

## MECHANISTIC MODELING OF ARSENIC RETENTION ON NATURAL RED EARTH IN SIMULATED ENVIRONMENTAL SYSTEMS

METHTHIKA VITHANAGE<sup>1,2</sup>, ROHANA CHANDRAJITH<sup>3</sup>, A. BANDARA<sup>4</sup> AND R. WEERASOORIYA<sup>1</sup>

<sup>1</sup>CML Labs, Institute of Fundamental Studies, Kandy, Sri Lanka,

<sup>2</sup>PGIS, University of Peradeniya, Peradeniya, Sri Lanka,

<sup>3</sup>Dept. of Geology, University of Peradeniya, Peradeniya, Sri Lanka,

<sup>4</sup>Dept. of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka

Arsenic is present mainly in water as a natural contaminant in the form of arsenate and arsenite. The natural release of arsenic species into groundwater results detrimental health effects. Developing a cost-effective unit process to remove Arsenic from drinking water is a pressing global need. Therefore final aim of this work was sharply focused at develop a removal method of  $As^{3+}$  and  $As^{5+}$  utilizing Red Earth that is abundant in Northwestern part of Sri Lanka.

Potentiometric surface titrations of Red Earth were carried out by auto titration system under inert environmental condition in 0.1, 0.01, 0.001M  $NaNO_3$ . The retention of As species, both  $As^{3+}$ ,  $As^{5+}$ , were examined as a function of pH and ionic strength in single- ( $As^{3+}$  or  $As^{5+}$  only) and dual-sorbate ( $As^{3+}$  and  $As^{5+}$ ) systems. The XRF analysis showed that the total chemical composition of Red Earth was found to be  $SiO_2$  (72.62),  $Al_2O_3$  (8.93),  $Fe_2O_3$  (8.62) and  $TiO_2$  (4.93). According to XRD analysis, the Red Earth sample is dominated by  $\alpha$ - $SiO_2$  phase exhibiting a characteristic peak at  $2\theta$  3.340. Initial results showed that the optimal solid concentration to be used to yield maximum adsorption capacity was 5 g/L when system pH 7.00 and initial  $[As^{3+}] = [As^{5+}] = 0.385 \mu mol/L$  (50 ppb of  $As^{3+}$ ) were fixed. Proton titration data of Red Earth showed that the  $pH_{zpc} = 8.85$  exhibiting that the red earth surface is dominantly positive when  $pH < pH_{zpc}$  (i.e. environmentally relevant conditions). Arsenic species adsorption on the solid system was examined as a function of pH. Both  $As^{3+}$  and  $As^{5+}$  were adsorbed over 90% on to Red Earth when initial  $[As^{3+}] = [As^{5+}] = 0.385 \mu mol/L$ .  $As^{3+}$  adsorption showed a monotonous behavior as a function of pH showing an apparent maximum at pH 5.5. When both  $As^{3+}$  and  $As^{5+}$  are present, the retention of  $As^{3+}$  has decreased by about 80% showing a competition of  $As^{5+}$  to the solid binding sites. The data modeling according to the surface complexation theory is currently in progress.