

Cr(III) adsorption at the feldspar water interface

Namal Priyantha^{1*}, Rohan Weerasooriya² and Prasad Gunathilaka¹

¹Department of Chemistry, University of Peradeniya, Peradeniya

²Institute of Fundamental Studies, Kandy

Contamination of the environment by Cr has become a major area of concern due to its high toxicity. Many attempts have been made to deal with this problem with limited success. Feldspar is found to scavenge Cr(III) from aquatic media effectively through interaction between Cr(III) species and $\equiv\text{Al-OH}$ edges of aluminosilicates present in feldspar.

Kinetic experiments show that the percent removal of Cr(III) rapidly increases up to 70 % within the initial stirring time period of 20 min, followed by a slow increase at extended stirring times. The initial increase indicates that, at the beginning of the process, adsorption is the predominant mode of interaction of Cr(III) with the feldspar surface. This conclusion is supported by the observation that settling time does not affect much on the percent removal of Cr(III). Once all the active adsorption sites are occupied, sorption process would take a diffusion-controlled path where Cr(III) species would diffuse into the available sites in the bulk of the feldspar matrix, which can be predicted from the observation of the slow removal of Cr(III) during extended stirring times.

The predominant adsorption behavior is further supported by the surface charge properties. Surface pH titration experiments of feldspar suspensions having an initial pH value of 8.4, carried out in solutions of different ionic strengths are indicative of the presence of negatively charged feldspar surface. Surface charge density vs pH curves at three different ionic strengths meet at the point of zero charge (ZPC) that lies between pH 9.5 and 10.0 beyond which the feldspar surface possesses a strong potential for adsorption of metal ions. Further investigation of the surface charge density of feldspar suspensions in the presence of Cr(III) points out that the surface charge density has diminished, indicating that the adsorption of Cr(III) on to the surface has balanced the charges of the feldspar surface. Further, experimental results fit with both the Langmuir and Freundlich isotherms which again explain the occurrence of predominant adsorption with an adsorption coefficient of $3.25 \times 10^{-3} \text{ dm}^3\text{g}^{-1}$, followed by isomorphic substitution, including ion exchange.

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* namalpriyantha@pdn.ac.lk

Tel: 081-2394445