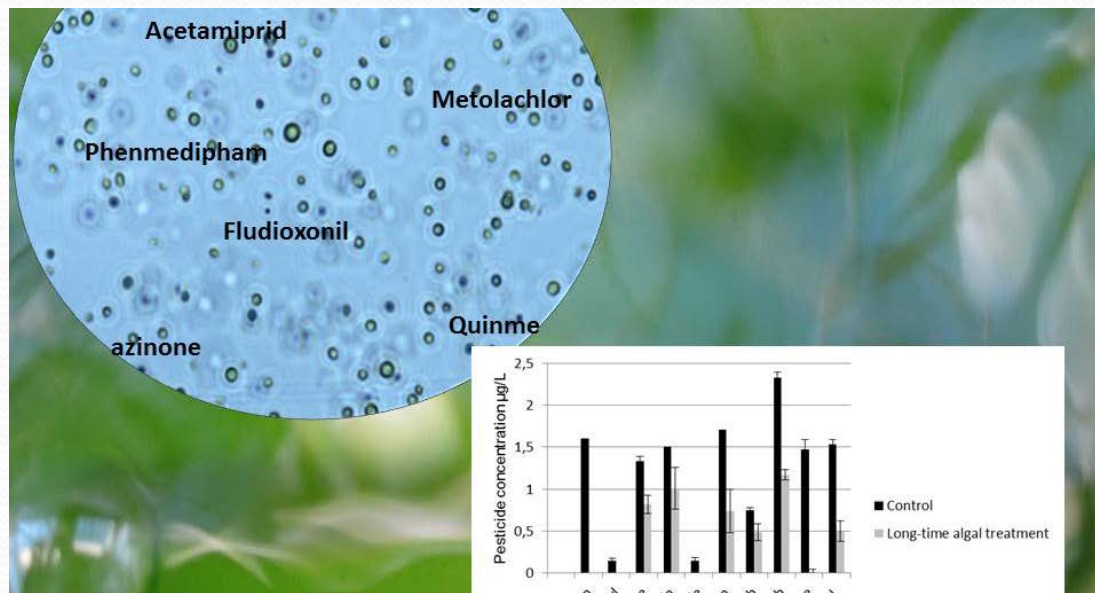
Commercial screen-printed electrodes

Paper-based electrodes

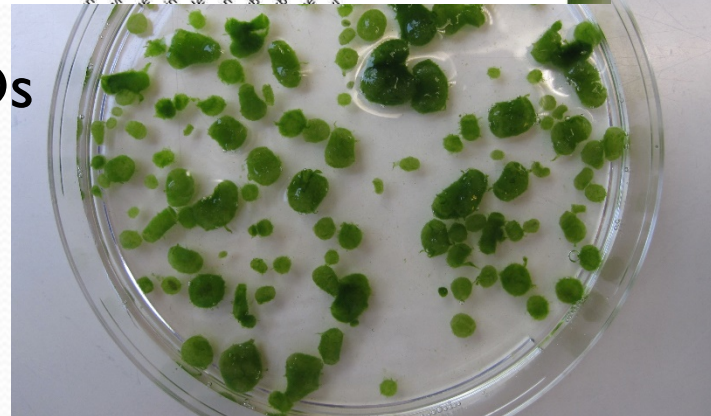


WP3

Alternative remediation processes for MMDs removal - biological approach

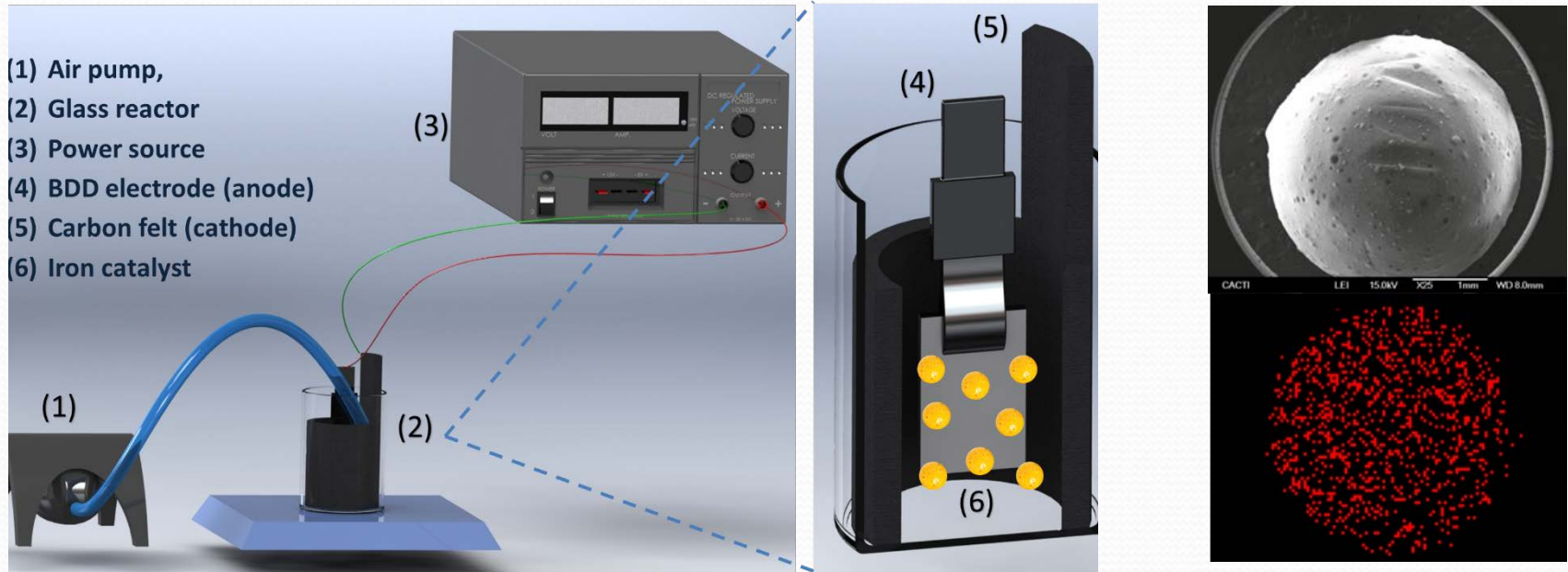


- Mycoremediation efficient for MMDs degradation
- Co-culture of microalgae and filamentous fungus (biopellets)



WP3

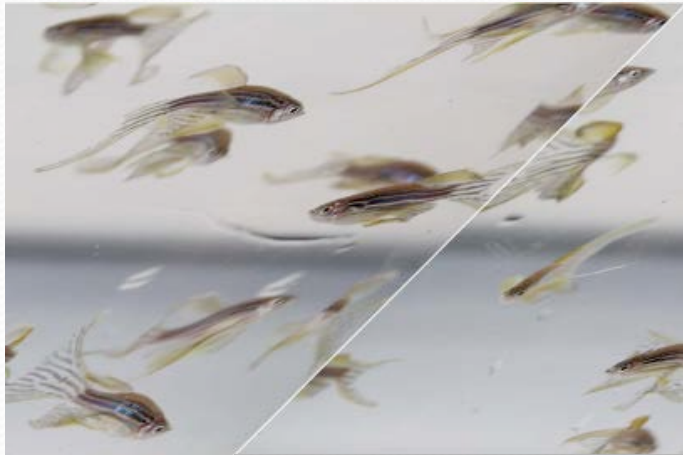
Alternative remediation processes for MMDs removal - electrochemical approach



- Electro-Fenton process
- Microbial Fuel Cells to reduce electricity consumption

WP4

Effect-based evaluation of treated wastewater



- A battery of recognized bioassays will be used for assessing biological effects of baseline and treated WW, and correlate them with chemical analysis;
- Integration of all results will provide a set of effective organisms, assays and endpoints to be used in evaluation of treated WW.

Scale-up and assessment of selected processes



Norte (Portugal)

- LCA
- SWOT



Focsani (Romania)

Expected Impact of the Project

- Design of (bio)sensors for specific MMDs with increased sensitivity, cheaper and easy-to-use;
- Improvement of treatment technologies to remove MMDs, providing new insights into environmental and economic approaches;
- Generation of ecotoxicological tools and strategic follow-up monitoring of WW treatment;
- Implementation of scale-up studies in 2 geographically different WWTPs (Portugal and Romania), to ascertain technical and economic feasibility at a larger scale and refine recommended action guidelines to be issued.

Expected Impact of the Project

Challenge-1 (Increasing the efficiency and resilience of water uses) in the *Sub-topic-1.a*. Efficiency issues include the development of (iii) Water reuse and recycling technologies in the agriculture and freshwater aquaculture sectors.

Development of MMDs removal technologies and effects-based quality assessment tools for WW

Implementation of innovative technologies for the monitoring of surface and groundwater bodies (*Sub-topic-1 b.iii*)

Development of biosensors, as well as selection of best tools to evaluate the ecotoxicity of WWTPs effluents in pilot studies

Challenge-3 (Integrating social and economic dimensions into the sustainable management and governance of water resources) in the *Sub-topic-3b* (Set-up of water-valuing schemes and the estimation of associated costs with a sustainability perspective including social, economic and ecological pillars)



Integrated solution for WW reuse for agricultural purposes, and its economic and environmental evaluation (LCA)

Expected Impact of the Project

- Sustainable solutions to removal of WW MMDs, envisaging the protection of natural resources and water reuse;
- Disseminating knowledge to society in general, which will have long lasting impact, especially to the priority theme “Developing Safe Water Systems for the Citizens” (SRIA);
- Contribute to European policies and their objectives tackling two main environmental objectives of EU WFD: identifying chemical pollutants for regulation and obtaining monitoring data for MMDs;
- Support the accomplishment of “Europe 2020 strategy” focused on promoting the greening of industry and protection of natural resources, through resource efficiency and development of nature-based solutions to societal challenges water and waste management.

REWATER answer to specific aims of the call:

- Multi-disciplinary work: Enhance cooperation and exchange of expertise between scientific partners and SMEs specialized in WW treatment;
- Proposal with fundamental and applied approach: solutions to removal of WW MMDs providing a balanced cascade of efficient methods, from detection to removal efficiency, complemented with scaling-up pilot studies;
- Stimulate mobility: mobility plans were designed
- Collaborative research and innovation during and beyond project life: reinforce a network of expertise building on on-going research activities at EU level; results will be translated into networking in REWATER afterlife, thus supporting implementation of its achievements, including through joint applications to other programmes

THANK YOU!

