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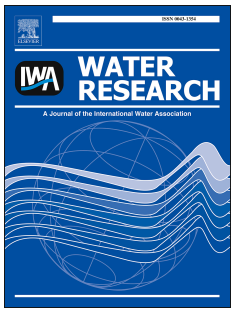

Characterizing the capacity of hyporheic sediments to attenuate groundwater nitrate loads by adsorption

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Characterizing the capacity of hyporheic sediments to attenuate groundwater nitrate loads by adsorption

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Abstract

Nitrate has been recognized as a global threat to environmental health. In this regard, the hyporheic zone (saturated media beneath and adjacent to the stream bed) plays a crucial role in attenuating groundwater nitrate, prior to discharge into surface water. While different nitrate removal pathways have been investigated over recent decades, the adsorption capacity of hyporheic sediments under natural conditions has not yet been identified. In this study, the natural attenuation capacity of the hyporheic-sediments of the Ghezel-Ozan River, located in the north-west of Iran, was determined. The sampled sediments (from 1 m below the stream bed) were characterized via XRD, FT-IR, BET, SEM, BJH, and Zeta potential. Nitrate adsorption was evaluated using a batch experiment with hyporheic pore-water from each study site. The study was performed in the hyporheic sediments of two morphologically different zones, including Z_1 located in the parafluvial zone having the clay sediment texture (57.8% clay) with smectite/Illite mixed layer clay type and Z_2 located in the river confluence area containing silty clay sediment texture (47.6% clay) with smectite/kaolinite mixed layer clay type. Data obtained from the batch experiment were subjected to pseudo-first order, pseudo-second order, intra-particle diffusion, and Elovich mass transfer kinetic models to characterize the nitrate adsorption