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Transport processes and mutual interactions of three bacterial strains in saturated porous media

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Transport processes of the bacterial strains *Klebsiella oxytoca*, *Burkholderia cepacia* G4PR-1 and *Pseudomonas sp* #5 were investigated in saturated column experiments to study the differences in transport characteristics and the mutual interactions of these strains during transport. Soil column experiments (114 mm long x 33 mm in diameter) were conducted with constant water velocities (3.9-5.7 cm/h) through a medium to coarse grained silica sand. All experiments were performed in freshly packed columns in quadruplicate. Chloride was used as tracer to determine the mean transit time, dispersivity and flow rate. It was injected as a pulse into the columns together with the bacterial strains suspended in artificial groundwater medium. In the first setup, each strain was investigated alone. In the second setup, transport processes were performed injecting two strains simultaneously. Finally, the transport characteristics were studied in successive experiments when one bacterium was resident on the sand grains prior to the introduction of the second strain.

In all experiments the peak C/Co bacterial concentrations were attenuated with respect to the conservative tracer chloride and a well defined tailing was observed. A one dimensional mathematical model for advective-dispersive transport that accounts for irreversible and reversible sorption was used to analyze the bacterial breakthrough curves and tailing patterns. It was shown that the sorption parameters were different for the three strains that can be explained by the properties of the bacteria. For the species *Klebsiella oxytoca* and *Burkholderia cepacia* G4PR-the transport parameters were mostly in the same range independent of the experimental setup. However, *Pseudomonas sp* #5, which is a motile bacterium, showed differences in the breakthrough curves and sorption parameters during the experiments. The simultaneous and successive experiments indicated an influence on the reversible sorption processes when another strain was present during the transport processes.