

BIOLOGICAL REDUCTIVE DECHLORINATION OF CHLORINATED ETHENES WITH USE OF VEGETABLE OIL AS ORGANIC SUBSTRATE – PILOT TESTING

BIOLOGICKÁ REDUKTIVNÍ DECHLORACE CHLOROVANÝCH ETHENŮ S VYUŽITÍM ROSTLINNÉHO OLEJE JAKO ORGANICKÉHO SUBSTRÁTU – PILOTNÍ OVĚŘENÍ

Jan Němeček, Petr Pokorný

ENACON s.r.o., Krčská 16/23, 140 00 Praha 4, Czech Republic, e-mail: nemecek@enacon.cz

Abstract:

In last years biological in-situ technologies are applied for remediation of contamination by chlorinated hydrocarbons (CHC). Method of biological reductive dechlorination (BRD) is based on supply of appropriate organic substrate to the contaminated subsurface. The organic substrate is fermented leading to production of molecular hydrogen. Hydrogen is consumed as electron donor in a sequential reduction of chlorinated hydrocarbons yielding nontoxic ethene and ethane. In the Czech Republic whey is mostly used as organic substrate due to simple injection into aquifer and a low cost. In case of highly permeable aquifers it is more convenient to use a substrate that acts longer and has lower migration ability. A vegetable oil is such a substrate that due to higher viscosity and its hydrophobic nature has low migration potential and degrades slowly. Slower start of hydrogen production due to slow hydrolysis may be a disadvantage of this substrate in some cases. At the site historically contaminated by CHC commercial product CAP 18 ME® was tested in a pilot scale. CAP 18 ME® is a blend of vegetable oil and fatty acids methyl esters (FAME), thus combines slow and long-lasting production of hydrogen by biodegradation of vegetable oil and rapid production of hydrogen by degradation of FAME. The product was injected into three multilevel permanent injectors situated perpendicular to groundwater flow. 2.5 months after injection of the product reductive dechlorination to ethene was observed in down-gradient monitoring wells. 8 months after injection of the substrate ethene already dominated. Biological reductive dechlorination yielded in decrease of total CHC concentration, 8 months after injection decrease of CHC in groundwater of monitoring wells by 84 % up to 99 % was observed, whereas according to TOC levels the organic substrate has not been exhausted.

Keywords:

Chlorinated hydrocarbons, remediation, biological reductive dechlorination, vegetable oil – based substrate