Microbial community and antibiotic resistance genes within reactive barriers for artificial aquifer recharge

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Aquifer recharge by Soil Aquifer Treatment (SAT) provides an opportunity to treat and store recycled water for subsequent reuse as common sustainable water management strategy. Beyond the occurrence of potential pathogenic microorganisms in reclaimed water, the spreading of antibiotic resistant bacteria (ARB) and antibiotic resistance genes (ARGs) is considered a critical issue for aquifer recharge practices. The aim of the study was to evaluate the effects of reactive barriers with different composition on the microbial community structure (i.e., abundance and phylogenetic composition), the persistence of fecal contamination indicators, and the occurrence of ARGs (i.e., sul1, sul2 and ermB). A sacrificial microcosm experiment was conducted for 46 days to determine the decay profiles of selected microbial contaminants from municipal wastewaters within reactive barriers characterized by different content of organic (i.e., green and mushroom compost) and inorganic substrates (i.e., sand and clay). Results showed a large variation in microbial community composition from the start to the end of the experiment per each treatment, together with a very limited or no variation of bacterial abundance and ARGs contamination. Preliminary results from a mesoscale artificial recharge system were similar, although a high efficiency in the removal of microbial biomass and potential pathogens was reported as a consequence of water filtration processes. Our outcomes confirmed the necessary definition on efficient strategies for a careful management and monitoring of Soil Aquifer Treatments.

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