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Assessment of vinyl chloride biodegradation in a contaminated aquifer

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Abstract

Vinyl chloride (VC) is the most toxic chlorinated ethene. VC is widely present as contaminant in groundwater and soil because of its use for the production of PVC. It is produced due to dechlorination of highly chlorinated ethenes in microbial organo-halide respiration pathways, which decrease their efficiency whistle decreasing chlorine numbers, thus leading to VC accumulation. Biodegradation can be achieved by cometabolic pathways in methylotrophic and methanotrophic microorganisms, due to non-specificity of the particulate methanol monooxygenase (pMMO) enzyme [1] and by aerobic chemoorganotrophic bacteria that can use VC as sole carbon and energy source by alkene monooxygenase (AkMO) and epoxyalkane:coenzyme M transferase (EaCoMT) [2].

In order to assess the VC biodegradative potential of the microbial community of an aquifer contaminated by chlorinated solvents, cometabolic and metabolic pathway biomarkers *pmoA*, *etnC* and *etnE* were quantified and monitored by RT-qPCR during the *in situ* biostimulation treatment through permeable reactive biobarriers. Microbial community of piezometers upstream and downstream the biobarrier were characterized by Illumina sequencing of DNA 16S rRNA gene. Aerobic bacteria able to growth in presence of VC/ethene were isolated. The ethene biodegradation kinetic evidenced that strains were able to use this compound as sole carbon and energy source. Genomic and transcriptomic analysis are ongoing on VC- or glucose-grown cells. From these results it is possible to withdraw that cometabolic and metabolic VC degradation pathways coexist in contaminated aquifers. The VC biodegradative potential was verified by the isolation of efficient VC degrading strains, that might be exploited in future bioaugmentation interventions.

Bibliography

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