Evaluation in a continuous-flow column of different fermenting substrates for the reductive dehalogenation of trichloroethene

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Abstract A continuous-flow column study was conducted to analyse the reductive dehalogenation of trichloroethene (TCE) in aquifer material with a composition high in iron oxides. The column was bioaugmented with the Point Mugu (PM) culture, which is a mixed microbial enrichment culture capable of completely transforming TCE to ethene (ETH). Most of the metabolic reducing equivalents were channelled to sulfate, Fe(III), and Mn(IV) reduction. When equal electron-reducing equivalents were added, the most effective dehalogenation was achieved using formate as an electron donor, with 14% of the electron equivalents going towards dehalogenation reactions, compared to 6.7% for lactate and 9.6% for propionate. Lactate and propionate addition resulted in a significant increase in Geobacter, Spirochaetes, and Desulfovibrio phylotypes relative to Dehalococcides when compared to formate addition. Molecular results support chemical observations that a greater percentage of the electron donor addition was channeled to Fe(III) reduction when lactate and propionate were added compared to formate.

Keywords reductive dehalogenation; column study; electron donors; chlorinated solvents