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

Info-package 4
Water Engineering Companies

Fact Sheet 4.1 – **Filtration membranes and new filter materials: facts and figures**

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 how the Membrane Bio reactor RichWater MBR technology under certain design and operation, provides a pathogen-free and nutrient-rich effluent (fertilizer savings and thus lower costs), where on average, 60% and 80% of the phosphorous and nitrogen (if possible, denitrification process can be avoided) are satisfactory extracted from the wastewater inflow, respectively (Nutrients remain in liquid phase). It correspond to a low-energy intensive treatment, which innovates the Standard MBR system.

INTRODUCTION

RichWater Technology.

The RichWater technology combines an efficient water treatment at low-cost using a Membrane Bioreactor (MBR), with a mixing station for the optimal water and nutrients combination, and a control system and monitoring with different water, plant and soil sensors. This combination allows offering a source of pathogen free water and *in situ* response to the watering demand and fertilization of each type of plant and soil. The Treat & Reuse MBR is designed to have a perm-selective membrane, which serves as a barrier that allows selective extraction of compounds from a wastewater stream. This characteristic allows the system, to have in the effluent, or liquid phase, the highest possible concentration of Phosphorous (PO_4^{3-}) and Nitrogen (Nitrate NO_3^-).

RichWater

Figure 1:RichWater - HORIZON 2020 Project

1. RichWater MBR vs Standard MBR.

Standard MBR has tended to generate treated water of higher purity with respect to dissolved constituents such as organic matter and ammonia, both of which are significantly removed by the activated biomass within the reactor. In contrast, and as upgrade of the Standard MBR process, we will present the innovation of RichWater MBR. Which can be defined as a membrane process (low-energy intensive treatment), which combines extraction (i.e., Nitrogen and Phosphorus) and rejection (i.e., Particles and Pathogens) in a semi permeable and selective immersed membrane with a pore size between 40 to 50 nm and 150 kDalton (MWCO) for the treatment of wastewater and effluent reuse in direct agriculture irrigation.

Under certain design and operation, the system provides a pathogen-free and nutrient-rich effluent (fertilizer savings and thus lower costs), where on average, 60% and 80% of the phosphorous and nitrogen (if possible, denitrification process can be avoided) are satisfactory extracted from the wastewater inflow, respectively (Nutrients remain in liquid phase).

Moreover, in the RichWater MBR system, parameters such as E. coli, BOD5, COD, Turbidity, and SS were effectively removed by the treatment, with average efficiencies higher than 99%, 95%, 94%, 90%, 98%, and 98% respectively (strict EU legal framework can be achieved for discharge and water reclamation in agriculture).

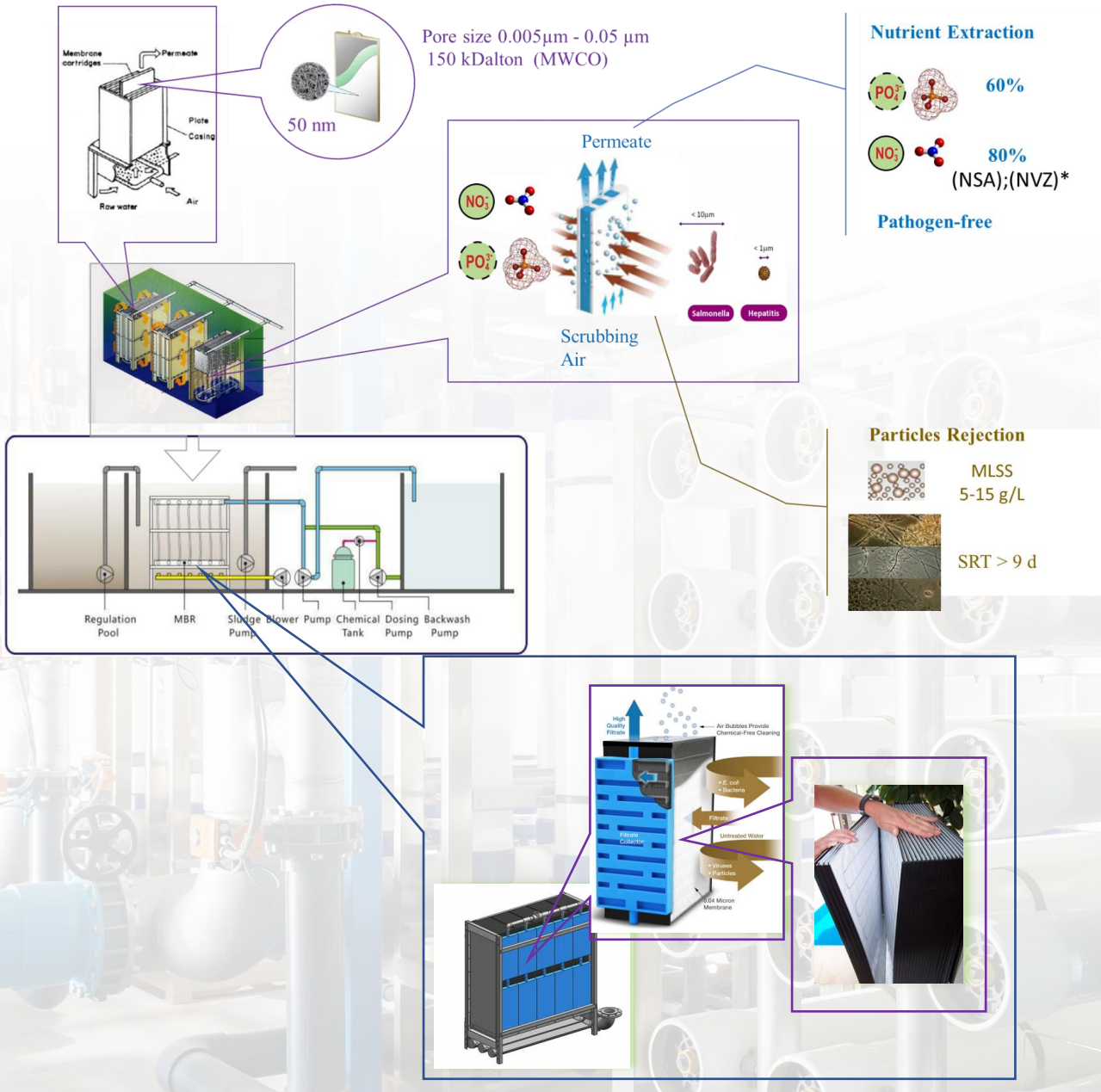

Figure 2: MBR system's functioning diagram

****Denitrification required Nitrate Vulnerable Zone (NVZ) European Legislation limit of 50mg/L Nitrate (N).***

2. Water Reclamation for Agriculture.

The RichWater system is based on a new groundbreaking system combining low-cost and energy efficient MBR treatment, a module for mixing the optimal fertigation water connected to the up-to-date irrigation technology and an advanced monitoring /control module including soil sensors to guarantee demand-driven and pathogen-free fertigation. Implementing the system in the agricultural production process results in a more eco-friendly use of water resources, cost savings for freshwater and fertilizer and the possibility for commercial food producer to adjust the fertigation unit for individual needs using a mixture of fresh and treated water. A low energy MBR has been designed for the wastewater treatment module in a way that the contained nutrients (mainly nitrogen and phosphorus) remain after the treatment whilst pathogens are removed. The mixing station mixes the appropriate proportion of freshwater and the treated wastewater coming from the MBR, which is then fed into the fertigation module (drip irrigation). The appropriate mixing level is determined by monitoring the level of nutrient content in the soil via sensors; this information is sent by remote control to the monitoring unit, which converts the signals to be read by the control unit. The control unit automatically adjusts the mixture inside the mixing module via valves according to the crop's demand.

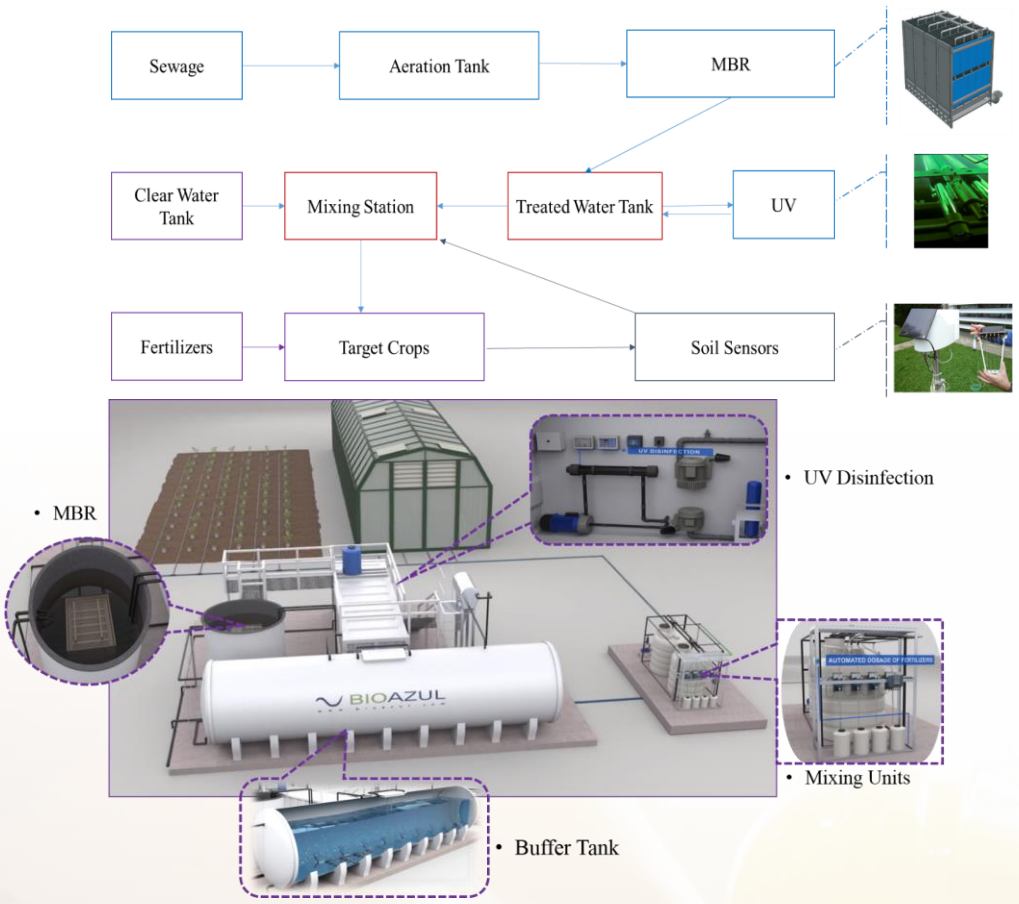

Figure 3 RichWater Modules for water reclamation in agriculture.

3. Further Reading

Acosta, A. C. (2017). Thesis M . Sc . WASTE. Technical Guidelines for Nutrient Recovery and Water Reuse in Agriculture and Industry by Analysis, Design and Operation of Treat & Reuse Membrane Bioreactors [MBR] in Europe.

Brepols, C., Schäfer, H., & Engelhardt, N. (2011). Chapter 3 Design, Operation and Maintenance. In The MBR Book (Vol. 61, pp. 55–207). Elsevier. http://doi.org/10.1016/B978-0-08-096682- 3.10002-2

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