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

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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 in detrimental health effects. Developing a cost-effective unit process to remove arsenic from drinking water is a pressing global need. Therefore, the final aim of this work was sharply focused at developing a removal method for As^{3+} and As^{5+} utilizing red earth that is abundant in the 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, 0.001 M NaNO_3 . The retention of As species, both As^{3+} and 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 (54.15%), Al_2O_3 (20.73%), Fe_2O_3 (12.39%) and TiO_2 (5.54%). According to XRD analysis, the red earth sample is dominated by $\alpha\text{-SiO}_2$ phase exhibiting a characteristic peak at 2θ of 3.340. Proton titration data of red earth showed that though the titration curves intercept at $\text{pH} = 8.8$ exhibiting that the red earth surface is dominantly positive when $\text{pH} < \text{pH}_{\text{zpc}}$ (i.e. environmentally relevant conditions). Initial $[\text{As}^{3+}] = [\text{As}^{5+}] = 0.385 \mu\text{mol/L}$ ($50 \mu\text{g/L}$ of As^{3+}) were fixed. Adsorption of arsenic species on the solid system was examined as a function of pH. Both As^{3+} and As^{5+} were adsorbed over 95% on to Red Earth when initial $[\text{As}^{3+}] = [\text{As}^{5+}] = 0.385 \mu\text{mol/L}$. In the dual sorbate system, when both As^{3+} and As^{5+} are present; the retention of As^{3+} decreases by about 80% above $\text{pH} > 7$. However, at $\text{pH} < 7$, adsorption of both species were shown strong adsorption. Modeling results showed a competition between arsenic species to the solid binding sites. However, both experimental and modeled data showed that there is no dependency of arsenic species on pH or ionic strength in both single and dual ion systems, which

indicated that the affinity of arsenic species on to natural red earth was strong forming inner sphere complexes with the red earth surface. As determined by the simple diffuse layer model, the binding constants were very well fitted with experimental data, proving that red earth can be effectively used to remove arsenic from aqueous systems by modifying the available filtering systems.