Examination of the Column Suitable for Hydrogen Diffusion Test

towards Bioremediation of VOCs-Contaminated Sediments

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Abstract

The demand for on-site remediation of contaminated soil is expected to increase after the amendment of Soil Contamination Countermeasures Act. Tetrachloroethylene (PCE) and Trichloroethylene (TCE) are typical VOCs contaminants in Japan. They can be decomposed to harmless ethene through the reductive dechlorination reaction by anaerobic bacteria. The reaction is bacterial respiration using H₂ as an electron donor, and hydrogen release compounds are widely applied for bioremediation in practice. The reductive dechlorination reaction by bacteria is stimulated after a hydrogen release compound is injected into the contaminated subsurface and hydrogen is released. The success in the bioremediation partly depends on the contact between the bacteria and H₂. The effective area would be predicted by understanding the diffusion of H₂ in subsurface environment.

However, only a few H₂ diffusion tests have been reported to date. In this study, as a preliminary study for the through-diffusion test, suitable column material for the H₂ diffusion test was examined. Since H₂ molecule is small and light, gas tightness is important for the test column. An acrylic container and a PFA container were used to determine the gas tightness. Unfortunately, these containers were not suitable for H₂ preservation. There is still room for improvement in material and structure of the column and the concepts of the improvement were also provided.

Key words: bioremediation, VOCs, H₂ diffusion test

はじめに

土壤汚染と原位置浄化

汚染物質の除去は、バイオレメディエーション、地下水揚水、封じ込め、不溶化など様々な方法が存在する。しかし実際の土壤汚染サイトでは、汚染物質を除去するという確実性から推奨除去が最も多く用いられてきた（例えば、環境省水・大気環境局 2009）。推奨除去は、処理コストが高いことによる土地所有者への過剰負担およびブラウンフィールド問題の発生、除去した土壌による二次汚染の恐れ、また、運搬・処理による二酸化炭素の多量排出など、課題が多い。

さらに、2010年4月1日を施行期日とした土壤汚染対策の改正に伴い、行政による健康被害のリスクの判断、それに応じた汚染区域や浄化措置の指示が行われるようになる。浄化措置の推奨除去への偏重を減らし、汚染土壌除去による二次汚染の拡大を防ぐため、汚染サイトで行う浄化措置、つまり原位置浄化の増加が予測され