COMBINATION OF ISCO AND BIOREMEDIATION FOR CONTAMINATED SOIL TREATEMENT

KOMBINACE ISCO A BIOREMEDIACE KONTAMINOVANÝCH ZEMIN

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Abstract:

Chlorinated solvents are frequently encountered as subsurface contaminants. They are highly toxic and can be potentially carcinogenic. Their presence in the environment therefore possesses significant health and environmental risks which have required its acute removal from the subsurface in the past. In situ chemical oxidation (ISCO) is a soil decontamination technique mainly used for removal of organic pollutants from the environment in situ. It has been previously described that some microbial species are able to degrade chlorinated ethylenes in the subsurface as part of their normal metabolic pathways. The main aim of this study was to alleviate the drastic conditions of ISCO application and to try combining this technique with bioremediation. Based on this initial idea, the growth of the selected microbial species in the presence of manganese oxide and/or humic acid (main subproducts of ISCO with permanganate) was investigated. Bioremediation of trichloroethylene under these conditions was then studied. Based on the experiments performed, it has been proven that manganese oxides and/or humic acids of concentrations between 1 mg/L and 10 mg/L can stimulate the growth of certain microbial species. Conditions required for such stimulation have been described in this study. Moreover, after the 15-day adaptation period, trichloroethylene was gradually added into the experimental system and it has been proven that the microorganisms present were able to partially degrade the contaminant. Based on the results obtained, reduction of the general ISCO application costs as well as reduction of the environmental impact on treated soil microflora might be possible in the future. Additionally, the final biological stage of remediation after ISCO application might enable us to reach lower contaminant concentration levels and avoid the rebound effect.

Key words:

ISCO, bioremediation, chlorinated pollutants, manganese oxides, humic acids