The Fate of H2O2 as the Residual from AOP within Managed Aquifer Recharge

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INTRODUCTION
The combination of advanced oxidation process (AOP) and managed aquifer recharge (MAR) is a potential system to remove more organic micro-pollutants during drinking water treatment processes. To prevent bromate formation through O3 during UV, H2O2 should be dosed excessively. The fate of H2O2 in aquatic system has been investigated comprehensively, however, an improved understanding of the fate of H2O2 in terms of H2O2 decomposition mechanisms, during MAR is key to set the maximum allowed H2O2 concentration in the infiltrated water of MAR.

The objectives of this study were to assess the fate of H2O2 within MAR and investigate the reactions of H2O2 with various biotic (bacteria/catalase in water and soil) and abiotic constituents (pure sand particle, inorganic salts in influent, organic matter in soil and influent and mineral substance coating on sand particles).

MATERIALS and METHODS
In this study batch experiments were performed to simulate MAR using slow sand filter sand with natural microbial communities and synthetic MAR water. The below table shows the different batch reactors that were prepared, containing different types of sand and water. Most batch reactors were prepared with sand originating from the top layer of a slow sand filter, but as a reference batch reactors were also prepared with clean and pure sand which was silicon dioxide without any impurities. Batches were placed in a dark and temperature (12°C) controlled room.

RESULTS and DISCUSSION

Results: H2O2 decomposition in the presence of pretreated MAR sand with more MnO and less Al2O3 was much faster than that in the presence of MAR soil with less MnO and more Al2O3. That indicated MnO instead of Al2O3 lead to a large fraction of H2O2 under abiotic conditions.

CONCLUSION
- Organic matter and inorganic ions dissolved in the synthetic MAR water did not affect H2O2 decomposition;
- Pure sand had no adsorption effect on H2O2;
- The reaction of H2O2 with naturally occurring metal oxides on the sand contributed to H2O2 decay and MnO pre-treatment of sand lead to a large fraction of H2O2 loss, also under abiotic conditions;
- Biotic decomposition, however, dominates H2O2 fate within the MAR system;

Regression analysis result clearly shows H2O2 decomposition rate has positive correlations with respect to initial 1 ATP concentrations.