

Making wastewater a resource to be valorised rather than a cost to be minimized

SCOPE

The aim of the project is to implement and demonstrate on a large scale the long-term technological and economic feasibility of an innovative, sustainable and efficient solution for the treatment of high salinity wastewater from the food and beverage industry. SaltGae is a case study to overcome the cross-cutting barriers to innovation identified in the European Innovation Partnerships (EIP) on Water.

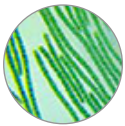
EXPECTED IMPACTS

- Creation of market opportunities based on the valorization of sludge effluents and biomass
- Development and acceptance of water efficiency standards and promotion of interoperability between water information systems
- EIP Water
- Water and wastewater treatment
- Water reuse and recycling
- Cross cutting challenges
- Water energy nexus
- Resource efficiency and environmental performance
- ETV: Support to the EU environmental technology verification pilot

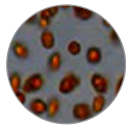
GLOBAL OBJECTIVES

- Develop a techno-economically viable solution for the treatment of saline wastewaters
- Establish three DEMO sites for demonstration of a sustainable and eco-innovative modular-based technology platform.

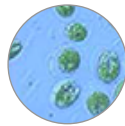
EXPECTED MICRO-ALGAE SPECIES



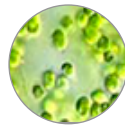
Spirulin



Dunaliella salina



Tetraselmis



Nannochloropsis

TECHNOLOGIES

SaltGae offers an integrated innovative solution for the treatment of high salinity and organic matter containing wastewater. Up to 80 g/L salinity and 60 g/L BDO food and other industries. SaltGae considers pretreatment to final water reuse.

- High salinity anaerobic digestion
- Microalgae for water treatment
- Energy efficient biomass harvesting
- Low and moderate flows efficient pumps and energy recovery devices for reverse osmosis membranes
- Biomass valorization
- Smart metering and chlorophyll sensors
- Integration in three demo sites
- High salinity two-stage anaerobic digestion:
 - Up to 80 g/L salinity
 - AD granular acidogenic reactor for wastewater: effluent 2500 mg/L BOD and acidification >90%
 - AD granular methanogenic reactor for WW: effluent: 500 mg/L BOD (fed to HRAP);
 - BOD reduction with biogas production

20 PARTNERS

From 9 countries: Belgium, France, Italy, Ireland, Israel, Portugal, Slovenia, Spain, and Sweden



DEMO SITE 1 - Slovenia

Tannery (hide warehouse) integrated technologies

KOTO and Algen use existing ponds built within the AlgaeBioGas project, to treat the water from the tannery warehouse

Contact: Robert Reinhardt robert@algen.si



Location: KOTO, Slovenia

Slovenian demo site – devoted to the treatment of tannery wastewater - is now fully operational, demonstrating anaerobic digestion working under the higher salinity conditions in two separate AD reactors (AD1 - hydrolysis, acidogenesis and acetogenesis, AD2 - methanogenesis). Biogas is being produced. The main algae pond, with previously adapted algal-bacterial consortium, was successfully fed with the AD2 effluent for two months. In order to optimise the SaltGae system, the main pond is currently being re-started with a new algal consortium, containing several new (marine) species. Special skimmer for the main pond was developed (Algen d.o.o.) and installed to allow harvesting of algae growing on the pond surface.

Integrated technologies

Sieving and pre-treatment
Anaerobic digestion (specialised two stage optimized for saline water)
100 m2 algal-bacterial wastewater treatment
Desalination pre-treatment–not yet
Reverse osmosis with an energy recovery device–not yet
Biomass harvesting (sedimentation and dissolved air flotation)
Naturally occurring algae-bacterial consortium, mostly *Scenedesmus* sp., *Monoraphidium* sp., *Ankistrodesmus* sp., various *Diatomaceae*

Demonstrator treatment capacity

Up to 1 m3/d
Salinity levels: up to 100 g/L
Organic matter: up to COD 10,000 mg O2/L (more realistic 3,00 mg/L)
1 kg/d of biomass
0.25 m3 methane/kg COD at salinity level 36 g NaCl/L (in the methanogenic stage)

Open to visits starting 2018

At this stage the anaerobic digestion is being adapted to the required salinity levels. Algal bacterial consortia following this will last until end of March.

DEMO SITE 2 - Israel

Aquaculture wastewater treatment

Arava uses water from aquaculture (fish farming) by algae

Contact Dr. Yair Kohn yairk@arava.co.il en.agri.arava.co.il



Location: Arava, Hazeva, Israel

The Israeli pilot site – aquaculture wastewater - is at the final stages of its entire construction; building the largest HRAPs (net house and ponds) and incorporating these with the BIBOQUA system and with the rest of the system already in place. Two net/greenhouses were constructed containing a set of 3 x 1000 L HRAPs and 2x 5000 L HRAPs, the final net/green house will contain a 3 x 50,000 L set of HRAPs. The existing HRAPs - connected to the fish system - provides the wastewater via a reservoir tank. The current system is fully operational. The fish system consists of three 10,000 L tanks that currently contain about 700 kg of total fish biomass. Wastewater contains around 200 ppt of nitrate and 10 ppt phosphate. Sludge is currently removed to a sedimentation tank that will be replaced by a DAF system. Water flows through a set of drum and biofilters with UV light from the fish tanks and to the reservoir tank.

Integrated technologies

Smart metering and DAF system
HRAP algal pond
RO system
Spirulina, *Tetraselmis*, *Nannochloropsis*
Dunaliella pond

Demonstrator treatment capacity

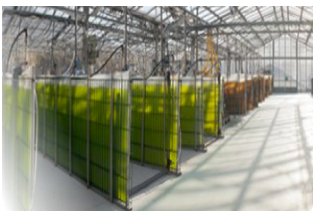
25–35 m3
Salinity levels: 2.5 g/L
Organic matter: COD 10,000 mg O2/L, 5 kg/d of biomass
0.35 m3 methane/kg COD

DEMO SITE 3 - Italy

Whey wastewater treatment

Archimede Ricerche uses their existing high performance ponds to treat water from the dairy industry.

Contact: Silvio Mangini mangini@archimedericerche.com



Location: Camporosso (Imperia), Italy

Archimede Ricerche Srl, part of A&A Fratelli Parodi group (Genoa), is the first Italian company to run an industrial plant for microalgae biomass to be used in natural cosmetics (oils, pigments), in aquaculture and as food supplement (nutraceuticals).

Archimede Ricerche Srl is member of EABA (European Algae Biomass Association, formed by most companies of European microalgae sector) since the constitution in 2009.

Integrated technologies

Dairy wastewater pretreatment
3000 m2 algal phyto depuration system
Biomass harvesting drying and storage
Microfiltration and centrifugation
Spirulina, *Tetraselmis* and *Nannochloropsis*

Demonstrator treatment capacity

20 m3/d
Salinity levels: 10–30 g/L
Organic matter: COD 5,000 mg O2/L,
TKN 100 ppm
20 kg/d of biomass