An understanding and ability to predict the transport and fate of microorganisms in the subsurface is needed for public health, environmental applications, and industrial processes. A dramatic increase in the number and sophistication of mathematical models for microbial transport and/or survival has occurred over the last several decades to reflect the research community’s evolving understanding. These models are based upon different assumptions to conceptualize water flow and microbial transport, retention, release, survival, and clogging. There is no consensus on the best model formulation, and no single model is expected to accurately simulate all scenarios. Existing model formulations to describe the fate of microorganisms in the subsurface were reviewed in the March–April 2014 issue of the *Journal of Environmental Quality*.

Solute transport models based on the advection dispersion equation with first-order kinetic terms for survival and exchange with the solid–water and air–water interfaces have historically served as the starting point for microbial transport models. However, many model assumptions that are valid for solutes may be violated for microorganisms. Consequently, the conventional model has often been inadequate in experiments designed to achieve mass balance, even when model parameters were obtained by inversion. To account for some of these discrepancies, a variety of alternative model formulations have been developed.

Microorganisms transport in natural porous media can be more complicated than solute transport because of sedimentation, size and/or anion exclusion, chemotaxic migration, and/or physical nonequilibrium processes. For example, microbial retention in saturated soils often exhibits a non-exponential behavior with depth compared with predictions by first-order kinetic models. This can be attributed to time-dependent retention processes such as blocking and ripening, different rates and strengths of microbial interaction, population heterogeneity, etc.

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