INCOVER
Innovative Eco-Technologies for Resource Recovery from Wastewater

Grant agreement nº: 689242
Call identifier: H2020-WATER-2015-two-stage

Innovative Eco-Technologies for Resource Recovery from Wastewater

INCOVER

Deliverable D3.7

INCOVER case-study 2

Work Packages 3

Added-value resources production

Document type	**:**	Demonstrator
Version	**:**	V2.0
Date of issue	**:**	26/07/2019
Dissemination level	**:**	Public
Lead beneficiary	**:**	AQUALIA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 689242.

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Executive summary

Deliverable D3.7 describes the Case-Study 2 validated at TRL 7-8. This deliverable consists on several photos of each technology and a global photo of the CS2.

1. Photo gallery of case-study 2

Case study 2 has been implemented in two locations: El Torno WWTP, Chiclana de la Frontera, and El Toyo WWTP, Almería, both in the South of Spain.

1.1 El TORNO WWTP, Chiclana, Spain.

Two main processes are implemented in Chiclana site to obtain resources from wastewater:

- Processes for PHA production.
- Processes for Biomethane and nutrient production.

PHA production is made through a two-stage anaerobic-photosynthetic HRAP system (Fig. 1.1).

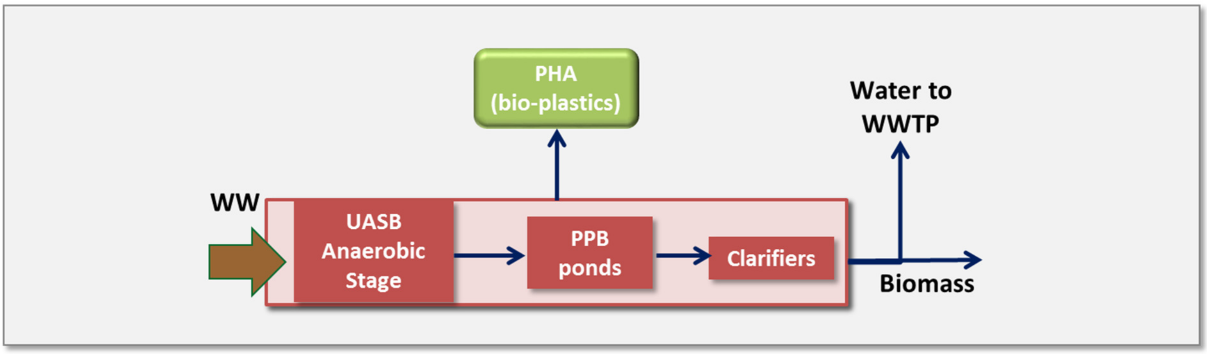

Figure 1.1: Diagram of the PHA production in case study 2, located in El Torno WWTP (Chiclana de la Frontera, Cádiz).

Two UASB anaerobic reactors pretreat wastewater with molasses (Fig. 1.2.)

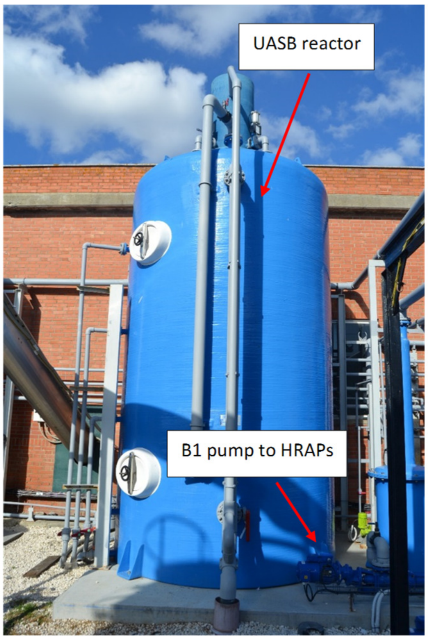

Figure 1.2: 20 m^3 UASB reactor.

A new PUSH anaerobic reactor patented by AQUALIA has been installed to improve the fermentation process (Fig. 1.3)

Figure 1.3: New PUSH reactor.

Two Phototrophic Purple Bacteria Ponds (PPBPond) of 32 m^2 each (Fig. 1.4) are operated with an innovative strategy developed at Lab scale (Fig. 1.5). After several weeks of operation, purple photosynthetic bacteria (PPBs) were selected (see on the left pond on Figure 1.6), which are able to accumulate PHA.

Figure 1.4: 2x32 m^2 PPBPonds.

Figure 1.5: PHA production at Lab scale.

Figure 1.6: POND 1 and POND2 DEMO for VFAs production at Chiclana with and without aeration. Purple bacteria in pond 1 (right).

Then, biomass separation is done by two clarifiers (Fig. 1.7) and then extracted by a centrifuge decanter (Fig. 1.8)

Figure 1.7: Clarifiers for PPBs separation.

Figure 1.8: Biotrend's pilot plant manager testing the pilot scale centrifuge decanter with digested PHA-containing biomass.

The second process at Chiclana is despicted in Figure 1.9. This process is developed to obtain other valuable resources from microalgae biomass, as biomethane and nutrients.

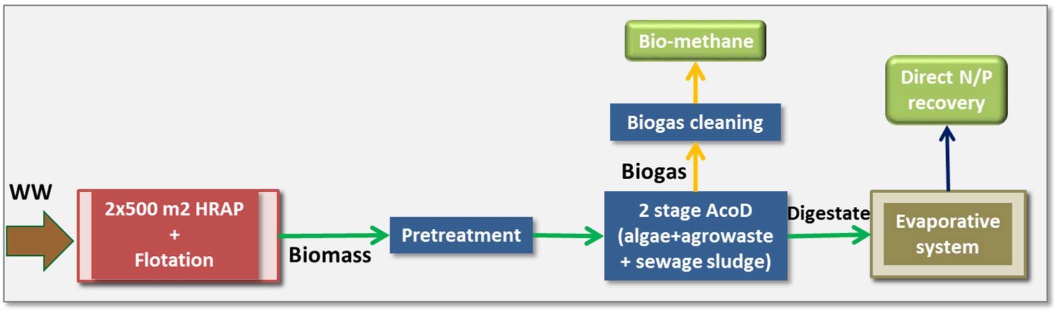

Figure 1.9: Diagram of biomass processing tasks at El Torno WWTP (Chiclana de la Frontera, Cádiz).

Wastewater is treated in two 500 m^2 HRAPs (Fig. 1.10) and harvested in a dissolved air flotation. Biomass is transformed into biogas using a 500 L tank for hydrolysis pre-treatment (Fig. 1.11) and a 20 m^3 anaerobic co-digester (Fig. 1.12). Agro wastes and sewage sludge are used as co-substrates.

Figure 1.10: 2x500 m^2 high rate algae ponds.

Figure 1.11: Hydrolysis tank for anaerobic pretreatment.

Figure 1.12: Anaerobic co-digestion system.

Biomethane is produced by an innovative biogas upgrading system (Fig. 1.13), through photosynthetic fixation of CO_2 as algal biomass using digestates as a source of nutrients.

Figure 1.13: Photosynthetic biogas upgrading at El Torno WWTP.

An evaporative system by planted filter is used for digestate stabilization from anaerobic co-digestion and nutrient recovery (Fig. 1.14).

Figure 1.14: Evaporative system.

1.2 El TOYO WWTP, Almeria, Spain

A general flow diagram of the plant is depicted in Figure 1.14.

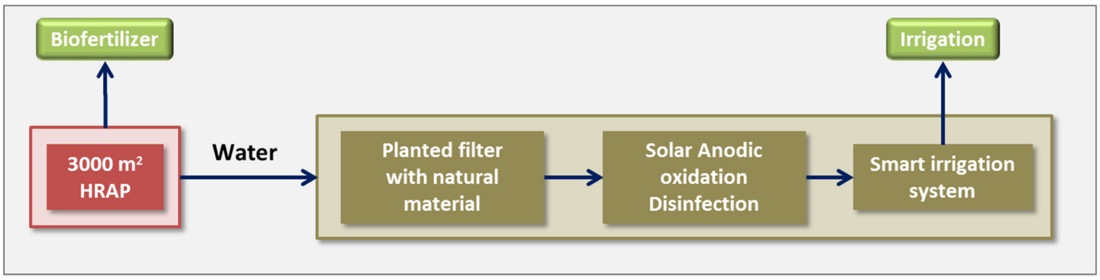

Figure 1.14: Flow diagram El Toyo WWTP (Almería).

Below, this is a general picture of the installation (Fig. 1.15), including 3000 m^2 HRAP, 250 m^2 planted filter, solar disinfection system and 250 m^2 smart irrigation of grass.

Figure 1.15: General photo of the installation.

A demo full-scale 3000 m^2 HRAP has been installed to obtain irrigation quality water (Fig. 1.16). This HRAP system is treating pre-treated wastewater.

Figure 1.16: High rate algae pond of 3000 m2 under construction (above) and full operation (below)

The HRAP is mixed by a paddle wheel or alternatively by a submersible mixer (Fig. 1.17) system patented by AQUALIA, the LEAR®, Low Energy Algae Reactor.

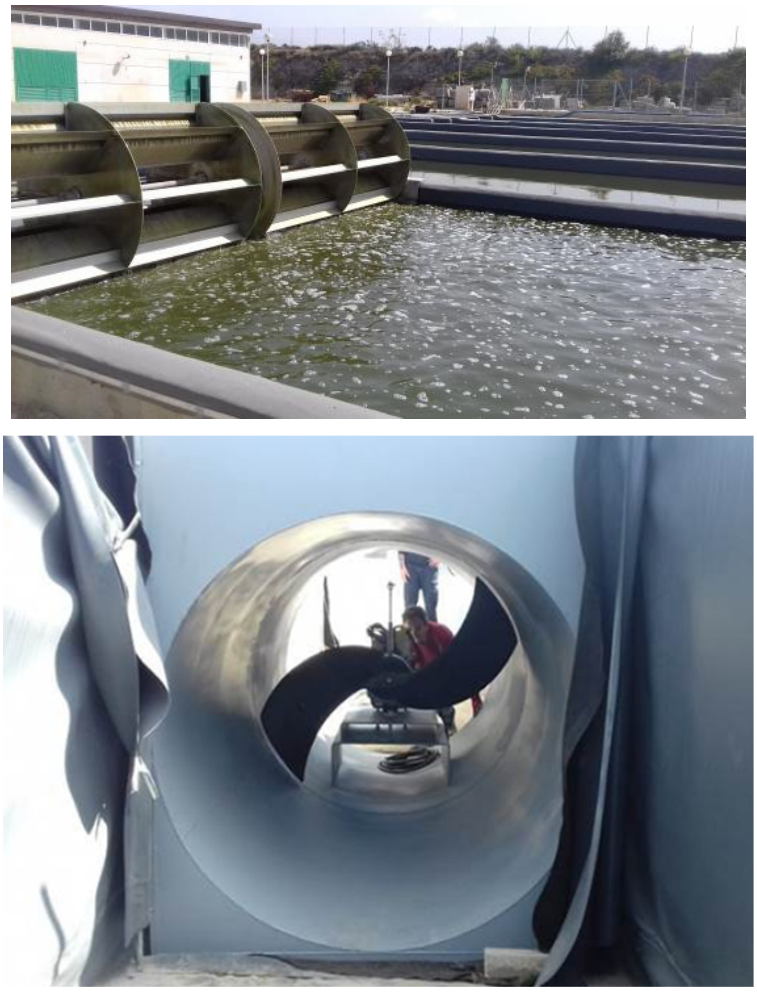

Figure 1.17: Paddle wheel (above) and LEAR (below) mixing.

After harvesting by flotation, the effluent is treated using planted filters (Fig. 1.18) with natural material for enhancing P and N recovery (Fig. 1.19).

Figure 1.18: Arundo donax planted filter (top) and planted filter evolution April, June and September 2018 (below).

Figure 1.19: P adsorption filters.

Irrigation water is be obtained and reused with solar anodic oxidation disinfection (Fig. 1.20) and a smart irrigation system. (Fig. 1.21)

Figure 1.20: Solar anodic oxidation disinfection.

Figure 1.21: Smart irrigation installation and evolution from June (top, right) to October 2018 (below).