

A HYBRID PROCESS OF BIOFILTRATION OF SECONDARY EFFLUENT FOLLOWED BY OZONATION AND SHORT SOIL AQUIFER TREATMENT FOR WATER REUSE

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Introduction:

- ✓ The reclamation process at the "Shafdan" includes 1) primary clarification; 2) activated sludge; and 3) tertiary soil aquifer treatment (SAT) with hydraulic retention times (HRTs) of a few month, which lead to the following malfunctions:
 - ✓ Increasing hydraulic load with strongly required HRT for DOC removal.
 - ✓ Long HRTs with high oxygen demand along the SAT result in anoxic conditions and mobilization of dissolved manganese from soil.
 - ✓ The occurrence of persistent trace organic compounds (TrOCs) in reclaimed water.

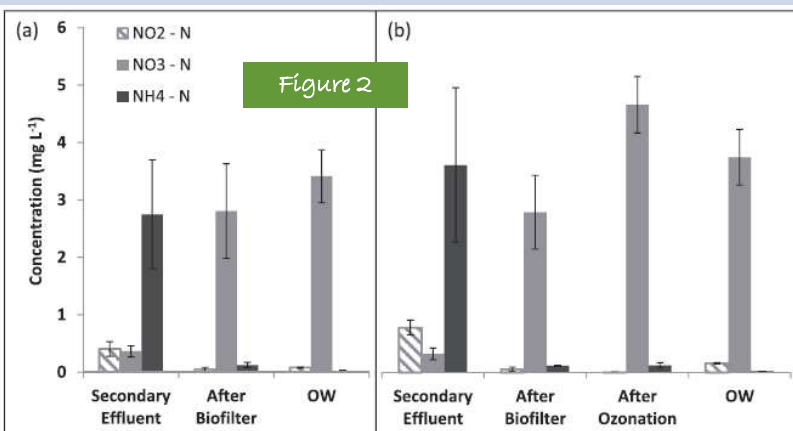
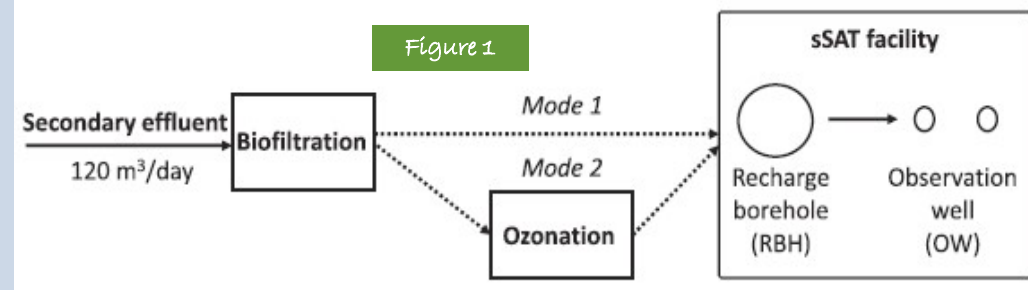
Experimental:

- ✓ The pilot system included biologically active high-rate filtration unit, ozonation unit and short SAT facility (figure 1)
- ✓ **Biofiltration unit:** Included coagulation/flocculation with 5 min HRT and addition of hydrogen peroxide to provide oxygen for microbial processes and it was operated in a modified active dual media filter combined infiltration and backwash cycle.
- ✓ **Ozonation unit:** Ozone was produced from pure oxygen and operated in continuous mode.

Objectives of this research:

This research focused on the combination of biofiltration prior and following ozonation as alternative treatment in order to:

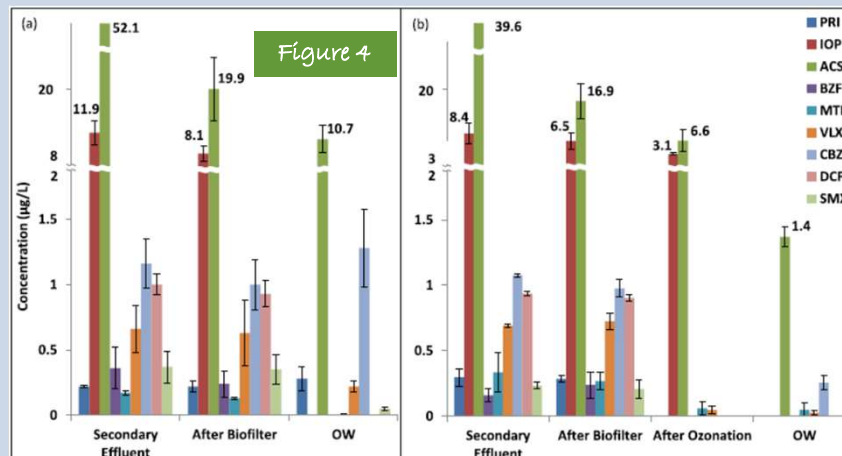
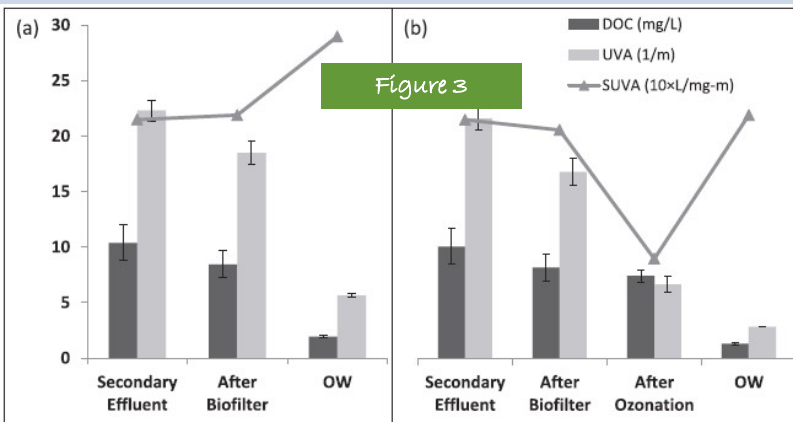
- ✓ Reduce footprint of the existing SAT; Eliminate residual TrOCs; Minimize Mn^{2+} mobilization



- ✓ **Short SAT facility:** A recharge borehole (RBH) and observation well in a depth of 27.5 m at a distance of 7.3 m downstream
- ✓ **Analytical methods:**
 - ✓ The target compounds of TrOC were detected and quantified by HPLC
 - ✓ TOC, DOC, Nitrogen compounds and bromate were determined by TOC analyzer, spectrophotometer and ion chromatography.

Results and Discussion:

- ✓ Biofiltration as pretreatment for short SAT showed complete nitrification with efficient removal of NH_4^+ and NO_2^- (Figure 2).
- ✓ Biofiltration reduce DOC concentration in about 17-22% in the secondary effluent (Figure 3).
- ✓ Ozonation increased NO_3^- -N concentration (Figure 2b).
- ✓ Efficient reduction of UVA (60%) observed by ozone (Figure 3b).
- ✓ Biofiltration reduce the concentrations of ACS and IOP from the TrOCs group by approximately 60% and 30%, respectively but not significantly (Figure 4).



Conclusions:

- ✓ Incomplete nitrification during secondary treatment lead to clogging in the reclaimed water.
- ✓ As a result of the pretreatment of biofiltration and ozonation the oxygen demand in the process was reduced and additional DO during SAT was succeeded.
- ✓ Improvement of the reclaimed water was achieved