AMSTERDAM INTERNATIONAL WATER WEEK

Abstract Title	Reclamation of municipal wastewater with direct nanofiltration (DNF) combined with UV/H_2O_2 AOP
Topic	O Improving water quality O Resilient water systems X Circular solutions: Reuse, Recover and Recycle O Transitions in water, agro/food and energy
Challenges and Solutions	Water scarcity is a present and growing issue in large parts of the world. In 2022, Europe saw the worst draught in centuries, and going forward drinking water producers will be struggling to fulfill our future needs. As the needs remain more or less constant in an area (barring population in- or decrease) the wastewater production remains unchanged. After treatment the wastewater is discharged into surface waters which in turn can act as a source for drinking water production. This means that wastewater is an underutilized resource. By reclaiming wastewater through tertiary, quaternary, and further advanced treatment much of the water demands can be satisfied.
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Abstract	Research was performed at Asten WWTP in the Netherlands by Van Remmen UV Technology together with NX Filtration. This research aimed to find synergies between dNF and UV/H_2O_2 for reclamation of wastewater for e.g. irrigation or industrial processes. The hypothesis is that dNF removes the bulk organics and increases the transmittance and that, subsequently, UV/H_2O_2 removes the remaining organic micropollutants (OMP). This way, micropollutants such as antibiotics would not be returned to the biology together with the concentrate when recirculated and therefore not negatively interfere with the biological

	processes. The transmittance increase over several different nanofiltration membrane densities and its effect on UV/H2O2 performance and OMP removal was investigated together with Membrane Science and Technology, University Twente. These were combined with modelled UV doses for ≥80% average removal efficiency to determine a total energy consumption. The most optimal combination gave a total energy consumption of 0,21 kWh/m^3 and a transmittance of >85% T_{10} based on the model study. This part of the research is in the publication phase as of 15th July 2023. The modelled scenario as well as a dose/setting response line were tested on municipal wastewater effluent. The dNF80 membrane reduced the bacteria count to below detection limit and had 54% average removal of micropollutants expressed as the Dutch defined guide-compounds (gidsstoffen). UV/H_2O_2 had 81,1% additional average removal of micropollutants to a cumulative of 96% total average system removal of guide compounds. The most difficult compound, metformin, was not removed by the dNF80 membrane but was removed to up to 90,6% by UV/H_2O_2. The residual H_2O_2 was removed from the water stream through a catalytic bed with activated carbon at a EBCT <2 min. According to EU regulation 2020/741 the water fulfils classification A of reclaimed irrigation water, for high quality re-use purposes. In addition to the results, the presentation will also discuss both the importance of finding synergies between technologies which normally may be considered competing, as well current difficulties and discussions regarding end-of-waste of wastewater streams and subsequent production of potable water.
Figures/diagrams/illustrations	Up to 2 (in abstract)