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Study of the hydrogeochemical processes during enhanced trimethoprim and sulfamethoxazole removal in artificial composite soil treatment system

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ABSTRACT

The removal of trimethoprim (TMP) and sulfamethoxazole (SMX) by column experiments was systematically investigated, in which an artificial composite soil treatment system (ACST) simulating irrigation soils at high infiltration rates (>89.11 m d^{-1}) was constructed. The levels of K^+, Na^+, Ca^{2+}, Mg^{2+}, Fe^{3+}, Mn^{2+}, Cu^{2+}, and Zn^{2+} during hydrogeochemical processes were focused in this study. The results demonstrate that ACST with high infiltration rates improved the removal of SMX and TMP, with removal rates about 20% higher than the removal rates of transitional sands. Moreover, under the condition of the same ACST infiltration rate, the removal rate of TMP was higher than that of SMX. This shows that influent high Na^+ concentrations might directly hinder the release of Ca^{2+}, while Ca^{2+} might participate in SMX and TMP removal. The results also show that a small portion of the K^+ released from dissolution were derived from soil desorption and participated in the removal of TMP and SMX. On the whole, SMX and TMP removal processes are related with hydrogeochemical processes of K^+, Na^+, Ca^{2+}, and Mg^{2+}. Effluent Fe^{3+}, Mn^{2+}, Cu^{2+}, and Zn^{2+} concentrations were on the μg L^{-1} level. In this study, the ACST is determined to be a suitable method for the treatment of water contaminated with SMX and TMP.

Keywords: Trimethoprim; Sulfamethoxazole; Hydrogeochemical processes; Ion exchange

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