



Effect of gravity on *Pseudomonas putida* and kaolinite cotransport in water saturated porous media

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Bacterial transport in porous media can be affected by several factors, such as cell concentration, water velocity, and attachment onto the solid matrix or suspended in the aqueous phase soil particles (e.g. clays). Gravity, also may significantly influence bacterial transport behavior in the subsurface. The present study aims to determine the gravity effect on transport and cotransport of bacteria species *Pseudomonas* (*P.*) *putida* and kaolinite colloid particles in porous media. Transport experiments were conducted under horizontal-, up- and down-flow conditions in water saturated columns packed with glass beads. These different flow modes represent different gravity effects, namely: no-, negative- and positive-gravity effect. Initial experiments were performed with bacteria and kaolinite alone in order to evaluate the effect of gravity on their individual transport characteristics. No significant gravity effect was observed on the transport of individual bacterial cells. In contrary, each different flow mode was found to differently affect kaolinite transport. Compared to the horizontal-flow mode, the kaolinite mass recovery was decreased during the up-flow mode, and increased during the down-flow mode. Finally, *P. putida* and kaolinite particles were injected simultaneously into the packed column in order to investigate their cotransport behavior under different flow modes. The experimental data indicated that the kaolinite-*P. putida* cotransport behavior was similar to that observed for the transport of individual kaolinite particles. It was observed that the *P. putida* mass recovery decreased during down-flow conditions. This phenomenon may be caused by the attachment of bacteria onto kaolinite particles, which were adsorbed onto the solid matrix.