

TOWARDS SUSTAINABLE AND SAFE MANAGEMENT OF NON-CONVENTIONAL WATER RESOURCES IN THE MEDITERRANEAN AGRICULTURAL SECTOR - THE FIT4REUSE PROJECT

S. Lavrnić 1, S. Bleich 2, R. Declercq 3, F. Fatone 4, A. Jaouani 5, Ö. Karahan Özgün 6, A. Lorenzo 7, S. Malamis 8, M.C. Sole 9, A. Toscano1

1 Alma Mater Studiorum - University of Bologna, Department of Agricultural and Food Sciences, Viale Giuseppe Fanin 50, Bologna 40127, Italy (stevo.lavrnica@unibo.it; Attilio.toscano@unibo.it)

2 MEKOROT, WaTech division, Israel (sbleich@mekorot.co.il)

3 Ecofilae, 650 rue Louis Lepine, 34000 Montpellier, France (remi.declercq@ecofilae.fr)

4 Marche Polytechnic University, Department of Material, Environmental and City Planning Science and Engineering, Via Brecce Bianche 12, Ancona 60100, Italy (f.fatone@staff.univpm.it)

5 University of Tunis El Manar - Higher Institute of Applied Biological Sciences of Tunis, Tunisia (ajaouani@yahoo.fr)

6 Istanbul Technical University, Department of Environmental Engineering, TR-34469 Maslak, Istanbul, Turkey (ozlem.karahan@itu.edu.tr)

7 Bioazul S.L., Severo Ochoa 7, Malaga 29590, Spain (alorenzo@bioazul.com)

8 National Technical University of Athens, School of Civil Engineering, Department of Water Resources and Environmental Engineering, Iroon Polytechniou 5, Athens 15780, Greece (malamis.simos@gmail.com)

9 Italian Institute for Environmental Protection and Research, Via Vitaliano Brancati 48, 00144 Rome, Italy (mariachiara.sole@isprambiente.it)

Abstract

The Mediterranean region is characterised by limited and irregular availability of water resources in both time and space. Climate change is expected to make the region even more vulnerable in the near future. Agriculture is still by far the greatest user of water in the Mediterranean basin accounting for more than 80% of the total consumption. Domestic wastewater is a very precious resource and should be valorised for irrigational use. Desalination technology, although widely used, still faces problems that can negatively affect its use for irrigation. Exploitation of these water resources in a safe and sustainable manner, within a context of circular economy and environmental sustainability, could bring significant benefits for the whole Mediterranean region. However, high treatment costs, possible negative effects on human health and the environment, and low public acceptance can hinder and restrict the safe usage of both treated wastewater and desalted water. These non-conventional resources can contribute to compensate the gap between available and needed water, and provide regular water supply throughout the year.

The PRIMA funded project FIT4REUSE will contribute to tackle these challenges by providing sustainable solutions that are fit for the local scenarios. The main project objective is to provide safe, locally sustainable and accepted ways of water supply for the Mediterranean agricultural sector by exploiting non-conventional water resources, namely treated wastewater and desalted water. FIT4REUSE will focus on innovative treatment technologies and on the use of non-conventional water resources in agriculture and for aquifer recharge.

FIT4REUSE will deliver fully assessed and validated treatment prototypes fit for the increasing quantity, quality and safety of non-conventional water resources by the end of the project, also reducing treatment costs. Pilot plants for domestic wastewater treatment, water desalination and brine treatment have been installed and they are operational. Innovative nature-based and intensive solutions for wastewater treatment are being optimised in order to reach requirements for agricultural reuse. Moreover, different technologies are being implemented and tested in order to decrease desalination costs. Tests are also performed with brine, to reduce its quantity and improve its quality. For example, algae and halophytes are being used to recover nutrients from it.

Irrigation test sites were planned and are under implementation in order to find the optimum conditions for the use of non-conventional water resources, including reuse of treated domestic wastewater, and to test their properties on irrigational infrastructure, soil and crops. Moreover, the project will prepare the Irrigation and Aquifer Recharge Guidelines for practitioners to meet market, safety and consumer demands and to ensure adequate irrigation and recharge patterns and proper use of treated wastewater in agriculture.

Water Reuse (Risk Management) Safety Plan for regions of the Mediterranean basin will be one of the most important project outcomes since it will cover different scenarios of use of non-conventional water resources, concentrating on the local representative needs and standards of the Mediterranean basin. It will include agricultural practices and effect of non-conventional water resources on soil, crops and drainage water, but also monitoring the effect of these resources on aquifers. The plan is under development and it will provide an instrument for risk assessment and safe reuse of reclaimed water.

The simulation platform SIM4REUSE was developed and is being tested to model the project technologies and extrapolate results to different conditions. Moreover, the platform is being integrated with the tools necessary to account for the parameters necessary for the development of alternative scenarios for the FIT4REUSE systems. A common methodological framework for sustainability analysis was already developed and the data needed re being collected.

A specific methodological framework based on a life cycle thinking approach to analyse the triple bottom line impacts of different non-conventional water reuse practices will consider drivers and barriers of the current local institutional, social and economic frameworks. It will include environmental, economic and social impact categories representing a holistic and operational decision-making tool.

The successful data collection an efficient communication between project partners and stakeholders has been facilitated through the development and use of Customized multi stakeholder and multi-level platform and Water reuse forums establishment. They are also being used to analyse legislative framework in different countries and to propose effective

ways for non-conventional water resources use and change in the public attitude. The most important stakeholders in selected participating countries will be connected and cooperate, also through the Multi-stakeholder platform, beyond the project end in order to support new/updated policies or regulatory instruments on wastewater reuse.

Keywords: treated wastewater, desalted water, Mediterranean region, sustainable agriculture