

How burping bacteria prevent buildings from collapse during earthquakes by microbial induced desaturation and precipitation

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Microbial induced desaturation and precipitation (MIDP) via denitrification can be used to improve soil properties. The MIDP process involves stimulating indigenous nitrate reducing bacteria, by injecting a solution containing dissolved organic carbon, calcium and nitrate. Oxidation of organic matter using nitrate as the reducing agent in presence of dissolved calcium introduces biogas, biomass and biominerals into the soil. Biogenic gas can dampen pore pressure build up during cyclic loading and prevent liquefaction of loosely packed sediments during earthquakes, while the biomass and biominerals fill up the pore space and can cement the soil grains increasing strength and stiffness. Experiments have been performed and numerical models have been developed at various scales to evaluate the potential of this novel bio-based ground improvement technique and investigate the effect of reaction kinetics flow regimes and geological heterogeneities on the formation, distribution and migration of biogenic gas and its effect on the mechanical and hydrological behavior.