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Experimental and theoretical study of Pseudomonas putida transport in a three-dimensional model aquifer

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This study is focused on the transport of Pseudomonas (P.) putida bacterial cells in a three-dimensional model aquifer. The pilot-scale aquifer consisted of a rectangular glass tank with internal dimensions: 120 cm length, 48 cm width, and 50 cm height, carefully packed with well-characterized quartz sand. The P. putida attachment onto the aquifer sand was determined with batch experiments, and was adequately described by a linear isotherm. Transport experiments with a conservative tracer and P. putida were conducted to characterize the aquifer and to investigate the bacterial behavior during transport in water saturated porous media. A three-dimensional, finite-difference numerical model for bacterial transport in saturated, homogeneous porous media was developed and was used to successfully fit the experimental data. Furthermore, theoretical interaction energy calculations suggested that the extended DLVO theory seems to predict bacteria attachment onto the aquifer sand better than the classical DLVO theory.