

USAGE OF LATERITE IN THE TREATMENT OF ARSENIC CONTAMINATED WATER

R.M.S.C.RANASINGHE AND D.R.I.B.WERELLAGAMA*

Department of Civil Engineering, Faculty of Engineering, University of Peradeniya, Peradeniya.

Arsenic is a common trace inorganic contaminant in drinking water supplies that has been identified as a significant health risk. It originates both from natural and anthropogenic sources. By drinking this water and due to the exposure of high doses of arsenic, many acute and chronic diseases can occur in humans. Present Sri Lankan standard (SLS 614,1983) for arsenic in drinking water is 50 ppb compared to the WHO and USEPA standard of 10 ppb. Most commonly reported symptoms of chronic arsenic exposure are conjunctivitis, melanosis, hyperkeratosis and some other skin lesions. In severe cases, gangrene in the limbs and malignant neoplasm have also been observed (Christen, 2000). Arsenic contamination in groundwater and the symptoms in humans have been reported in countries such as Argentina, Bangladesh, Chile, China, Ghana, Hungary, Mexico, Taiwan, Thailand, USA, Vietnam and West Bengal (India).

Presently there are several methods available for the removal of arsenic, which are very expensive, and complex. This study was an effort to find a low-cost treatment methodology for arsenite (As(III)) removal from potable water using laterite. Laterite is found abundantly in Southwestern Sri Lanka and it contains iron, which enhance the removal of arsenic. The treatment procedure can be briefly given as follows. Laterite (passing through 0.075mm sieve) was added to the water sample followed by rapid mixing ensuring complete solution. After that, slow mixing allowed reactions to take place and sorption to occur. The mixture was settled for 1 hour and the supernatant was preserved using concentrated HCl until analysis. Every sample was analyzed using Atomic Absorption Spectrophotometer (AAAnalyst 300, Perkin Elmer with FIAS 100) on the following day. According to the obtained results, arsenic removal efficiency using laterite varied from 50% to more than 90%. Optimum removal (>90%) was observed at a pH around 10. The current USEPA standard can be achieved using the laterite treatment at pH=10 if arsenite / laterite ratio is less than 10 ($\mu\text{g/g}$). Laterite dosage should be increased if the treatment is to be carried out within neutral (6-8) pH range. During treatment; sorption was very rapid reaching the equilibrium state within 5 minutes. The iron concentration in the treated water was also lower than the allowable limit in drinking water (0.3 mg/L).

The higher removal at basic pH range may be explained by the different species of As(III) oxy-anions present in different pH ranges. According to the literature (Dutre and Vandecasteele, 1998), H_3AsO_3 , which is the neutral form of arsenite, is the predominant species in the neutral and acidic pH ranges. In basic pH ranges when $\text{pH}>8$; H_2AsO_3^- , HAsO_3^{2-} and AsO_3^{3-} will be dominant and therefore As(III) is non reactive below this pH (Tokunaga et al., 1999). Also due to the increasing amount of sorption sites and the formation of iron oxyhydroxide with the increasing laterite concentration, the removal efficiency gets increased.

Financial assistance by ADB is gratefully acknowledged.