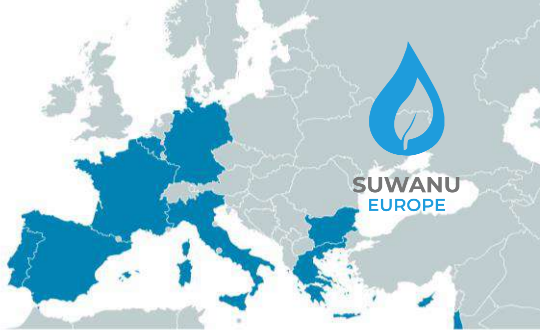

Sustainable **Water treatment** and
Agricultural reuse options in Europe

Info-package 4
Water Engineering Companies

Fact Sheet 4.5 – **Other technologies for water reclamation**

Filtration membranes and new filter materials → Sensors and other innovative tools for monitoring reclaimed water quality → Light-driven technologies for producing reclaimed water → Nature based options for water reclamation processes → **Other technologies for water reclamation**

SUWANU EUROPE is a H2020 project aiming to promote the effective exchange of knowledge, experience and skills among practitioners and relevant actors on the use of reclaimed water in agriculture. This factsheet is part of a total of 5 factsheets in Info-package 4 aimed at water engineering companies, that describe different reclamation technologies able to provide a treated effluent that complies with the standards for irrigation in agriculture.

1. Introduction

Water reclamation for irrigation can be practiced for a variety of agricultural needs, each requiring different water quality. Diverse types of technologies can be combined to reach the desired water quality, the highest quality goal being seen as an equivalent to the use of potable water. To allow reclamation for irrigation purposes several water quality goals must be reached simultaneously, including salinity, turbidity, pH, nutrient load and pathogen removal. Nowadays there is an increasing demand for the removal of additional pollutants which are not typically removed during conventional wastewater treatment such as pharmaceuticals, personal care products, pesticides, herbicides and hormones. This section will review advanced treatment technologies which can be applied to reach superior reclaimed water quality suitable for unrestricted irrigation and better.

2. MAR and SAT

Figure 2 - Soil Aquifer Treatment

Managed Aquifer Recharge (MAR) is the intentional recharge of different types of water to convenient aquifers for subsequent recovery or to achieve environmental benefits. One of the methods is the Soil Aquifer Treatment (SAT) which uses natural water resources for effluent reclamation. Aquifers are subterranean soil layers that can contain and convey water. In SAT, effluent is spread over dedicated basins where they can infiltrate to the underlying aquifer. During the infiltration, often practiced in areas with thick sand/sandstone soil layers, treated wastewater pass through the upper layers of the soil where changing oxidation conditions provide a wide range of physical-chemical and biological processes. This process significantly improves the quality of the effluent by removing pathogens, organic matter, and other undesirable compounds. producing reclaimed water of very high quality that meet the requirements for unrestricted irrigation and in some cases, also most of the requirements set for drinking water. The region of the aquifer receiving the infiltrated effluents then becomes a seasonal and multi-year storage basin for large quantities of reclaimed effluent ready for reuse, unaffected by short term changes to effluent quality or system malfunctions. The long-term storage and infiltration process also provide a superior natural means for pathogen removal, assuring the safety of the reclaimed effluent (Sharma and Kennedy 2017; Sprenger et al., 2017).

3. Advanced Oxidation Processes

Trace Organic Chemicals (TOrCs), such as pharmaceuticals and personal care products, are not fully transformed or removed by traditional reclamation methods. Increasing demand for their removal from irrigation water and before discharging effluents to natural streams calls for the use of advanced treatment methods that use oxidation to break down TOrCs (for more information on TOrCs see FS 3.1).

Advanced Oxidation Processes (AOP) typically apply the use of highly reactive molecules or radicals which are unstable, with a half life in water of only a few seconds to a few minutes and must therefore be generated on site. These unstable molecules/radicals can readily react with certain functional groups on organic molecules and facilitate their mineralization to CO_2 and H_2O. Many other organic chemicals that are not fully mineralized by AOP can still be partially degraded structures that are often more biologically available, making them more susceptible to biodegradation.

There are several AOP technologies, including ozonation, UV/H_2O_2, photocatalysis, Fenton reactions and others that are still being developed (Alharbi and Price, 2017).

Figure 3 - ozonator at the Shafdan WWTP R&D center

4. Biologically Active Filtration

This process provides and engineered solution which mimics many of the aspects provided by SAT: effluent slowly percolates through filtration media in a process that allows both mechanical filtration and biodegradation of organic matter by bacteria launched on the filtration media. Typical filtration media are either anthracite or Biologically Active Carbon (BAC), both of which provide a large surface area for bacteria growth. One of the common uses for biologically activated filtration is after AOP (typically ozone), to allow biodegradation (complete mineralization) of molecules that were transformed during ozonation. The combination of ozonation and BAC filtration is now mandated in Switzerland before discharging effluent to streams for downstream reuse for both potable and irrigation purposes. Biologically active filtration can also be used as a pre-treatment to ozonation and other advanced treatments, when additional filtration/nitrification/ biological degradation of organic matter is needed before entering the advanced treatment stage (Hellauer et al., 2017; Lakretz et al., 2017).

Reference/further readings

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THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION' HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT N. 818088