EU–LIFE+Demonstration Project BacAd

LIFE07 ENV/B/000022 **NEWSLETTER 2**

Full scale bioaugmentation for cost-efficient remediation of a large groundwater contamination with CAH

http://www.bioaugmentatie.be

Contents in this issue:

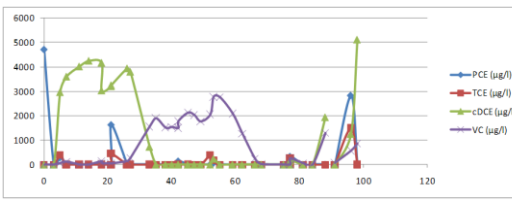
Fermenter 100 L

Column test setup

Growth of microbial cultures

Two cultures have been selected out of 5 tested on the basis of their superior performance in the laboratory microcosm tests (newsletter 1). They have been grown in large quantities for field applications. This included 2 batches of 50 liter each for 2 push-pull tests (culture 1 grown on Nutrolase and culture 2 grown on glycerol). In a later stage a larger quantity of 100 liter was grown for a small-scale plot test (grown on glycerol).

The first culture that was grown on the substrate Nutrolase was contaminated by pathogenic bacteria. This was caused by a contamination of the Nutrolase. The authority OVAM has given permission to use it in the field on the condition that the pathogenic bacteria would be monitored and that they should be contained. The other cultures grown on glycerol were not contaminated with pathogens.



Conversion of PCE during growth of culture 2

Laboratory column tests with cultures

Column tests have been performed to collect site specific information on bacterial migration, on degradation rates of chlorinated ethenes and to verify the survival of the cultures that are injected in the soil. The results will be used as input for the design of full scale system in the field.

Site materials from the small scale pilot test area at the site of Punch Metals were used to fill two vertical columns under anoxic conditions. The columns were percolated with groundwater to which glycerol was added as a substrate for the bacteria. The two cultures that are to be used in the push-pull field tests were injected at the bottom of the columns when reducing conditions had developed. The migration of the cultures in the columns was measured by analysis of DNA in groundwater samples at different column heights. A third column without addition of bacteria was used as negative control.

Breakthrough of DNA at the end of the columns was measured by QPRC (vcrAB) for both of the inoculated columns. For one culture this was after flushing with 1,5 Pore Volumes and for the other culture breakthrough occurred after flushing with 2 PV. In each of the inoculated columns PCE was degraded to ethane. In the negative control column PCE biodegradation stopped at 1,2-DCE.

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Push-Pull pilot tests in the field

Two push-pull tests (PP) were performed at the contaminated site. Each push pull test was done with a specific culture and organic substrate. For PP1 nutrolase was injected 5 times starting December 2010 and lasting through day 620. The microbial culture was injected in March 2011 when the redox conditions in the groundwater had become favourable. For PP2 glycerol and nutrients were injected 5 times starting in May 2011 and culture 2 was injected in September 2011. In each test area the injections were done with an injection well screened from 16-22 mbg and monitoring of the effects was done by periodic analyses of groundwater samples from the injection well and a downgradient monitoring well. Groundwater was extracted to add the substrate and was reinjected by means of a cubitainer under nitrogen gas headspace.

The two push-pull test with cultures grown on *Nutrolase* and glycerol induced complete dechlorination in the field. Acidic groundwater conditions have slowed the process and required neutralization. Glycerol has proved to a better substrate than *Nutrolase*. The culture grown on *Nutrolase* was contaminated by pathogenic bacteria. It was shown that the *Nutrolase* was the origin of the pathogens. The in-situ evolution of the pathogens has been monitored. At the end of the pilot test the pathogenic bacteria were not detected anymore.

Site visit

A site visit has been organized on June 14, 2012 in the presence of the EU-Life representative *Astrale*. The mobile transfer system for execution of bioaugmentation was shown, as well as the groundwater treatment system and the field pilot test locations.

More information?

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