Particle size distribution of colloids affected by hyporheic exchange

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Abstract

Colloids exist widely in rivers which can act as contaminants or carries of contaminants. Hyporheic exchange drives colloids to transport into the hyporheic zone. However, the variation of the particle size of colloids has seldom been considered in previous transport theories of colloids. This study aims to investigate the variation of the particle size of colloids and functions for different sized particles via laboratory experiments and simulations. The results show that the settlement and convection-diffusion of colloids play a dominant role in the exchange of colloidal particles between the stream and the streambed. Large particles can settle into the streambed more rapidly as settlement domains the process, which however can hardly be detected in the overlying water during the later period of the experiment; the exchange process of small-sized particles is affected more by convection and diffusion, and a retarded trace release can be monitored from the streambed to the stream; while for middle-sized particles, mass transfer coefficient and settling velocity affect exchange process together. Because the variation of particle size (affecting specific surface area, surface electrochemical characteristics) can have a substantial effect on the contaminants carriers (colloids) in the hyporheic zone, the knowledge of it should be taken into account in future studies.

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