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The suppression of elution of boron, arsenic, and selenium from coal fly ash particles by the removal with acid washing

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Abstract

Coal fly ash, which is a by-product of coal-fired power plants generally contains various trace elements. Since some of them has been recognized to be hazardous, the Ministry of the Environment of Japan has been regulated the elution concentration of them. The regulation of elution concentration of boron, arsenic, and selenium, which has been listed as hazardous substances, has been 1, 0.01, and 0.01 mg/L, respectively. In this study, the acid washing process developed was applied to the removal of boron, arsenic, and selenium from coal fly ash in order to avoid an excess elution of them to soil. Laboratory- and bench-scale investigations on the dissolution behavior of boron, arsenic, and selenium from various coal fly ash specimens into dilute H2SO4 solvent were conducted with the aid of inductively-coupled plasma mass spectroscopy (ICP-MS) and high performance liquid chromatography (HPLC). Boron, arsenic, and selenium in the specimens were dissolved into H2SO4 solvents very rapidly; however, in some cases, the concentrations of arsenic and selenium in the solutions decreased with an increase in the pH of H2SO4 solution. The species of arsenic or selenium in the dilute H2SO4 was estimated as H3AsO4 or H2SeO3, and their anionic species was considered to adsorb with the elevation of pH under the presence of ash particle. The sufficient removal of arsenic was achieved by controlling pH and avoiding the adsorption of arsenic on the surface of ash particles, and the elution of them from coal fly ash sample was successfully below the regulation limit.

Biography

Shunsuke Kashiwakura has completed his PhD at the age of 27 years in March 2010 from Tohoku University, Japan. After one-month employment as a postdoctoral fellow, he started working as an assistant professor at Institute for Materials Research, Tohoku University, Japan. As a constituent of his doctoral thesis, he published 9 papers in reputed journals.