Artificial recharge using wastewater treatment plant effluents: Evaluation of nitrogen fate in meso-scale experiments by means of an isotopic approach.

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The Mediterranean region suffers from increasing water scarcity, which is further exacerbated by climate change and high-water consumption for agricultural, industrial, and urban purposes. The use of non-conventional water sources (e.g. treated wastewater, drainage water, and desalinated water) and alternative techniques, such as Managed Aquifer Recharge (MAR) systems, are considered to be very promising to address the challenge of water scarcity in arid and semi-arid environments.

Artificial recharge using wastewater was evaluated in six meso-scale recharge systems equiped with different permeable reactive layers (PRL) consisting on a mixture of sand and organic rich components (vegetable compost and woodchips). The rest of the system, filled with sand, emulates the aquifer and it is characterized by horizontal flow and saturated conditions. The goal was to evaluate the role of the PRL in the fate of dissolved nitrogen compounds (N) from wastewater tratment plant effluents. To achieve this goal, the isotopic characterization of N species ($\delta^{15}N_{NO_3^-}$, $\delta^{18}O_{NO_3^-}$, $\delta^{15}N_{NH_4^+}$, $\delta^{15}N_{NO_2^-}$ and $\delta^{18}O_{NO_2^-}$) was performed.

Preliminary results showed that, after infiltration, NH_4^+ from input wastewater treatmnet plant effluent is partially nitrified to NO_3^-. Nitrification was not complete because O_2 was also consumed to oxidize dissolved organic carbon (DOC) present in wastewater and in the PRL. Once O_2 was completely consumed, due to the high DOC content (4.6 mmoL/L), NO_3^- produced by nitrification was subsequently denitrified. The variation produced in the isotopic composition of the different nitrogen compounds analyzed was controlled by the extent of nitrification and denitrification processes throughout the systems.