AMIA
WWT TECHNOLOGIES FOR WATER REUSE

COMBINATION OF INNOVATIVE TECHNOLOGIES FOR WATER REUSE

INNOVATIVE COMBINATION
OF WWT TECHNOLOGIES
FOR WATER REUSE:

Anaerobic-Aerobic
Microalgae & AOP Processes

CALL

The European project LIFE AMIA is a demonstration project funded by the European Union through the LIFE 18 call under the Grant Agreement LIFE18/ENV/ES/000170.

TOTAL BUDGET

1.945.914 €

PROJECT DURATION

September 2019 - December 2022

MOTIVATION

Water scarcity is an increasingly serious problem affecting human health, economic development and the maintenance of ecosystems. With the world's growing population, increasing demand for water for agriculture, industry and human consumption, coupled with climate change, the pressure on available water resources is increasing.

In addition, the energy cost of water treatment accounts for around 1% of the annual energy cost of countries, which drives the development of more sustainable technologies to achieve quality water for reuse with minimal environmental impact.

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1. The project

The LIFE AMIA project designs a technological solution for the treatment and regeneration of urban wastewater for reuse, for application in small and medium-sized populations. Its main objective is to obtain high quality reclaimed water in compliance with European reuse regulations, through the use of low energy consumption technologies, removal of emerging pollutants and pathogens and application of the circular energy principle for waste minimization.

The project achieves an innovative wastewater treatment plant (WWTP) concept that combines three processes in series: a compact anaerobic-aerobic treatment (A^2C), a microalgae photobioreactor (HRAP) and an adsorption process with advanced electrooxidation (AOP).

Its objective is to obtain an energy source (biogas) from the first treatment, thus reducing energy consumption, the recovery of nutrients (mainly nitrogen and phosphorus) from the aerobic sludge biomass, as well as from the harvested microalgae, for application as a biofertilizer for soil. In addition, the significant reduction of organic pollution, pathogens and micropollutants not removed in conventional WWTPs, is achieved using the latest electrooxidation treatment.

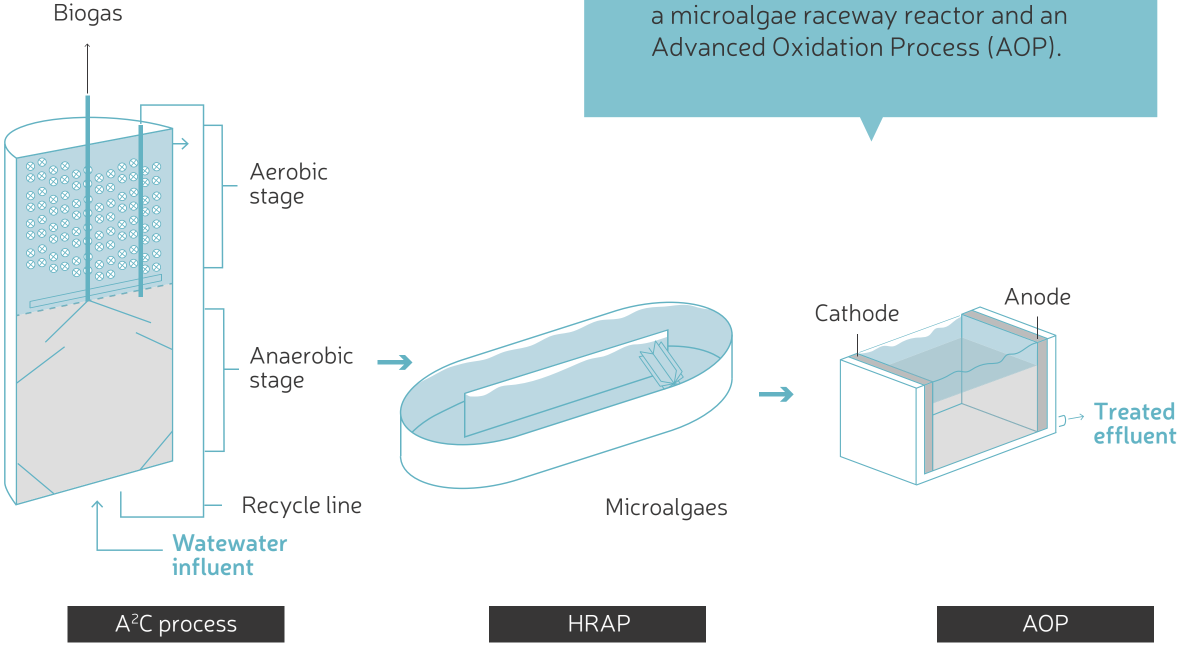
These objectives are achieved through the synergy between the different innovative technologies in series.

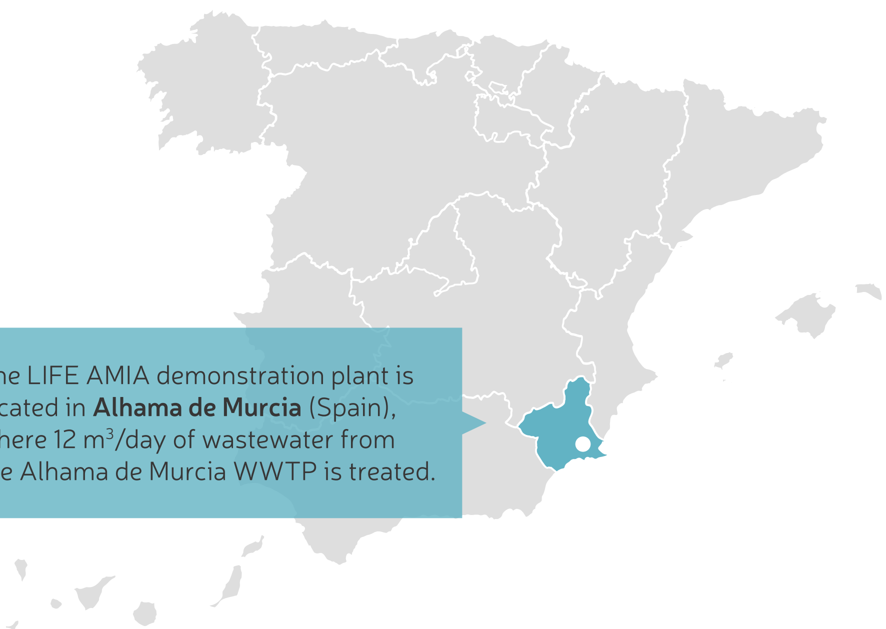
Anaerobic treatment, with biogas production and lower energy consumption.

Microalgae treatment with low requirements of energy.

Adsorption technology and electrooxidation powered by renewable energies.

LIFE AMIA technology consists of an **innovative process** that combines a compact anaerobic-aerobic treatment, a microalgae raceway reactor and an Advanced Oxidation Process (AOP).





The LIFE AMIA demonstration plant is located in **Alhama de Murcia** (Spain), where 12 m^3/day of wastewater from the Alhama de Murcia WWTP is treated.

1.1. Specific objectives

Reuse wastewater in agriculture in accordance with the new European Water Reuse Directive.

Provide an energy-self-sufficient system to treat urban wastewater.

Reduce the environmental impact of the sludge produced, by reducing sludge production and thus minimizing management costs.

Reduce the carbon footprint and greenhouse gas emissions.

Remove micropollutants and pathogens from wastewater.

Recover nutrients (algae) to be used as biofertilizer.

Introduce metagenomic techniques for the quantification of microorganisms.

1.2. Participants in the project

In the project, coordinated by FACSA, the consortium is formed by the following partners: FACSA, CEBAS-CSIC, ATLANTIS, ESAMUR, EUROFINS-IPROMA and ARVIA.

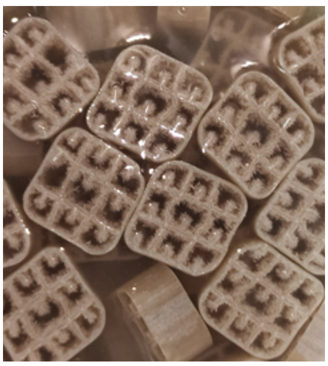
2. The Life AMIA solution

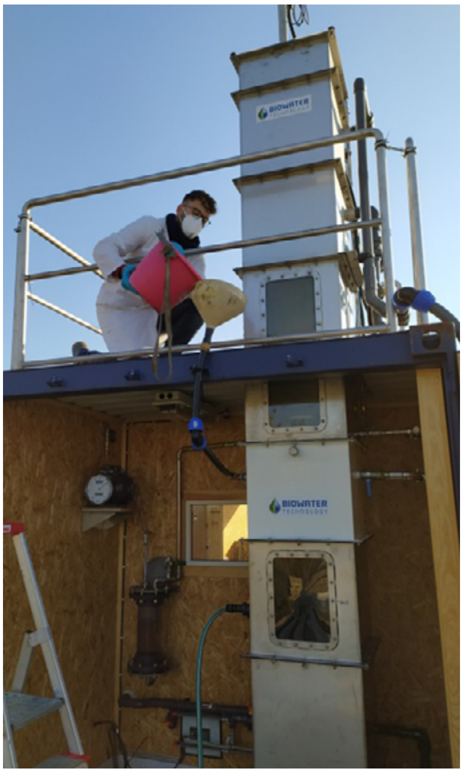
START: SEPT. 2019

...**water demand** will increase by 55% compared with present levels.

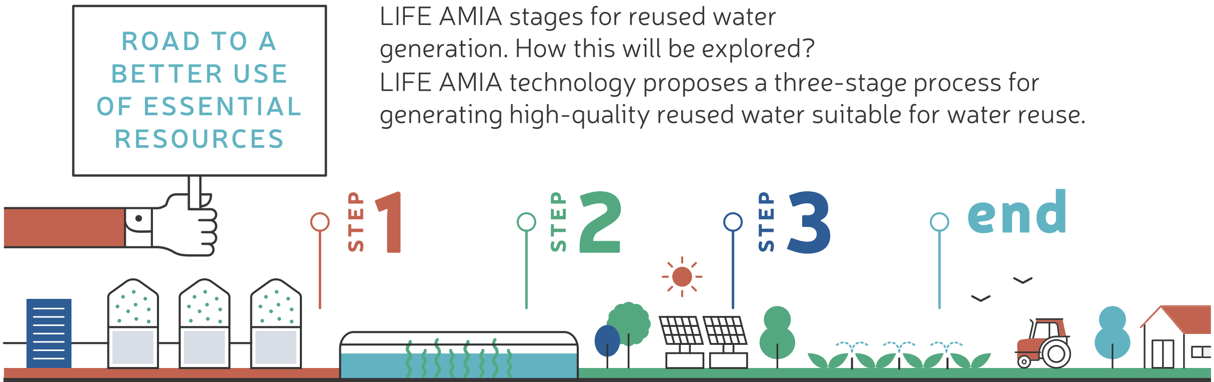
Water stress affects 130M inhabitants, equivalent to 30% **European population**.

END: DEC. 2022





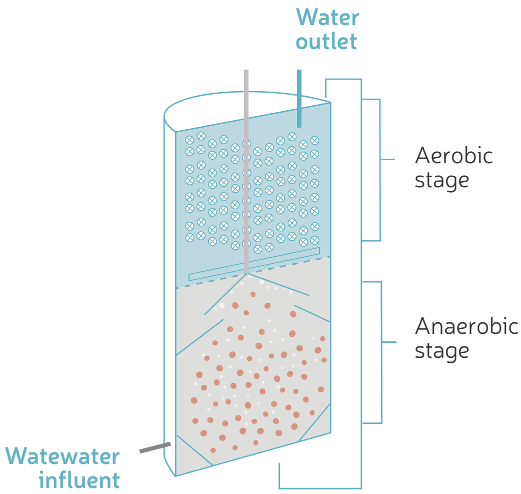
Stages of the process



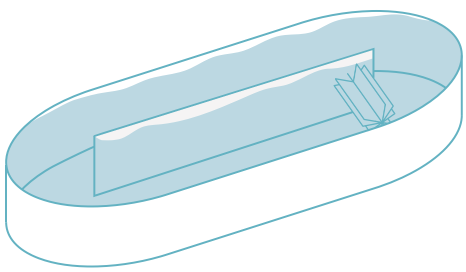
LIFE AMIA stages for reused water generation. How this will be explored?
LIFE AMIA technology proposes a three-stage process for generating high-quality reused water suitable for water reuse.

Compact anaerobic-aerobic treatment with biogas production.	Microalgae-based treatment for nutrient recovery.	Advanced adsorption-electrooxidation tertiary treatment supplied with renewable energy.	Reuse of regenerated water in agriculture.

The LIFE AMIA treatment begins with a compact anaerobic-aerobic system. Water is fed into the bottom of the anaerobic chamber, which uses granular biomass in an upflow reactor (EGSB type) to produce biogas. After a three-phase separation system, the water is directed to the upper chamber where it is treated with a moving bed technology (MBBR).

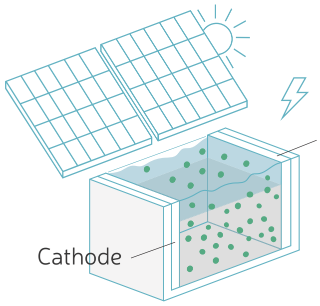


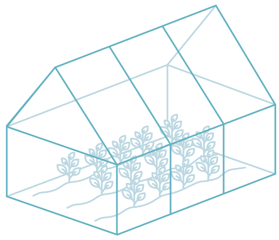
The water is then treated in two raceway microalgae reactors or HRAP (High-rate algae pond) where the water is treated for 4.5 days, and autotrophic photosynthetic microorganisms use sunlight to fix the dissolved CO_2 and assimilate the nutrients present in the wastewater, mainly nitrogen and phosphorus. The system uses a pH regulation system with a CO_2 dosage to keep the pH in the range of 7-8. After leaving the HRAP reactor, the microalgae are harvested from the liquid using a dissolved air flotation (DAF) system, obtaining the biomass that can be used as fertilizer due to its high nutrient content.



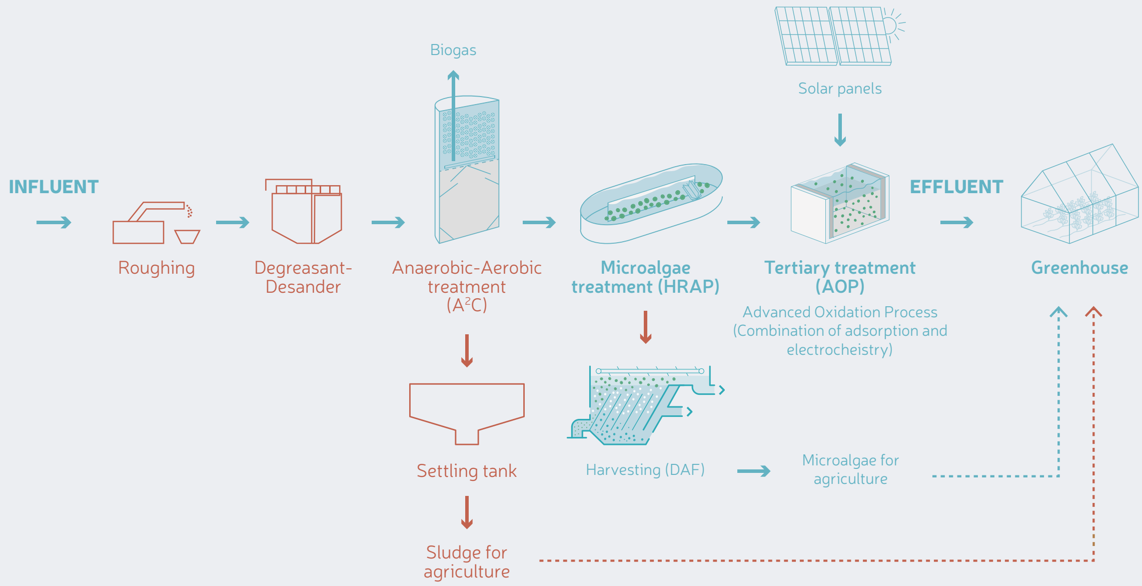
As a last step, the purified water undergoes a tertiary treatment for its regeneration through an advanced adsorption and electrooxidation (AOP) process powered by solar energy. This innovative process uses a bed of NYEX® particles to adsorb organic molecules, which are then oxidized to CO_2 through the application of a small electric current (5-15A) that also regenerates the particles. The use of solar energy as the main source of energy improves the sustainability of the treatment.

In addition, the biomass obtained (sludge and microalgae) are applied as biofertilizer in agriculture.





Complete diagram of the process



The application of LIFE AMIA in the WWTP of small towns can provide:

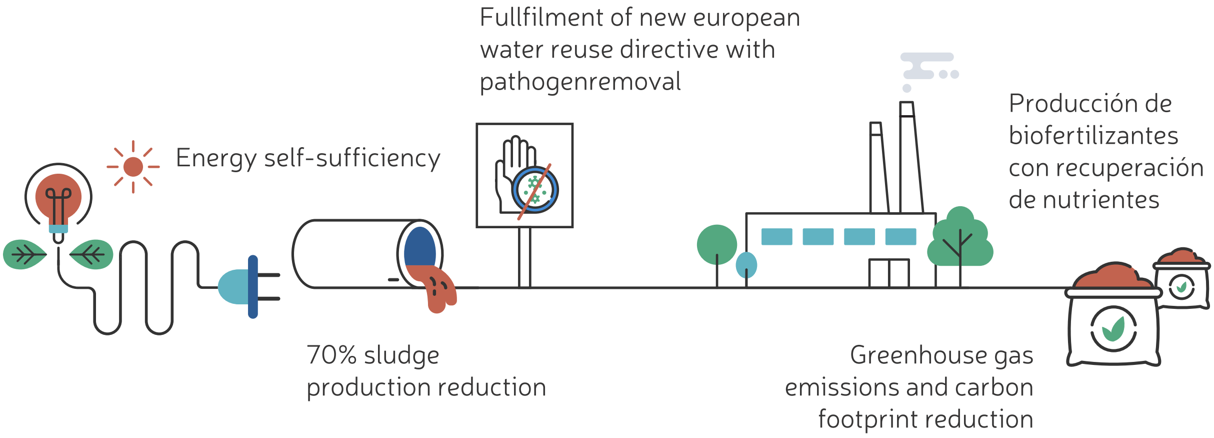
35, 5 t
nitrogen

15, 16 t
phosphorus

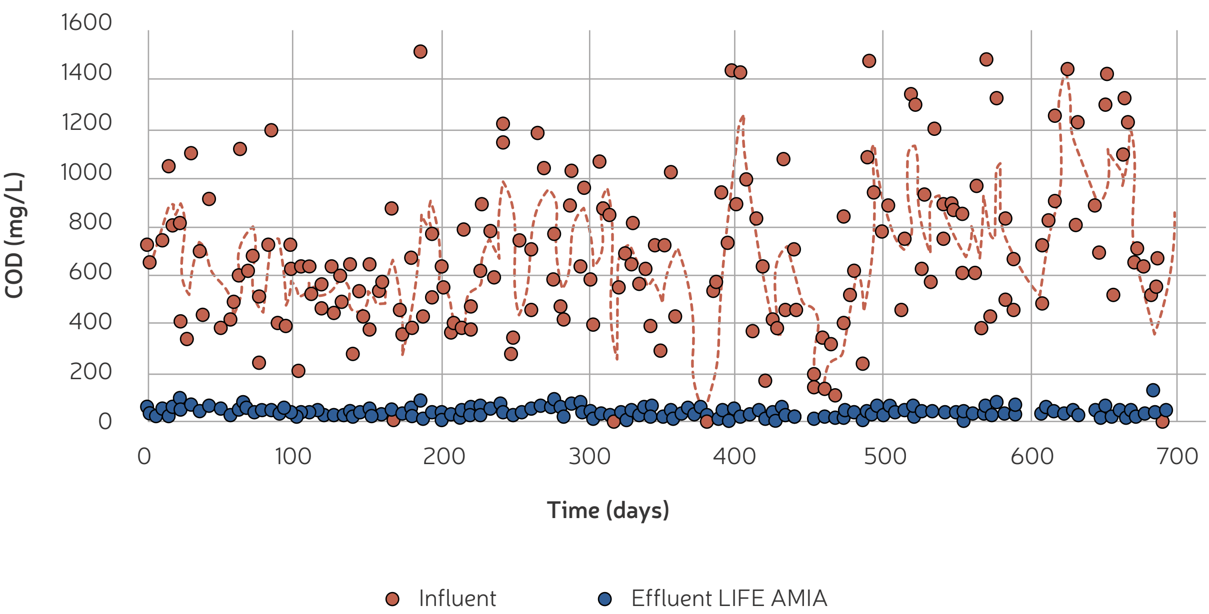
35, 6 Ha
fertilized

- 6,91 t
CO_2 per year

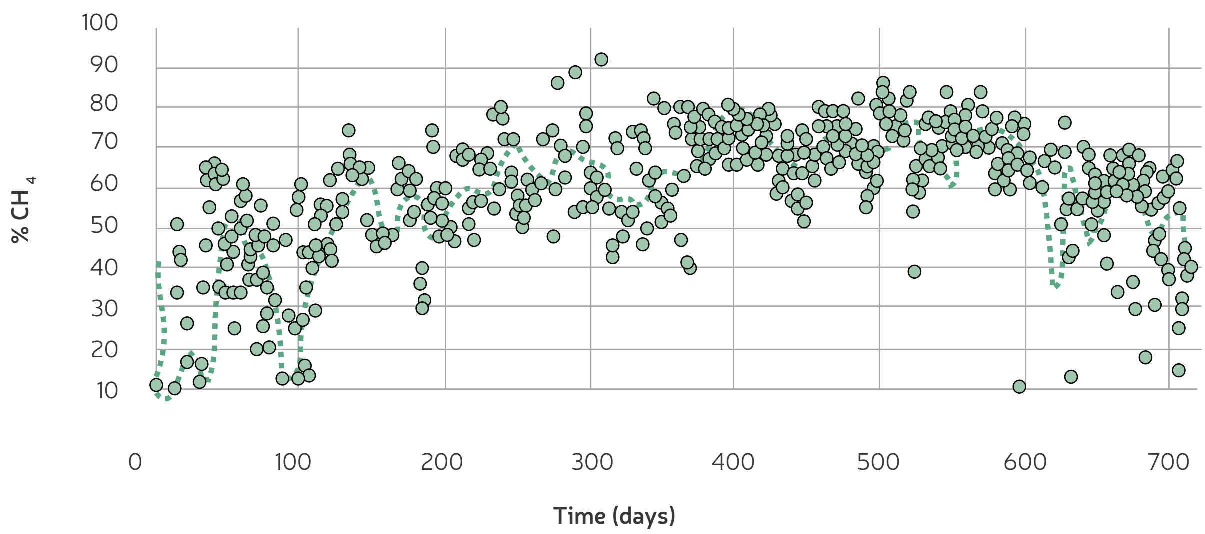
3. Results



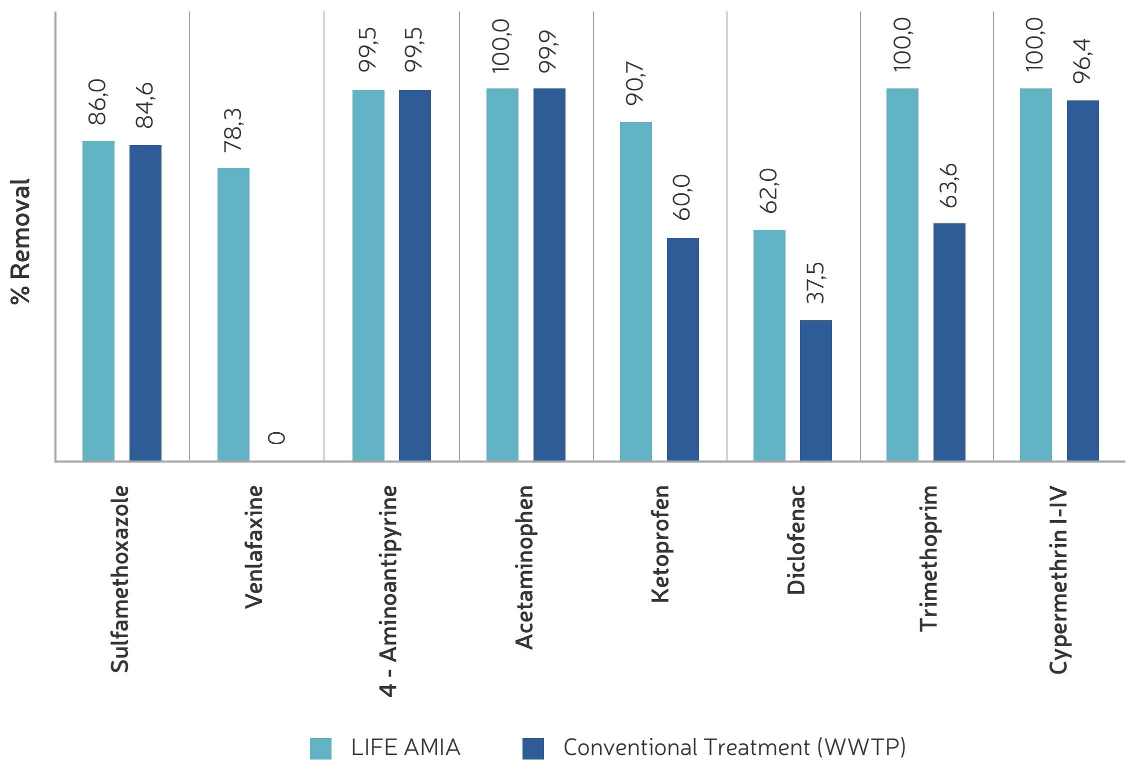
Organic matter removal in the LIFE AMIA process



Methane content in the biogas produced



Removal of drugs, pesticides and other compounds of emerging concern



Milestones

Obtain water suitable for reuse in agriculture in accordance with the new European Regulation on water reuse.

Achieve an energy self-sufficient system to treat urban wastewater.

Reduce the environmental impact of the sludge produced, reducing sludge production and management costs by 73.2%.

Reduce the carbon footprint and greenhouse gas emissions by 48% compared to conventional treatment.

Introduction of advanced metagenomic techniques for the quantification of microorganisms.

Recovery of 27.9 gN/m^3 and 12.63 gP/m^3 in the biomass obtained (sludge and microalgae) to be used as biofertilizer.

Removal of micropollutants and pathogens from wastewater, highlighting the elimination of drugs such as venlafaxine, ketoprofen or diclofenac that are not sufficiently eliminated in conventional treatment.

Long-term benefits

Mitigation of global environmental pollution.

LIFE AMIA allows to reduce the pollutant load of the wastewater and reduces greenhouse gas emissions from wastewater treatment with a higher performance to conventional technologies.

Improved energy management.

The use of renewable energy and the production of biogas allow the LIFE AMIA treatment to be powered, thus achieving treatment with lower energy requirements.

Application of the circular economy principle.

The application of the biomass obtained as biofertilizer allows the minimization of waste, cost savings and the use of available resources.

Increase in the viability of wastewater treatment in small and medium-sized WWTP.

The advantages achieved by LIFE AMIA compared to conventional treatment allow the extension of the technology to rural areas or small towns where tertiary water treatment is not available due to the energy or technological costs.

Avoid the accumulation of micropollutants in the water.

Many compounds of emerging concern can be toxic to ecosystems and humans causing health problems such as cancer, hormonal, and neurological problems. LIFE AMIA eliminates these compounds avoiding their accumulation in water bodies and protecting the environment.

The introduction of metagenomics techniques in water purification.

Metagenomic techniques allow a complete analysis of the microbial community present in a sample. They can be used for the control and monitoring of treatment processes, helping to improve their efficiency, optimize operating conditions and design more efficient processes.

4. Communication actions

Throughout the project, the consortium has carried out numerous communication and networking activities in order to disseminate the results achieved and transfer the knowledge acquired in LIFE AMIA.

24
Communication actions

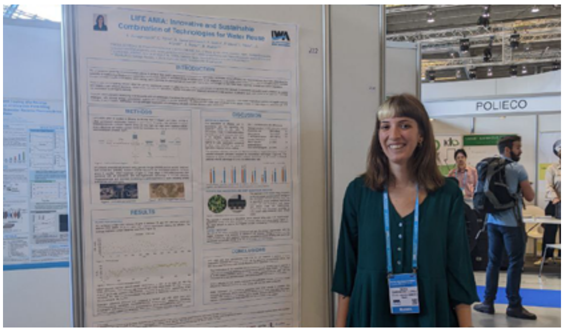
10
Conferences or congresses attended

1
Conference day

LIFE AMIA Conference | 2022

Our events

The LIFE AMIA consortium organized the LIFE AMIA workshop to present the project to technicians from the world of wastewater treatment and to all types of interested parties, with an attendance of more than 200 people, both in person and online.



IWA World Congress | 2022

30th LIFE AMIA aniversary

IWA Young Water Professionals Congress | 2022

Final meeting of the project with CINEA, MITECO, Ernst & Young y NEEMO | 2022

LIFE Platform Meeting | 2022

Kick Off Meeting | 2022

Project conference LIFE SPOT | 2022

LIFE AMIA

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Del Mar avenue, 53 - 12003 Castelló de la Plana (Spain)
Tel.: (+34) 694 255 063 - ezuriaga@facsa.com

www.lifeamia.eu