

## **DIHYDROGEN (H<sub>2</sub>) PULSES FOR POSSIBLE APPLICATION IN GROUNDWATER BIOREMEDIATION FROM CHLOROETHENES**

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Groundwater contamination by chloroethenes (PCE, TCE, DCE, VC) poses a global challenge, affecting groundwater quality and availability. Microbial dechlorination through organohalide respiration (OHR) represents a sustainable solution to eliminate such contaminants. Only a few bacterial genera are known to perform anaerobic OHR, including Chloroflexi, Firmicutes, and Proteobacteria. Since microbial dechlorination rate is limited by the amount of electron donors available to bacteria, dihydrogen (H<sub>2</sub>) pulse is studied to implement bioremediation interventions.

The present study aims to investigate at a microcosm-scale level the effect of H<sub>2</sub> pulses on OHR process in a real-case groundwater contaminated by chloroethenes (150-300 mg/L) from landfill leachate. Thesis comprised: 1) natural attenuation, 2) H<sub>2</sub> pulse, 3) H<sub>2</sub> + nutrient and vitamin B supplementation, 4) abiotic control.

After two months of incubation, an average decrease of 50%, 84%, and 40% was observed for PCE, TCE, and 1,2-DCE, although the addition of H<sub>2</sub> or H<sub>2</sub> and nutrients did not highlight any significant differences with respect to natural attenuation. After an initial increase (from 120,000 to 160,000 µg/L), a decrement of VC was detected after two months.

Bacterial populations increased significantly during the first month of incubation in all thesis (Tukey's test  $p < 0.05$ ). H<sub>2</sub> pulse caused a significant (Tukey's test  $p < 0.05$ ) increase of *Dehalococcoides* from  $5.89 \times 10^2$  to  $2.87 \times 10^3$  gene copies/mL. Other functional biomarkers involved in OHR highlighted a small but not significant increase during the incubation time. Chemical and microbiological data evidenced that a natural attenuation process was active in the studied groundwater. H<sub>2</sub> pulses could represent a possible strategy to enhance OHR, although analyses at successive incubation times will provide more exhaustive conclusions on the dehalogenation process.

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