

Fluoride Removal from Groundwater in the East Nile Area (Sudan) Using Locally Available Charcoal

Authors : Motwkel M. Alhaj, Bashir M. Elhassan

Abstract : The East Nile area is located in Khartoum state. The main source of drinking water in the East Nile Area (Sudan) is groundwater. However, fluoride concentration in the water is more than the maximum allowable dose, which is 1.5 mg/l. This study aims to demonstrate and innovative, affordable, and efficient filter to remove fluoride from drinking water. Many researchers have found that aluminum oxide-coated adsorbent is the most affordable technology for fluoride removal. However, adsorption is pH-dependent, and the water pH in the East Nile area is relatively high (around 8), which is hindering the adsorption process. Locally available charcoal was crushed, sieved, and coated with aluminum oxide. Then, different coating configurations were tested in order to produce an adsorbent with a high pH point of zero charge pH PZC in order to overcome the effect of high pH of water. Moreover, different methods were used to characterize the adsorbent, including: Scanning Electron Microscope (SEM), Energy Dispersive X-Ray Spectroscopy (EDX), Brunauer - Emmett - Teller (BET) method, and pH point of zero charge pH PZC. The produced adsorbent has pH PZC of 8.5, which is essential in enhancing the fluoride adsorption process. A pilot household fluoride filter was also designed and installed in a house that has water with 4.34 mg/l F- and pH of 8.4. The filter was operated at a flow rate 250 cm³/min. The total cost of treating one cubic meter was about 0.63\$, while the cost for the same water before adsorbent coating modification was 2.33\$/cm³.

Keywords : water treatment, fluoride, adsorption, charcoal, Sudan

Conference Title : ICWDS 2022 : International Conference on Water Distribution Systems

Conference Location : Amsterdam, Netherlands

Conference Dates : November 03-04, 2022