Geophysical Research Abstracts
Vol. 17, EGU2015-2910, 2015
EGU General Assembly 2015

Carbofuran biodegradation in brackish groundwater and its effect on the hydraulic properties of the porous medium

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A chalk fractured aquitard beneath an industrial site is subjected to intense contamination due to percolation of contaminants from the different facilities operating at the site. In order to reduce further contamination, draining trenches were excavated and filled with coarse gravel (3-4 cm in diameter) forming a porous medium, to which the contaminated groundwater discharges from the fractures surrounding the trenches.
This research is aimed at establishing a biodegrading process of high efficiency and performance within the draining trenches. The research includes both field and laboratory experiments.
An experimental setup of five columns (50 cm length and 4.5 cm in diameter) was constructed under highly controlled conditions. Over the course of the experiments, the columns were filled with different particle sizes and placed in a temperature controlled chamber. Filtered groundwater (0.2 μm) from the site groundwater, enriched by a model contaminant carbofuran (CRF), was injected to the columns; as two of the columns were inoculated by CRF degrading microorganisms native in the site's groundwater, two columns were inoculated by CRF degrading bacteria from the external environment, and one column was used as a control. During the experiment, measurements were taken from different locations along each column. These include: (a) CRF concentration and (b) hydraulic pressure and solution viscosity (in order to obtain the changes in permeability). A tracer test using uranine was carried out in parallel, in order to obtain the changes in hydraulic parameters. Correlating CRF concentration variations to changes of hydraulic parameters enable the deduction due to the effect that biological activity (under different temperature regimes) has on the hydraulic properties of the porous medium and its effect on the process of contaminant groundwater bodies' remediation. Preliminary results suggest that although biodegradation occurs, microbial activity has minor effect on the hydraulic properties of the porous medium under the explored conditions.