MICROBIAL BIOREMEDIATION OF AQUIFER AFFECTED FROM CHLOROETHENES AND PETROLEUM HYDROCARBON CONTAMINATION

In 2014, 20% of contaminated site in Europe were treated by bioremediation techniques, prevalent contaminants being: petroleum hydrocarbons, chlorinated compounds and heavy metals.
Mixed contaminations can be lowered by anaerobic (reductive dechlorination) and aerobic (oxidation) microbial metabolisms. Successive anaerobic-aerobic systems can be used for biodegradation of by-products, such as vinyl chloride, and petroleum hydrocarbons.
In order to assess feasible treatment to improve reductive dechlorination at a contaminated site (Dogaletto, VE, Italy), anaerobic microcosms were set up by using groundwater samples added or not with molasses. GC-MS analysis demonstrated that the addition of the substrate improved reductive dechlorination reactions, leading to higher concentrations of vinyl chloride and ethenes. The addition of molasses was then applied at the contaminated aquifer in the frame of an anaerobic active permeable barrier treatment. Two year field monitoring evidenced that molasses addition improved dehalogenation of high chlorinated ethenes (i.e. perchloroethene from 900 to 450 µg/l) with concomitant formation of vinyl chloride that increased from 33'00 to 69'000. The treatment affected the microbial community structure: *Bacteroidetes*, glucose fermenting bacteria, relatively increased in relation to dechlorinating bacteria of the *Dehalococcoides* genus. Despite this, *Dehalococcodes* gene copy number increased, as determined by q-PCR. In the aerobic active permeable barrier, vinyl chloride and petroleum hydrocarbons decreased, respectively, from 13'550 to 2'600 µg/l and from 3'171 to 1'368 µg/l. A low number of BTEX-degrading bacteria were isolated and characterized and vinyl chloride degrading populations are under study.
The obtained data demonstrated that bioattenuation processes were active at the contaminated aquifer and specialized anaerobic and aerobic bacterial populations can be further exploited for a complete bioremediation.