INSIGHTS FROM PARTICLE TRACKING ALGORITHM ON THE EFFECT OF MOTILITY ON BACTERIAL TRANSPORT IN POROUS MEDIA

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Bacterial transport in the subsurface is relevant to bacterial invasion into surface water and groundwater systems and biological events such as horizontal gene transfer (HGT) through cell to extracellular DNA contact. The surfaces of natural porous media serve as a reservoir for extracellular DNA, protecting it from enzymatic degradation. The frequency of HGT events on soil surfaces is proportional to contact time between bacterial cells and DNA adsorbed to soil surfaces, that in turn can be controlled by bacterial motility. This work employed a pore scale (radial stagnation point flow cell) model to investigate the transport and deposition of both flagellated and non-flagellated strains. Flagellated strain deposited more than non-flagellated strain in the pore scale experiments and the deposition rate coefficient (KRSPF) increased to 4.6 times as ionic strength changed from 1 mM to 100mM; however, the non-flagellated strain KRSPF did not show correlation with ionic strength. Traditional colloidal transport theory does not explain the phenomena. Pore scale images analyzed by particle tracing algorithm provided microscopic evidences on the distinguishable transport mechanisms of flagellated and non-flagellated strains. The modified particle tracing algorithm serves as a unique tool to study bacterial transport in porous media at single cell level, and insights from resulting visualization help improve the understanding of bacterial transport and deposition processes.