The effect of density-driven flow on the transport of solutes with high concentrations in the hyporheic zone

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Abstract

In this study, both laboratory experiments and numerical simulations were conducted to investigate the effect of density-driven flow on the transport of high-concentration pollutants in the hyporheic zone. The results show that the density gradient can change the flow of pore water and the strong density-driven flow can lead to an unstable flow, which increases the effect of preferential flow and thus causes the appearance of solute fingers in the hyporheic zone. Notably, these solute fingers become more obvious with the increase of depth. The appearance of solute fingers depends on the relative strength of the pumping exchange and density gradient, which are represented by the dimensionless number M* and N* respectively. Finger flows appear near the interface when M* is less than 0.5 N*. This study may contribute to better understanding the transport and destination of solutes and thus may provide some insights into the assessment on pollution incidents.

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