

Technical University of Denmark



Electrochemically induced reduction and oxidation of chlorinated solvents in groundwater

Hyldegaard, Bente Højlund; Weeth, Eline B. ; Jakobsen, Rasmus; Overheu, Niels D.; Gent, David B.; Ottosen, Lisbeth M.

Publication date:
2017

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):
Hyldegaard, B. H., Weeth, E. B., Jakobsen, R., Overheu, N. D., Gent, D. B., & Ottosen, L. M. (2017). Electrochemically induced reduction and oxidation of chlorinated solvents in groundwater. Abstract from Electrochemical Science and Technology Conference 2017, Kgs. Lyngby, Denmark.

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



Electrochemically induced reduction and oxidation of chlorinated solvents in groundwater

Bente H. Hyldegaard^{1,5}, Eline B. Weeth¹, Rasmus Jakobsen², Niels D. Overheu³, David B. Gent⁴, Lisbeth M. Ottosen⁵

¹*COWI A/S, Denmark, Denmark, behd@cowi.com/ebwe@cowi.com*

²*GEUS, Denmark, raj@geus.dk*

³*Capital Region of Denmark, Denmark, niels.doessing.overheu@regionh.dk*

⁴*U.S. Army Corps of Engineers, USA, David.B.Gent@erdc.dren.mil*

⁵*DTU Civil Engineering, Denmark, benho@byg.dtu.dk/lo@byg.dtu.dk*

Widespread contamination of chlorinated solvents threatens the quality of groundwater based on extensive use in the past for e.g. dry-cleaning and metal processing. The chlorinated solvents and their chlorinated degradation products are acute toxic and carcinogenic. Furthermore, the compound's properties challenge the current treatment systems. Thus, optimized means of protecting the groundwater from this group of contaminants is important. We propose, as an alternative method for remediation, establishment of electrochemical zones for in situ reduction and oxidation of chlorinated solvents and degradation products.

It is known that i) fast electrochemical reduction of chlorinated solvents near the electrodes can be obtained and ii) reactants can be generated, which can subsequently reduce or oxidize the chlorinated solvents. Effort has mainly been on the influence of electrode materials and configurations, and of the system parameters such as current density, flow rate etc. So far no studies on electrochemical remediation of chlorinated solvents have been performed under constant current with field extracted contaminated groundwater and unrefined sand as aquifer material.

This study has taken these challenges and developed systems for assessment and optimization of electrochemical zones in 1D and 2D experimental set-ups targeting plume control. The set-ups allow for assessment of the influence of single parameters, e.g. current density and flow rate, as well as power consumption, lateral dispersion of generated reactants, electrode configuration, material and spacing. For this conference, focus will be on the electrochemical aspects of the method: Electroless plating of cathodes, selective corrosion of anodes, electrocatalytic hydrodechlorination, competing electrochemically induced reduction and oxidation reactions in the complex saturated geochemical settings, polymerisation of methane, electrokinetically enhanced volatilisation of contaminants, and electrocatalysed formation of minerals possibly with reactive properties.