Micro-scale heterogeneous bacterial distribution impacts on biodegradation

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Abstract

The microorganisms in groundwater rarely cover the matrix uniformly, but form colonies. This limits substrate bioavailability and biodegradation. With a high-resolution numerical model of a pore channel with bacterial colonies we simulated the transport and biodegradation of organic substrates and compared them to 1D simulations based on effective rate laws for bioavailability-limited biodegradation. We quantified bioavailability limitations and evaluated the applicability of established effective rate concepts if microorganisms are heterogeneously distributed. Effective bioavailability was reduced (> one order of magnitude).

Key words

pore-scale microbial degradation
bioavailability
effective rate laws

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