Prolonged performance of pesticide residue degradation in bioaugmented sand filter columns

Lea Ellegaard-Jensen, Morten Dencker Schostag, Mahdi Nikbakht Fini, Nora Badawi, Jens Aamand, Lars Hestbjerg Hansen

Background: Drinking water resources, such as groundwater, are threatened by pollution. One concern is the pesticide metabolite 2,6-dichlorobenzamide (BAM) frequently found in groundwater in concentrations exceeding the EU legal limit of 0.1 µg/L. Studies have therefore attempted to add BAM-degrading bacteria to sand-filters at drinking water treatment facilities. This biotechnology has shown promise in purifying BAM polluted water. However, the degradation potential was lost over time due to a decrease of the degrader population.

Aim: to overcome the constraints leading to loss of degraders from inoculated biofilters. Our approach to this was threefold: 1) development of a novel inoculation strategy, 2) lowering the flowrate to reduce washout of cells, and 3) increasing the concentration of nutrients in a smaller inlet water stream. The two latter were achieved via modifications of the inlet water by applying membrane treatment which, besides producing an ultra-pure water fraction, produced a residual water stream with all nutrients including BAM concentrated in a 10x reduced volume. This was done to alleviate starvation of degrader bacteria in the otherwise oligotrophic biofilters and to enable a decreased flowrate.

Results: we achieved 100% BAM removal over a period of 40 days in sand-filter columns inoculated with the BAM-degrader *Aminobacter* sp. MSH1. Molecular targeting of the degrader strain showed that the population of degrader bacteria persisted throughout the sand-filter column and over the entire timespan of the experiment.