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REMOVAL OF FLUORIDE FROM AQUEOUS SOLUTIONS USING NATURAL APATITE: A LABORATORY SIMULATION

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Even though fluoride is an essential element for health of both human and animals, it is well known for its detrimental effects due to increased bioaccumulation. Unlike most other trace elements, much of the fluoride entering the human body is supplied from water. Millions of inhabitants, particularly in the tropical belt, are vulnerable to fluoride related health problems due to consumption of high fluoride groundwater. Most of these countries are poor and unable to use expensive defluoridation techniques. Therefore, simple, efficient and inexpensive defluoridation methods are required to supply better quality drinking water. In this study, naturally occurring apatite collected from Eppawala, Sri Lanka have been investigated for its defluoridation ability under laboratory conditions. The effect of pH, absorbent dosage, absorbate concentration, kinetics and isotherms related to the sorption process were evaluated during the study. Fluoride adsorption on to apatite is strongly pH dependent and the highest fluoride removal was observed at pH 6.0, and it decreases at low and high pH values. Fluoride removal efficiency is increased with the absorbent dosage mainly due to increasing the number of adsorption sites. However, the fluoride sorption was enhanced when low solid content is used in the suspension. The sorption process was very rapid which occurred within the first 10 minutes. The kinetic studies indicated that the removal process follows a pseudo second-order kinetic model. Langmuir isotherms were best fitted (R^2=0.9537) with the sorption over a range of fluoride concentrations from 5.0 to 25.0 mg/L. The monolayer coverage of fluoride on Eppawala apatite was estimated as 0.212 mg/g. The results obtained from this simulated experiment can be used to design an inexpensive, accessible and environmental friendly method for removal of fluoride in water supplies for rural communities.