Geophysical Research Abstracts, Vol. 9, 08383, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08383

Kinetic re-supply and degradation of oxygen: Modelling of pulsed gas injection

S.E. Oswald, G.U. Balcke, S. Meenken

Department Hydrogeology, Helmholtz Centre for Environmental Research - UFZ, Leipzig, Germany (E-mail: sascha.oswald@ufz.de; fax: +49 341 2352126)

We performed a series of laboratory column experiments to study the transfer of oxygen into an flowing aqueous phase for pulsed gas injection such as sequential oxygen sparging or air entrapped recurrently by a moving water table. These experiments gave clear evidence that the oxygen transfer into the aqueous phase is slowing down with consecutive oxygen injection events depending on the time interval between injections. Furthermore, it was shown that breakthrough of dissolved oxygen is retarded compared to an inert tracer, that oxygen breakthrough curves show a decreasing maximum concentration and an increased tailing, and that background concentrations of dissolved gases had a crucial influence on the actual phase transfer rate of oxygen. A numerical model that includes the required kinetic processes has been applied to simulate the experimental data. The results demonstrate that the reverse transfer of dissolved gases from aqueous phase into gas phase is a key to understand the dynamics of the oxygen transfer. The model now can be used to optimize a gas sparging set-up, for example to decide when to set the next gas injection, which should notably not be done by solely using the detected oxygen concentration itself. Furthermore, the model can predict the influence of oxygen consumption by biodegradation reactions on the oxygen re-supply and vice versa, which was then also encompassed in a second series of experiments.