



Bacterially Induced Calcite Precipitation and Strontium Co-Precipitation under Flow Conditions in a Porous Media System

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The process of *in situ* carbonate mineral formation has implications in many environmental applications, including, but not limited to aquifer decontamination, enhancement of soil stability, and carbon capture and storage (CCS). The high stability of carbonates and the potential for co-precipitation of contaminants within carbonates are attractive attributes for several potential engineering applications.

Ureolytic precipitation of calcium and strontium carbonates by *Sporosarcina pasteurii* was examined in two-dimensional flat plate porous media reactors. Complete reactor plugging due to biofilm formation and calcium carbonate precipitation was achieved in Sr-free systems after 14 hours and in Sr-inclusive systems after 15 hours. Comparison of the reactor influent and effluent after 11 hours indicated that Ca^{2+} concentrations in the Sr-free reactor effluent were reduced to approximately 0.48% of the influent concentration while the Ca^{2+} and Sr^{2+} concentrations of the Sr-inclusive effluent were reduced to 0.64% and 2.34% of the influent concentration indicating a slight inhibitory effect of strontium on calcium carbonate precipitation. Despite this slight inhibition, more than 98% of the Ca^{2+} entering the reactors was precipitated. Calcite was identified as the main mineral formed and a larger mean crystal size and density were observed near the reactor influent. Homogenous partition coefficients calculated from extracted precipitates suggest higher Sr^{2+} partitioning near the inlet region, where higher precipitation kinetics exist. Results confirm the possibility of effective calcite-based co-precipitation of Sr^{2+} under flow conditions and contributes towards the development of field-scale calcium carbonate mineral-based immobilization strategies.