AquaNES

Demonstrating Synergies in Combined Natural and Engineered Processes for Water Treatment Systems

Bank filtration combined with reverse osmosis: Experience in Baja, Hungary

Challenge

As part of the AquaNES “Demonstrating Synergies in Combined Natural and Engineered Processes for Water Treatment Systems” project, a slow sand filter was operated at the pilot water treatment plant (PWTP) of the National University of Public Service’s Faculty of Water Science in Baja, Hungary. The aim of the study described here was to simulate riverbank filtration (RBF) and assess the efficiency of slow sand filtration when a thin, clogged, biologically active top layer is present and to demonstrate that RO process can be sustainably operated, when feed is bank filtered water.

Expected benefits

Reverse osmosis is capable of near complete rejection of all dissolved components, thus a constant quality can be achieved. The long-term treatment of bank filtered water on reverse osmosis has never been studied in Hungary so far. Bank filtration sites are vulnerable to not just emerging micropollutants, but industrial and municipal wastewater discharge as well. Therefore, it is imperative to start investigations on the long-term sustainability of advanced treatment processes such as RO.

Results

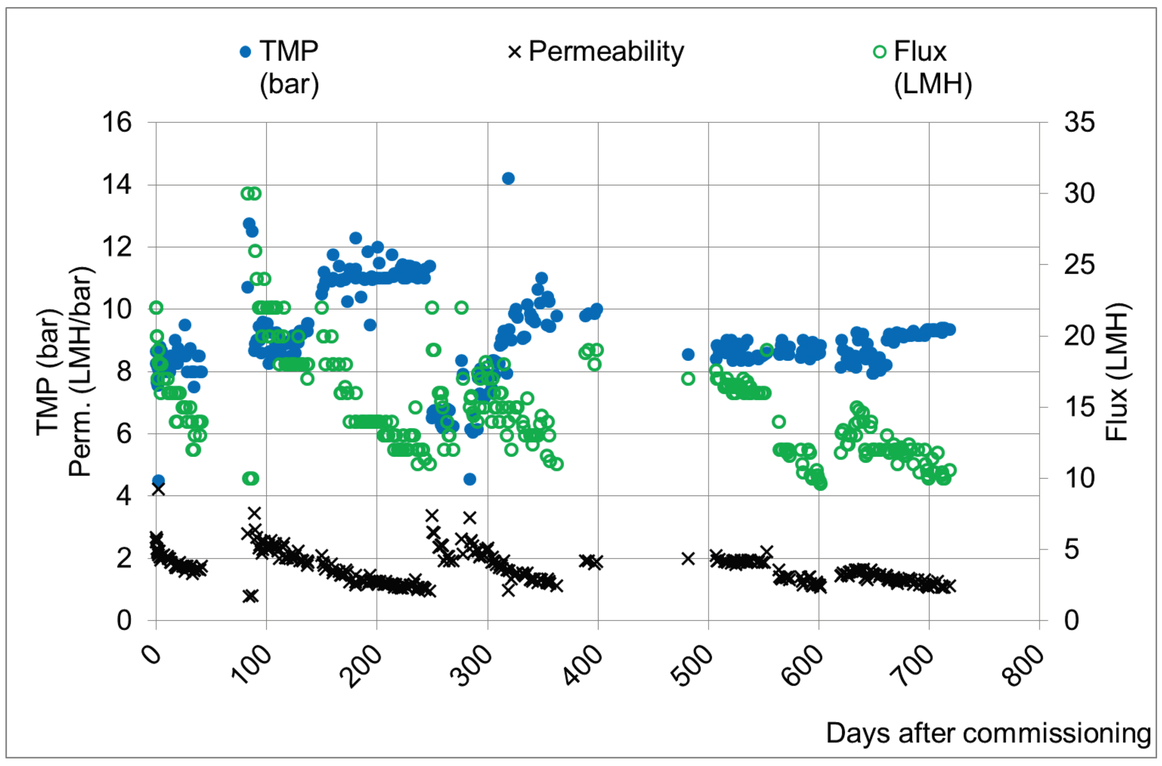

Figure 2. Registered parameters (TMP, permeability and flux) of the RO-unit

Conclusions

In this way, the natural system (the biologically active zone) can be utilized not only to decrease turbidity and reject a significant number of pathogens, but to reduce the biofouling potential of the membrane by the removal of easily degradable substrates which otherwise contribute to biofilm growth. When membrane filtration is applied, the decrease in the portion of land-side groundwater is of first priority and the pathogen rejection can be safely carried out with the combination of short filtration by RBF or other MAR schemes and membrane treatment.

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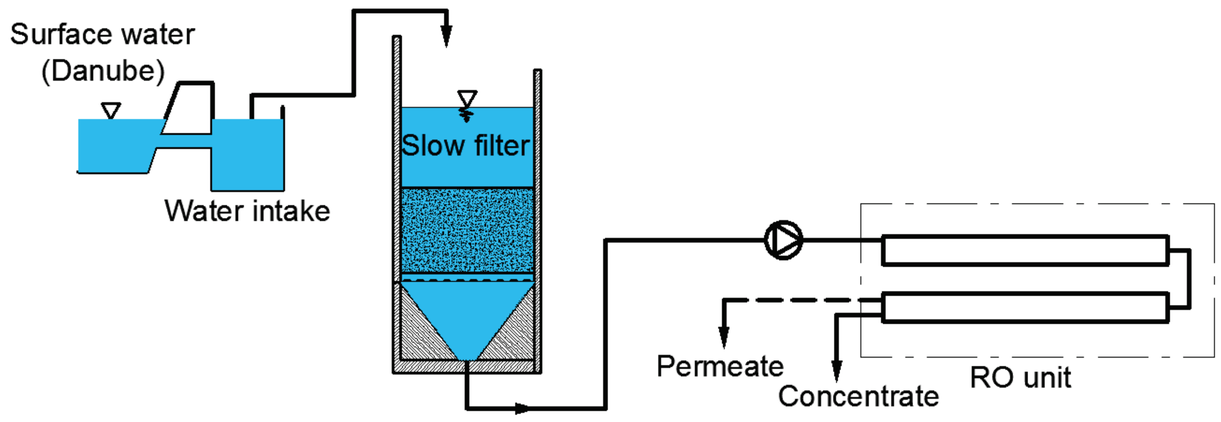

Figure 1. Scheme of RO unit fed with slow filtered surface water for RBF simulation

Technical demonstration

The RO - simulated bank filtration scheme was operated over two years in PWTP. Apart from registering the operating parameters (transmembrane pressure, permeability and flux) water quality monitoring also took place. UV disinfection were carried out in the filtered water as well.

- RO proven to be sturdy and capable of long term operation, even with worse than recommended water quality
- Slight chemical instability and small changes toward anoxic conditions doubled the fouling rate even at drinking water quality iron concentrations (see 270-370 days after commission)
- Due to the low number of bacteria in the river water, only less than 1 log removal values could be observed during the time of the experiment.
- Because of these low initial values, a strong reduction could only be observed for three parameters: colony count at different temperatures and Pseudomonas.
- Altough the surface water quality produced low results for pathogen indicators, pathogen rejection could be observed on the filtration unit, even at short travel distances.

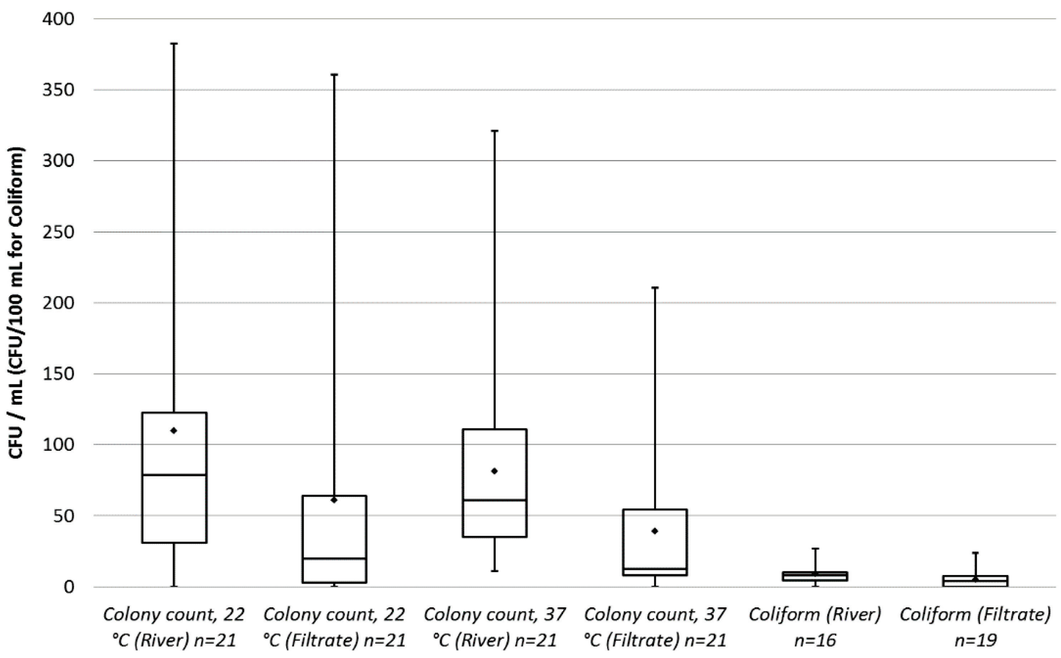

Figure 3. Values of microbiological indicator parameters

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