Effect of oxidation to the pore size distribution: Implications for adsorption of ^{133}Cs on pumice tuff

MOHAMMAD RAJIB[1)*] AND CHIAKI T. OGUCHI[2)]

[1] Graduate School of Science and Engineering, Saitama University; (*correspondence: rajib.mohammad@gmail.com)
[2] Department of Civil and Environmental Engineering, Saitama University (ogchiaki@mail.saitama-u.ac.jp)

The present study demonstrates the change of pore size distribution (PSD) due to oxidation of pumice tuff, a potential host rock for low and intermediate level radioactive wastes, and its possible consequences to adsorption of cesium on it. Batch study was carried out with both pumice tuff blocks and powdered samples to determine adsorption coefficient, K_d, at different pH, ionic strength and initial nuclide concentration of stable cesium (^{133}Cs). Mercury Intrusion Porosimetry and Scanning Electron Microscopic analysis before and after batch experiment showed that the pore area has significantly reduced in oxidized tuff though the porosity remains similar as fresh part. Both fresh and oxidized tuffs have similar PSD with most of the pore sizes range between 10-0.6 μm. Although, large fraction of pores in oxidized tuff are accumulated in the narrower range of 3.9 to 9.5 μm. As individual, 6.6 and 7.9 μm size pores comprise most of the pore areas in oxidized tuff. The average pore area greatly varies from ~4.6 m^2/g in fresh tuff to ~2.5 m^2/g in oxidized tuff indicating inaccessibility of smaller size pores in oxidized part.

With relation to water-rock interaction, less than 3.3 μm size pores exhibited a tendency to increase with the decrease in ionic strength, opposite to pores larger than 3.3 μm size, regardless of pH, initial nuclide concentration or oxidation. Moreover, as a result of increased amount of 0.33-0.033 μm size pores after the aging period, pore area of the fresh tuff increased from ~4.6 to ~7.5 m^2/g. These may have significant effect to the adsorption mechanism of cesium on pumice tuff.