Desalination and Water Treatment
www.deswater.com
41 (2012) 364–371
March
1944-3994/1944-3986
doi: 10.1080/19443994.2012.664742
Taylor & Francis
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Application of enhanced bioremediation for TCE-contaminated groundwater: a pilot-scale study

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Received 10 December 2011; Accepted 30 January 2012

ABSTRACT

The industrial solvent trichloroethylene (TCE) is among the most ubiquitous chlorinated compounds found in groundwater contamination. The objective of this pilot-scale study was to apply the combined biosparging and enhanced *in situ* bioremediation technology to remediate TCE-contaminated groundwater at a TCE-spill site. A biosparging well was installed inside the TCE plume for oxygen supplement. Primary substrate (cane molasses) was injected into the TCE plume through the biosparging well to enhance the rate of TCE co-metabolism. Three monitoring wells were installed in series downgradient of the biosparging well along the groundwater flow path. Results of polymerase chain reaction and nucleotide sequence analysis revealed that no appropriate TCE-degradation enzymes were observed in site groundwater. Thus, aerobic-activated sludge containing TCE-degraders collected from an industrial wastewater treatment plant were injected into the biosparging and three monitoring wells as an inoculum to provide microbial consortia for TCE biodegradation. After sludge injection, TCE-degraders (type I and II methanotrophs) and TCE-degrading enzymes (e.g. toluene monooxygenase, phenol monooxygenase) were detected in the injection and downgradient monitoring wells and remained in the aquifer during the 140-day pilot-scale study. Results indicate that significant TCE removal was observed (with TCE concentration dropped from 210 to 18 μg/L in substrate injection well). This reveals that appropriate substrates and inocula are required to effectively enhance the aerobic co-metabolic rate of TCE. Results from this study indicate that the enhanced *in situ* bioremediation is a promising technology to remediate TCE-contaminated groundwater.

Keywords: Bioremediation; Co-metabolism; Groundwater contamination; Trichloroethylene

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