Geophysical Research Abstracts
Vol. 16, EGU2014-6170, 2014
EGU General Assembly 2014

Reactivities of two commercial nano iron particles for degradation of trichloroethene

Philipp Schöftner (1), Georg Waldner (1), Werner Lottermoser (2), and Thomas Reichenauer (1)

(1) AIT - Austrian Institute of Technology GmbH, Konrad-Lorenz-Strasse 24, 3430 Tulln a.d. Donau, Austria. (Thomas.Reichenauer@ait.ac.at), (2) Salzburg University, FB Materialforschung und Physik, Hellbrunner Str 34, 5020 Salzburg

Nanoscale Zerovalent Iron (nZVI) is capable of degrading and stabilizing a high number of organic and inorganic contaminants in the source zone and plume of polluted aquifers including chlorinated ethenes. nZVI shows favorable characteristics compared to μm and mm sized zerovalent iron particles. Its high specific surface area causes 10-100 times higher reaction rates compared to bigger particles and nanometer sized particles have a longer migration distance compared to bigger particles, thus they can be applied via injection without major disturbance by the aquifer. Reaction characteristics of ZVI particles differ between particle types hence particle properties and reaction characteristics of novel, hardly investigated, commercially available, nanoscale Nanofer Star, Nanofer 25 and Nanofer 25S particles were investigated in batch experiments and compared with previously often used, no longer produced RNIP particles. Trichloroethene (TCE) was used as model substance for volatile chlorinated hydrocarbons. Surface area normalized reaction constants for TCE degradation over RNIP particles were 6 times higher than with Nanofer Star particles and the reaction was much more selective with respect to TCE. Electrons that were released by oxidation of RNIP particles reacted mainly with the target contaminant TCE whilst Nanofer particles oxidized at nearly 100 % under formation of H2 by reduction of H+. Undesired reaction to H2 caused reduced Nanofer particle longevity due to high oxidation rates. Between Nanofer particles only minor differences were observed. Differences in sulfur content between particles may be an important reason for differences in reactivity due to the concomitant existence of hydrophobic and hydrophilic sites. Furthermore combination of Nanofer particles with microbes that can utilize H2 for dehalorespiration may pose an advantageous field of application of Nanofer particles.