Reactive Transport Model for biodegradation of jet fuel in lateritic aquifer

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Methods

This work presents results of long term monitoring of dissolved BTEX plume generated by jet fuel trapped in porous media. Natural attenuation is occurring by combined Fe(III) reduction, methanogenesis reactions which is effectively limiting the size of dissolved plume. From field data and reactive transport simulations using the Geochemist's Workbench package it was possible to establish a conceptual model for jet fuel biodegradation as well as groundwater hydrochemistry evolution.

Results

The oxidation of biodegradation products such as Fe^{2+} and CH_4 play an important role in the evolution of the redox conditions of the aquifer. Another important aspect identified in the simulations was the role of high natural values of CO_2 partial pressure ($\sim 10^{-1.5}$ atm) in the unsaturated zone. Reaction 1 represents the true overall reaction of destruction of BTEX by reduction of Fe (III) in lateritic aquifers.

$$C_7H_8 + 36FeOOH + 14H_2O + 65CO_2 \rightarrow 36Fe^{2+} + 72HCO_3^- \quad (1)$$

The non-representation of high natural values of pCO_2 in the reactive transport models led to a very large deviation from the conditions observed in the field (Figue 1).

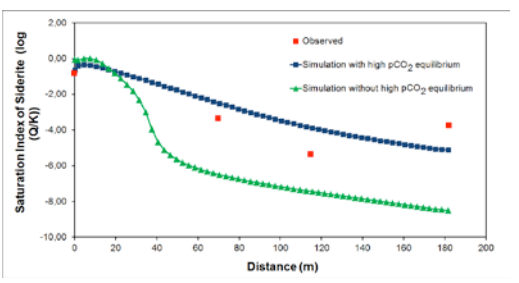

Figure 1 - Observed and simulated saturation indexes of siderite as a function of distance from the source zone for two different scenarios.