Layman's report

The demonstration project is co-financed by the European Commission's LIFE program with Grant Agreement number LIFE14/ENV/ES/000150.

Synergic TPAD and O_3 process in WWTPs for Resource Efficient waste management

CALL

LIFE STO3RE is a European demonstration project, funded by the European Union in the 2014 LIFE Program under Grant Agreement LIFE14/ENV/ES/000150

TOTAL BUDGET

1.957.874 €

PROJECT DURATION

SEP 2015 - JUN 2019

MOTIVATION

The European population exceeds **500 million inhabitants** and has more than **50.000 wastewater treatment plants** (WWTP), which generate a total of more than **10 million tons of dehydrated sludge** per year that must be managed.

Livestock farms in Europe generate more than **930 million cubic meters of pig slurry** annually, which in many cases are applied directly to agriculture.

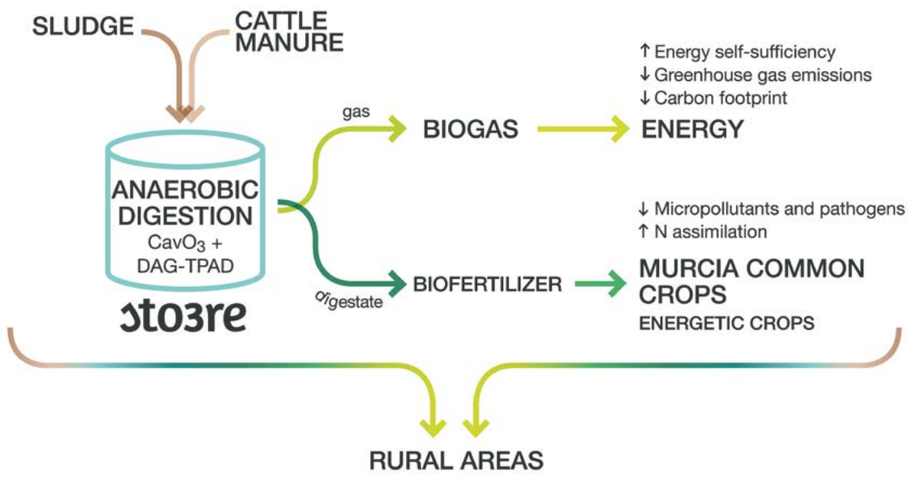
LIFE STO3RE

1. THE PROJECT

LIFE STO3RE project aims to promote a circular economy model applied to the joint management of excess sludge produced in wastewater treatment plants of small and medium size and of the pig slurry generated in pig livestock farms. Its main objective is the protection of the aquatic environment from pollution caused by nitrates, pathogens and organic micropollutants from the sludge and pig slurry.

The technology developed consists of the combination of the **anaerobic digestion in a double temperature phase** (thermophilic digester followed by mesophilic digester), together with **oxidation** by adding **ozone** and **hydrodynamic cavitation**. The objective of this process is to separate the main phases of anaerobic digestion, to maximize biogas production. Ozonation and hydrodynamic cavitation have been validated as pre and post-treatment of the co-substrate, with the triple objective of reducing micropollutants, pathogen content and increasing biogas production.

This system provides, on one hand, a high quality **biofertilizer** and, on the other one, **biogas** to self-supply the joint system of co-digestion of sludge and pig slurry.



LIFE STO3RE is designed for rural areas where a centralized system of sludge management of small and medium-sized wastewater treatment plants and nitrogen-rich wastes such as pig slurry, will reduce investment and exploitation costs. The demonstration plant, located in the WWTP of Totana (Murcia), has been treating 1 t/day of sludge from WWTP and pig slurry from nearby farms.

SPECIFIC OBJECTIVES

1. **Reducing the impact of pig slurry and sewage sludge** on surface and aquifer waters.
2. **Reducing the carbon footprint and greenhouse gas emissions** produced by slurry storage.
3. **Designing a joint management model** of sludge and wastes with a high N content for rural areas, in order to reduce investment and operation costs.
4. **Maximizing the production of biogas** by the effect of the double temperature digestion, hydrodynamic cavitation and ozonation.
5. **Ensuring a quality biofertilizer,** which complies with the new legal regulations for the application of sludge in agriculture.
6. **Studying the effect of the biofertilizer** obtained on the surrounding crops.

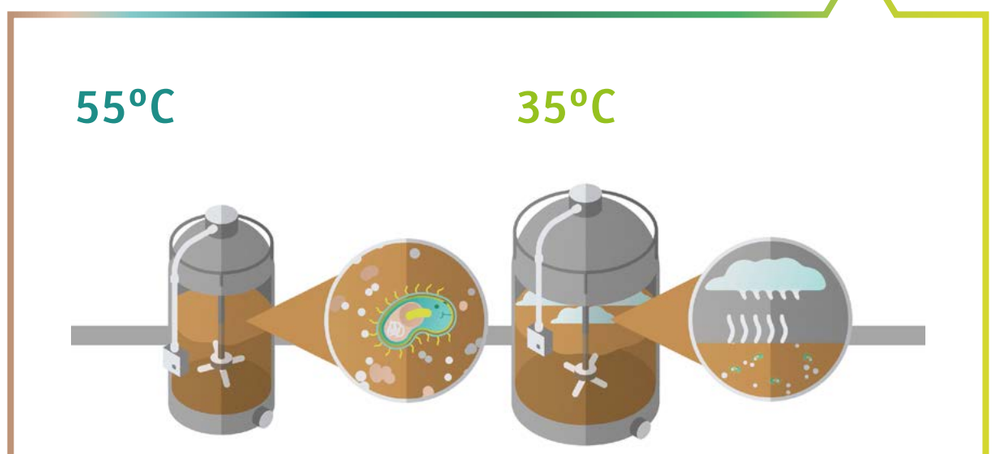
PARTICIPANTS IN THE PROJECT

The project, coordinated by FACSA, has been developed by a consortium formed of 5 Spanish partners from the scientific, public and private environment: FACSA, ESAMUR, IPROMA, AINIA and CEBAS-CSIC.

2. STO3RE SOLUTION

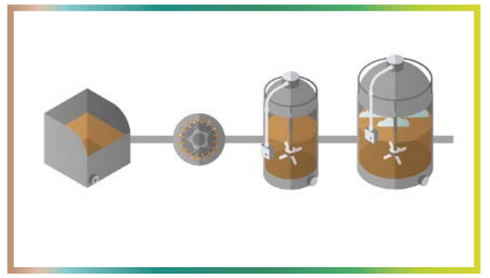
The technology that has been developed in the Life Sto3re project consists of the combination of the anaerobic digestion in a double temperature phase, together with oxidation by the addition of ozone or hydrodynamic cavitation, applied as a pre or post-treatment. Due to this process, it is possible to separate the main phases of anaerobic digestion to maximize biogas production and sanitation of the digested product.

The process of **anaerobic digestion begins in a first digester that operates at 55ºC**, where the bacteria produce volatile fatty acids, followed by a second **anaerobic digester at 35ºC**, in which the methanogenic bacteria transform them into biogas.

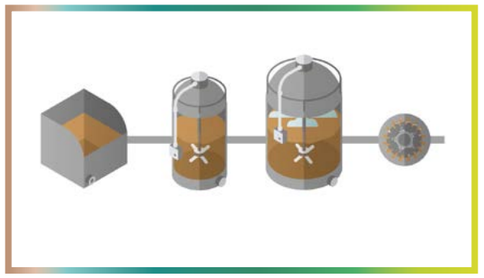


Ozonation or hydrodynamic cavitation are applied as pre-treatment of the co-substrate to favour hydrolysis, or as a post-treatment to increase the elimination of micropollutants and pathogenic microorganisms.

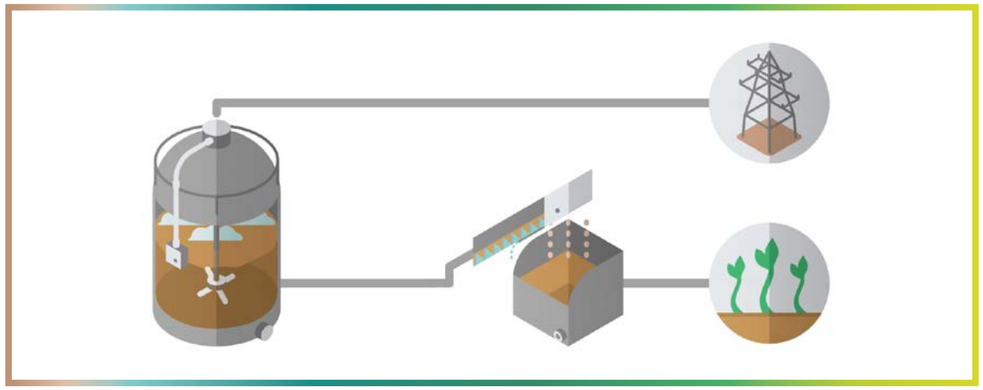
Pretreatment



Postreatment



This system produces, on one hand, a high quality biofertilizer and, on the other, biogas to self-supply the joint co-digestion system.



The application of this technology on industrial scale will enable the generation of a biofertilizer in sufficient quantity to:

Cover the needs of

1.700 hectares
of crops per year

Recycle about

300t of
nitrogen

80t of
potassium

70t de
phosphorus

3. PROJECT IMPLEMENTATION

LIFE STO3RE MODEL IMPLICATIONS

Pig slurry storage pools

Pig slurry transport

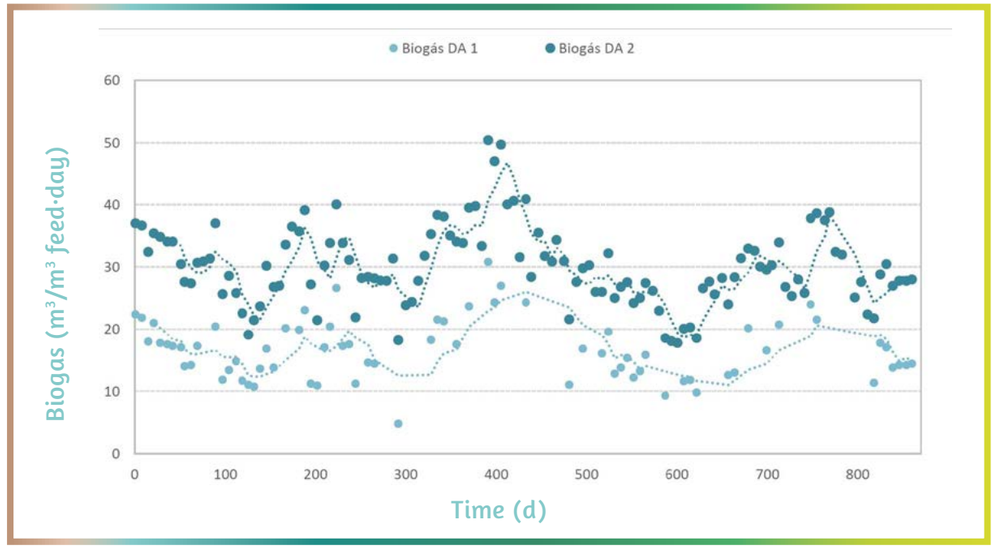
STO3RE treatment

Biofertilizer transport

Agricultural application

RESULTS

The production of biogas in the double temperature phase anaerobic digestion is 35% higher than that of the conventional digestion in a single phase.



The continuous operation of the LIFE STO3RE demonstration plant has allowed us to achieve results of considerable relevance, including the achievement of the following milestones:

Elimination of micropollutants: Emerging contaminants such as Diclofenac (anti-inflammatory), Sulfadiazine (antibiotic) or Imazalil (post-harvest fungicide) are eliminated using STO3RE technology.

Elimination of pathogens: *Escherichia coli and Salmonella* are completely eliminated, so that through the STO3RE technology a microbiologically safe biofertilizer is obtained.

Nutrient recovery: Obtaining a biofertilizer with a content of 720 kg of nitrogen, 19 kg of potassium and 17 kg of phosphorus per ton of dry matter, which covers the annual needs of 4,000 m2 of crop per ton applied.

Odour elimination: The STO3RE technological solution manages to eliminate the unpleasant odour of sludge and slurry, obtaining an odourless biofertilizer.

Biogas production: The STO3RE technology is capable of energy recovery of WWTP sludge and slurry obtained 19 m3CH4/m3·d as renewable energy, increasing biogas production by more than 30% in relation to conventional anaerobic digestion.

Carbon footprint reduction: The treatment of slurries prevents indirect emissions of greenhouse gases, which significantly reduces the carbon footprint.

Economic viability: The energy recovery of WWTP sludge and slurry through STO-3RE technology achieves the energy self-sufficiency of the treatment process, which enables the feasibility of the joint management model in rural environments.

LONG TERM BENEFITS

Mitigation of global environmental pollution

Since the multi-waste treatment and resource recovery approaches of the LIFE STO3RE project contribute to reducing the environmental impact of conventional WWTPs and surrounding farms.

Improved water cycle management

Since the WWTP, through STORE technology, optimizes its energy balance by obtaining biogas, and obtains a high quality biofertilizer.

Improvement of the nutrient cycle

Thanks to the obtention of a new generation organic amendment that allows nitrogen, phosphorus and potassium to be recovered for agronomic use.

Improved air quality

Due to the reduction of indirect greenhouse gas emissions associated with slurry storage.

Increase of the economic viability of small and medium-sized rural WWTPs through joint management

Availability of an appropriate treatment alternative for the treatment of livestock waste from the plant environment.

Acquisition of new knowledge that contributes to technological progress in waste management

Project partners have acquired new knowledge and developed technical skills, necessary for the construction and operation of new WWTP with LIFE STO3RE technology.

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 acquired knowledge.

Innovation Prize

Awarded in the VI edition of the FPIA Awards of the "Colegio de Ingenieros Agrónomos de Levante"

100
Press releases and published articles

35
Workshops or conferences attended

2
Organized workshops

3
TV Reports

2
Radio interviews

OUR EVENTS

LIFE STO3RE consortium has organized 2 workshops to disseminate the project, both for wastewater treatment technicians and livestock farmers, and all kinds of audience with interest in the treatment of sludge and slurry, which have had 70 and 125 attendees.

www.lifesto3re.com

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