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Enhanced reduction of methylmercury by zero-valent iron particles

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The consumption and accumulation of high concentration of methylmercury ($MeHg^+$) through food pyramid leading to fatal public health problems could adversely affect central nervous system of fetus and its development of alteration. The gradual increase of $MeHg^+$ concentration in the natural and engineered environments attracts an attention and requests cost-effective and sustainable remedial technologies for the effective removal of $MeHg^+$, which is the most recent trend in environmental technology Markets. Zero-valent iron (ZVI) technology has been widely known for its effective treatment of diverse contaminants due to its high reactivity; moreover, ZVI has a metallic iron core that shows reducing (electron-donating) power and an iron oxide shell having an adsorptive capacity for metal ions on its surface. In this study, nanoscale zero-valent iron (nZVI) was synthesized via reduction of ferric ion with sodium borohydride; pumice-nZVI (P-nZVI) particles were produced by coating pumice granules with nZVI, and impregnation method was applied for the synthesis of indium-ZVI (In-ZVI) catalyst. The size and shape of the particles, distribution of nZVI and indium on P-nZVI and ZVI were analysed by a scanning electron microscope, respectively. This research has investigated the reactivity of nano-iron particles for the reduction of methylmercury in their suspension systems by conducting batch kinetic experiments. P-nZVI and nZVI particles showed much faster reaction kinetics for the reduction of $MeHg^+$ to Hg(0) than In-ZVI particles. The iron particles have been tested for adsorption properties. A series of control tests helped to determine the reaction mechanism. The experimental results suggest that zero-valent iron technology is a promising candidate for remediation of soil and groundwater contaminated with methylmercury in aqueous and subsurface environments.

Biography

Dr. Woojin Lee is working as a professor in civil and environmental engineering department of Nazarbayev University. He received a Ph.D. from Civil Engineering at Texas A&M University, College Station and postdoctoral fellowship training in Chemistry at Indiana University, Bloomington. He has been teaching and researching in the field of environmental science and engineering including environmental catalysts, carbon sequestration and conversion, fate of emerging chemical contaminants, and, integrated water treatment technologies at KAIST and POSTECH since 2005.

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