

Conserving resources with water reuse

awaregio – modular wastewater treatment processes for the reuse of water, nutrients and energy as an opportunity for small and medium-sized enterprises in regional structural change



As a permanently available resource, treated wastewater is too valuable in times of climate change to be discharged unused into water bodies. Regulation (EU) 2020/741 now regulates minimum requirements for water reuse, which will also apply in Germany from 26 June 2023. Under the leadership of FiW e. V., the BMBF pilot project awaregio demonstrated the development of innovative key components for the reuse of wastewater, wastewater-based nutrients and energy in agriculture, fish farming and for drinking water substitution, opening up new market opportunities for small and medium-sized enterprises (SMEs) in regions under structural change.

Modular pilot plant for water reuse

In cooperation between research institutes in Aachen and Leipzig, SMSs in Brandenburg, Saxony and North Rhine-Westphalia and the Linksniederrheinische Entwässerungs-Genossenschaft (LINEG), a modular, robust and energy-saving wastewater treatment system was planned, built and operated as a pilot plant with connected aquaponics at Moers-Gerdt municipal wastewater treatment plant.

The awaregio concept succeeded in generating biogas from the wastewater even under Central European climatic conditions by using an anaerobic reactor as primary purification and minimising the accumulation of excess sludge. This primary treatment allowed for a reduction of the organic influent load by two-thirds without energy input.

As secondary treatment processes, four alternative modules were investigated with regard to the achievable product water qualities: a soil filter (SF), UV irradiation, ultrafiltration



Planted ebb and flow table with tomatoes, cabbage, hot peppers, etc. © FiW e. V.



African catfish grow excellently at 27 to 31 °C. © Terra Urbana

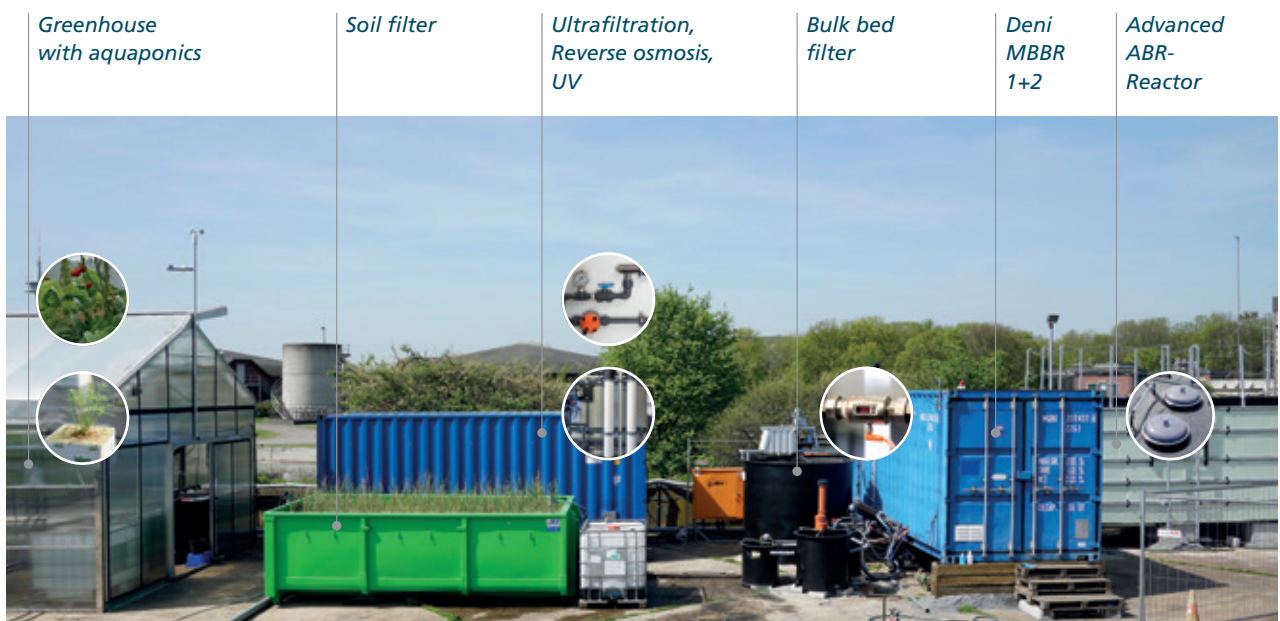
(UF) and low-pressure reverse osmosis (RO). The soil filter was very robust and efficient reducing COD effluent concentrations and advanced bacteria elimination. In addition, a (partial) desalination of the thus pretreated wastewater in low-pressure RO membranes was successful.

In terms of resource efficiency, the low energy requirement is remarkable: With the soil filter as secondary treatment, even an energy surplus can be achieved with the awaregio concept. If the energy-intensive reverse osmosis is included, the energy demand is no higher than the average value of municipal wastewater treatment plants

in Germany (< 34 kWh/(E*a)). Desalination of treated wastewater is energetically more favourable by a factor of 10 than seawater desalination.

Product water qualities achieved

Depending on the type of secondary treatment, the awaregio concept allows adaptation to different agricultural irrigation requirements. To evaluate the achieved product water qualities of different modules, tests were carried out on acute-toxic (algae, daphnia and fish embryos) and mechanism-specific effects (cell toxicity, endo-



Stations of the awaregio pilot plant. © FiW e. V.

crine, oestrogenic, androgenic and mutagenic potential, and dioxin-like effect). The fate of contaminants was investigated using passive samplers and individual samples.



Soil filter – robust and efficient. © FiW e. V.

All three qualities UV, UF and SF were useable in aquaponics. In addition, low-pressure RO makes it possible to produce partially desalinated water that in principle can be reused for many other purposes – even as supplementary water for drinking water supplies in arid regions.

Utilisation in Germany and in International Cooperation

If appropriate qualitative and risk management aspects are taken into account, water reuse in international cooperation but also in Germany can contribute to reduce water-scarcity conflicts in arid regions. The irrigation of energy wood plantations was identified (short rotation plantation) was identified as a potential low-conflict field of water reuse application in Germany.

The awaregio concept opens up new market possibilities for the local and regional management of water, nutrient, and energy resources. Results from the awaregio project are used internationally in the BMBF project WateReTUNE in Tunisia.

Project overview

PROJECT TITLE

awaregio – modular wastewater treatment processes for the reuse of water, nutrients and energy as an opportunity for small and medium-sized enterprises in regional structural change.

PROJECT PERIOD

10/2016 – 09/2019

PROJECT PARTNERS

TERRA URBANA Umlandentwicklungsgesellschaft mbH; Institut für Infrastruktur und Ressourcenmanagement der Universität Leipzig; Linksniederrheinische Entwässerungs-Genossenschaft; RWTH Aachen University Institut für Umweltforschung; EvU® – Innovative Umwelttechnik GmbH; A3 Water Solutions GmbH

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