REUSE

INNOVATIVE PRODUCTION OF WATER FOR REUSE IN AGRICULTURE IRRIGATION AT MEDITERRANEAN ALENTEJO REGION

S. Antunes[1], J. Pinto Coelho[2], J. Madeira[3], C. Cordovil[4], J. Marinheiro[5], D. Guerreiro[6], D. Morais[7], D. Lopes[8], I. Saraiva[9], J. Gomes[10], M. Ruivo[11], M. Moreira[12], M. Santos[13], M. Varela[14], S. Ramalho[15], V. Vilar[16], N. Brôco[17]

[1] AdP VALOR, s.antunes@adp.pt, Rua Visconde Seabra, 3, 1700-421 Lisboa, phone +351212469400
[2]AdP VALOR, j.coelho@adp.pt
[3]AdP VALOR, reuse@adp.pt
[4] ISA, cms@isa.ulisboa.pt
[5] ISA, jmarinheiro@isa.ulisboa.pt
[6]AgdA, d.guerreiro@adp.pt
[7] FEUP, daniela.morais@fe.up.pt
[8] EFACEC, diana.lopes@efacec.com
[9] EFACEC, isabelsaraiva@efacec.com
[10] EDIA, CGomes@edia.pt
[11]EDIA, MRuivo@edia.pt
[12] FEUP, francisca.moreira@fe.up.pt
[13]COTR, marta.santos@cotr.pt
[14] COTR, marta.varela@cotr.pt
[15] AgdA – Águas Públicas do Alentejo, S.A., s.ramalho@adp.pt
[16] FEUP – Faculdade de Engenharia da Universidade do Porto, vilar@fe.up.pt
[17] AdP VALOR, n.broco@adp.pt

Abstract

The rising pressures due to climate change effects in Portugal, especially in the southern region where productive activities heavily rely on agriculture, highlight challenges of ensuring efficient water management, perceiving water true value and the look for alternative water sources.

Reuse is a project developed by a consortium formed by AdP VALOR, AgdA, COTR, EDIA, EFACEC and ISA, supported by the Portuguese Environmental Fund (FA), which aims to promote the circular economy and the reuse of treated wastewater (WfR) in agricultural irrigation in Alentejo, a region that, despite the low rainfall and the emerging effects of climate change, hosts highly intensive agricultural practices.

The Reuse project was developed between 2019 and 2020, covering two irrigation campaigns.

The project incorporates three different actions:

1. A pilot plant to evaluate the viability of a low operational cost treatment technology (solar disinfection), to produce safe water for reuse and to evaluate its application for agriculture irrigation;
2. Development of a pilot project to demonstrate the interface between the urban wastewater treatment plants and the irrigation infrastructures in order to understand the dynamics behind the barriers created by transport of water, dilution and self-depuration effects up to the irrigation perimeter;
3. A communication campaign aimed to raise the awareness around efficient water management and its value to the agricultural sector.

The **first action** aimed to test the WfR production system that incorporates a solar disinfection technology for polishing treatment of secondary effluent of Beja WWTP.

The system consists of compound parabolic concentrators (CPC): solar panels with a reflective surface of aluminium with the shape of two truncated parabolas. Water undergoing disinfection circulates inside a borosilicate tube, with a high UV radiation transmission, installed in the focal point between the parabolas, in a serpentine flow. Water is recirculated through the concentrators the number of times needed to ensure the required exposure time and UV dosage in order to attain the desired disinfection level.

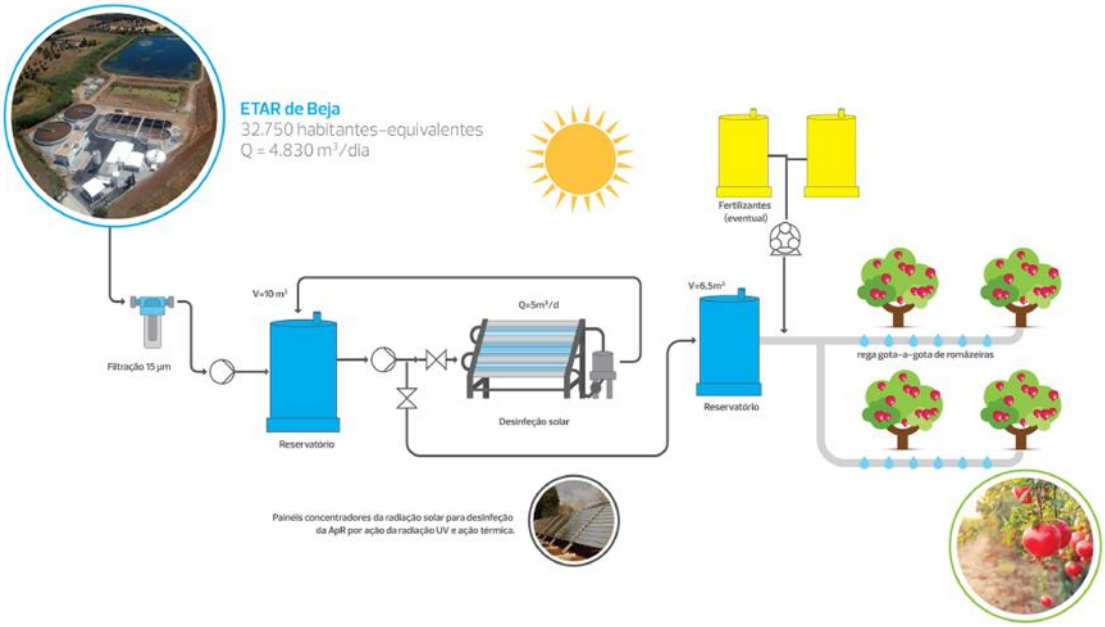

Figure 1 - Scheme of the disinfection pilot installed at Beja WWTP

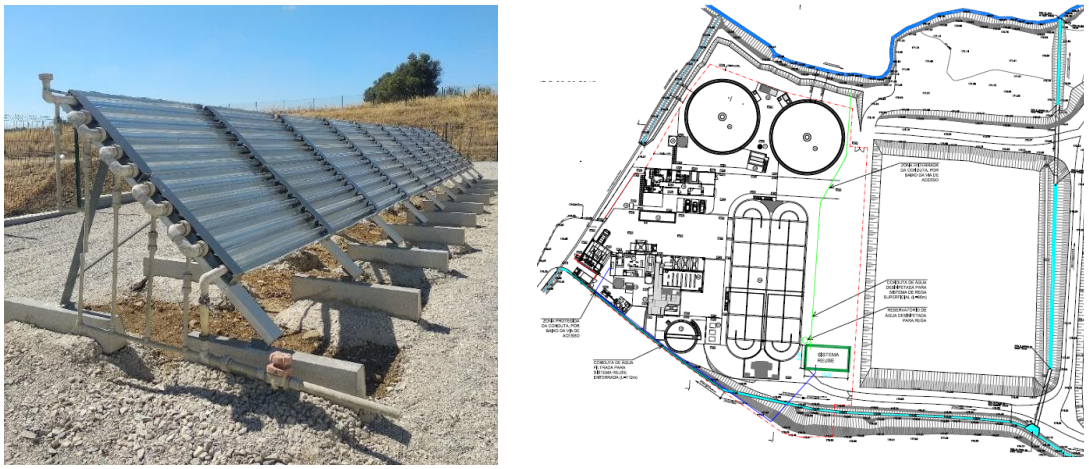

Figure 2 - Solar CPC modules and Beja WWTP scheme

Preliminary on-site tests were started in Beja WWTP pilot, to adjust operating conditions prior to the supply of WfR for drip irrigation of a pomegranate orchard.

Operating conditions such as contact time, radiation intensity, recirculation flow rate, feed rate and other key factors for treatment efficiency were evaluated.

In order to apply the fit-for-purpose approach to ensure the production of safe water for the orchard irrigation as well as the protection of the nearby environmental recipients, a risk assessment analysis was performed so that the methodology established in the recent Portuguese law regarding water reuse could be tested.

Water reuse effects in crop growing, soils and water bodies were also studied in order to benchmark the environmental and economic performance of water reuse against irrigation with natural water sources.

The main results of action 1 can be seen through the following graphs.

The risk assessment developed throughout the reuse scheme demonstrated that the impact of WfR on health and environment recipients was negligible. And that implementation of barriers and good practices throughout the reuse scheme ensures the production and safe use of WfR.

According to the results obtained in the Project, the objectives pursued in action 1 were achieved in a very significant way. Beja pilot's solar disinfection technology produced WfR with the required quality for the irrigation of the pomegranate orchard and no significant impacts were observed on the irrigation system neither on the development of the plants and fruits.

However, this last conclusion still needs full confirmation by conducting additional irrigation campaigns.

In **action 2**, the dilution, self-purification and natural decay of microorganisms in the final water quality during transport to the area of Odivelas Reservoir was studied. In this pilot, 4 points were monitored on the water line, one upstream of the Alvito WWTP discharge and three downstream of this discharge, allowing to evaluate the effectiveness of the existing natural barriers along the transport system.

A complementary assessment about the human pressures existing along the water line will be required for a correct interpretation of the obtained results.

Action 3 showed considerable interest from the agricultural sector in the water reuse as an alternative water source, namely in areas where high levels of water scarcity are already apparent.

Considering not only the positive evolution of the Reuse project but also its importance as a flagship to promote water reuse in the current context of climate change and increasing water scarcity, it was decided to extend the REUSE project for another irrigation campaign, in order to better evaluate and understand the effects of WfR on irrigation activity and thus obtain more robust predictions for the medium and long term.

Keywords: Water reuse; Solar disinfection; Fit-for-Purpose Approach; Risk Assessment