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Characterize Behaviour of Emerging Pollutants in Artificial Recharge: Column Experiments - Experiment Design and Results of Preliminary Tests

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Emerging pollutants (EPs) have been detected in water resources as a result of human activities in recent years. They include pharmaceuticals, personal care products, dioxins, flame retardants, etc. They are a source of concern because many of them are resistant to conventional water treatment, and they are harmful to human health, even in low concentrations. Generally, this study aims to characterize the behaviour of emerging pollutants in reclaimed water in column experiments which simulates artificial recharge.

One column set includes three parts: influent, reactive layer column (RLC) and aquifer column (AC). The main influent is decided to be Secondary Effluent (SE) of El Prat Wastewater Treatment Plant, Barcelona. The flow rate of the column experiment is 0.9-1.5 mL/min. the residence time of RLC is designed to be about 1 day and 30-40 days for AC. Both columns are made of stainless steel.

Reactive layer column (DI 10cm * L55cm) is named after the filling material which is a mixture of organic substrate, clay and goethite. One purpose of the application of the mixture is to increase dissolve organic carbon (DOC). Leaching test in batchs and columns has been done to select proper organic substrate. As a result, compost was selected due to its long lasting of releasing organic matter (OM). The other purpose of the application of the mixture is to enhance adsorption of EPs. Partition coefficients (Kow) of EPs indicate the ability of adsorption to OM. EPs with logKow>2 could be adsorbed to OM, like Ibuprofen, Bezafibrate and Diclofenac. Moreover, some of EPs are charged in the solution with pH=7, according to its acid dissociation constant (Ka). Positively charged EPs, for example Atenolol, could adsorb to clay. In the opposite, negatively charged EPs, for example Gemfibrozil, could adsorb to goethite.

Aquifer column (DI 35cm * L1.5m) is to simulate the processes taking place in aquifer in artificial recharge. The filling of AC has two parts: silica sand and compost. The grain size of the sand is about 0.5mm. Aquifer deposits usually contain some natural organic matter. Therefore, compost (<1mm) was selected to be mixed with sand with the ratio of 1:99. Long residence time of AC and high concentration of DOC are favourable to generate variable redox states, which favour EPs degradation.