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In situ imaging of bacteria transport and attachment in geologic materials using positron emission tomography

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Contamination of groundwater by *Escherichia coli* (*E. coli*) bacteria has been a persistent and growing risk to globally strained groundwater resources. Prevention, mitigation, and regulation of contaminants requires a fundamental understanding of the mechanisms of transport and attachment of *E. coli* in complex geological materials under hydrogeologic conditions. This work demonstrates the first experimental quantification of dynamic bacteria transport and attachment distributions in geologic materials using 3D medical imaging. The approach relies on radiolabeling *E. coli* bacteria with positron-emitting radioisotopes and then using positron emission tomography (PET) to monitor bacterial distribution and transport in heterogeneous sand packed column experiments. The results of this study indicate that bacteria attachment coefficient distributions are described by gamma probability density functions. As expected, these functions shift to higher attachment coefficients with decreasing grain size and decreased sediment sorting. Results from these radiolabeling and imaging techniques provide a transformational approach to directly measure and understand dynamic bacteria attachment and detachment behavior in realistic geologic systems.

Participation

In-Person

References

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