Integration of Permeable Reactive Barrier Technology and Immobilization for MTBE and BTEX Contaminated Groundwater Treat

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ABSTRACT

The purpose of this study was integration of permeable reactive barriers (PRB) technology and immobilization for MTBE and BTEX contaminated groundwater treatment. This study was first investigated to make the immobilized bead highly strong stability. After conducting batch and column tests, it was integrated with PRB system. PRB was run at various concentrations of substrate and removal efficiency was monitored.

Results revealed that (1) Bead was formed with high stability with 2.46 hours and 6 hours immersed in solution of (5% H_3BO_3, 2.5% $CaCl_2$) and 5% KH_2PO_4. (2) Bead has pore structure for bacteria occupancy, allowing oxygen and substrates transfer. (3) Results from batch experiments showed that: (3a) For toluene-degrading Pseudomonas sp. YATO411 strain, the most suitable value of initial biomass concentration for immobilizing was 26.7 mg/L; (3b) Rate of toluene removal was highest with 12.4 mg/L.h; (3c) When exposing at high concentration of toluene, immobilized cells were more effective than suspended cells; (3d) Pseudomonas sp. YATO411 was not only degrading toluene, but also used benzene and ethylbenzene as the source of carbon and energy; (3e) Methylibium petroleiphilum PM1 can be used for immobilization when bead was immersed in (H_3BO_3, $CaCl_2$) for 0.5 hours, and KH_2PO_4 for 2.5 hours. (4) Results from column test showed that toluene removal increased along with increasing amount of bead. (5) Results from long term PRB monitoring showed that: (5a) MTBE removal has only shown significant increasing to 42.4% when Methylibium petroleiphilum PM1 was introduced to PRB system; (5b) When BTEX was shock loading to 80 ppm, integration PRB with immobilization of Pseudomonas sp. YATO411 has increased removal efficiency of B, T, and E to 99.4, 98.2, and 97.5 (%) comparing to 49.2, 48.6, and 62.9 (%), respectively, incase of non-integration.

Keywords : Permeable reactive barrier、immobilization、MTBE、BTEX、Methylibium petroleiphilum PM1、Pseudomonas sp. YATO411

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