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# Preliminary results of column experiments simulating nutrients transport in artificial recharge by treated wastewater

María Leal (1), Raffaella Meffe (1), and Javier Lillo (2)

(1) IMDEA Water, Alcalá de Henares, Spain (maria.leal@imdea.org, +348305961), (2) University Rey Juan Carlos, Móstoles, Spain (+34914887016)

Nutrients (phosphates, nitrates, nitrites and ammonium) are very often present in treated wastewater as consequence of the inefficient removal capability during wastewater treatments. Such compounds represent an environmental concern since they are responsible for contamination and/or eutrophication problems when reaching the water bodies (groundwater, river, streams…). Therefore, when wastewater reclamation activities such as artificial recharge are planned, special attention should be paid to these compounds to avoid groundwater deterioration. In this context, we proposed the installation of a Horizontal Permeable Reactive Barrier (H-PRB) made of different reactive materials, among them zeolite and palygorskite, to remove nutrients or at least to decrease their concentrations.

The overall aim of this research is to evaluate if the application of a H-PRB could represent a feasible solution for the attenuation of nutrients when unconventional water resources (i.e. treated wastewater) are used for recharge activities. Specifically, this study is intended to identify the transport processes affecting nitrates, nitrites, ammonium and phosphates when treated wastewater is infiltrated through the reactive materials of the H-PRB.

Column experiments are generally suitable to examine the interactions between reactive materials and treated wastewater that affect the transport behavior of nutrients. For example, processes such as adsorption can be identified and quantified. Thus, laboratory column experiments were carried out using zeolite or palygorskite as column infilling material and synthetic treated wastewater as column influent. The experiments are closely connected to an experimental field study in Carrión de los Céspedes (Seville-Spain) where a pilot H-PRB is currently under evaluation. The columns were operated under saturated conditions applying a constant flow rate of 1.2 mL/min equivalent to the infiltration rate estimated through infiltration experiments at the field site. Wastewater synthesized in the laboratory simulates the secondary effluent used for recharge activities in the Experimental Plant of Carrión de los Céspedes,

Experimental results showed that ammonium and phosphates are clearly retarded when infiltrating through both materials (zeolite and palygorskite) as consequence of cation exchange and surface complexation processes. Indeed, after about 14 days from the beginning of the experiments the two compounds do not appear at the column effluent exhibiting a very strong retardation. Concerning nitrites and nitrates, no retardation is observed. Preliminary interpretation of the experimental results by means of the geochemical modeling code PHREEQ-C confirmed and quantified the importance of specific reactive processes affecting transport of nutrients through the applied reactive materials.