Microcosm Experiments and Modeling of Microbial Movement Under Unsaturated Conditions

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Abstract

Colonization of bacteria in porous media is now recognized as being facilitated by highly unsaturated flow. In this study, we examined how microbial colonization of unsaturated porous media is influenced by the presence of a nutrient source. The primary objectives were to: (1) examine the role of acetate in promoting microbial colonization, (2) develop a mathematical model to describe the process of colonization, and (3) compare the colonization rates obtained from experiments with the model predictions. Our observations indicated that acetate was transported directly into the dry sand from the bottoms of columns, and that the long-range transport of acetate was facilitated by hydraulic gradients. The long-range transport of acetate was facilitated by hydraulic gradients, and hence by the movement of bacteria. The model was able to provide adequate predictions of the colonization rates obtained from experiments, and thus we concluded that the model was an appropriate framework for describing the process of bacterial colonization. Our experimental data matched theoretical predictions. The model was able to provide adequate descriptors for describing the process of bacterial colonization. Our experimental data matched theoretical predictions. The model was able to provide adequate descriptors for describing the process of bacterial colonization.