CHARACTERIZATION OF FLUORIDE INTERACTION ON NANOGIBBSITE WATER INTERFACE

U.G.A.M.CHANDRASENA

Postgraduate Institute of Science, University of Peradeniya, Sri Lanka

High fluoride concentration in drinking water has been recognized as problems to human health. Several technologies applied for removing excess fluoride in water. Among those technologies adsorption process has been explored widely with various adsorbent materials due to its satisfactory results. In this study, defluoridation capacity was investigated with thermally treated nanogibbsite (HNGB). The adsorbent was characterized by Branauer-Emmett-Teller (BET) surface area, Thermo Gravimetric Analysis/Differential Thermal Analysis (TGA/DTA), Point of Zero charge (pH $_{ZPC}$) and FTIR measurements. The batch adsorption of fluoride is explored using HNGB under different processing conditions such as pH of the solution, contact time and ionic strength. BET surface area showed enhancement of surface area from 56 up to 399 m^2/g due to the thermal treatment of nanogibbsite. Analysis of FTIR spectroscopy convinced that the hydroxyl groups on the adsorbent surface were involved in the sorption of fluoride. pH $_{ZPC}$ value was found as 7.0 (± 0.2). Fluoride adsorption did not change with the ionic strength implying inner sphere complex formation. Defluoridation capacity of HNGB was significantly affected by pH. When initial fluoride concentration is 10.0 mg/L, the maximum fluoride removal was 98% at pH 6.0 with adsorbent dose of 2.0 g/L. A significant reduction in the defluoridation capacity was observed at pH < 6.0. Additionally, the adsorption was fast within the first 60 min and fluoride adsorption followed pseudo second order kinetic model with correlation coefficient greater than 0.999. HNGB showed a best fit with Freundlich isotherm and revealed multilayer adsorption.

Key words: fluoride, defluoridation, nanogibbsite, adsorption