Fluoride is an important and necessary element for human health. Fluoride in the drinking water, depending on the concentration, may be helpful or harmful to health for especially babies and young children. Fluoride level should not be more than 1.5 mg/L in drinking water according to the drinking water standards of WHO[1]. Many methods were used to remove excessive fluoride from drinking waters. Among these methods, adsorption is a relatively much better option as compared to other techniques.

The aim of this research work is to investigate the adsorption capabilities of some natural adsorbents for removal of fluoride ion from aqueous solution. These adsorbents are ignimbrite and diatomite materials. Batch adsorption experiments were conducted to examine the effect of various physicochemical parameters such as pH, adsorbent dose, contact time, initial fluoride concentration and temperature. In order to increase adsorption capacity, ignimbrite and diatomite was activated by 2M H$_2$SO$_4$. The fluoride adsorption capacity of acid-activated form was found to be higher than that of the original form for adsorbents. Scanning electron microscope (SEM) images were evaluated for surface characterization of adsorbents. The maximum adsorption capacity for all adsorbents was achieved at 10 mg/L fluoride concentration, 1 g/mL adsorbent dosage, 273 K and pH 6. All adsorption experimental data fitted the Freundlich isotherm. Thermodynamic studies revealed that the adsorption of fluoride on adsorbents is exothermic and a spontaneous process. The adsorption kinetic was also studied in terms of pseudo-first order and pseudo-second order kinetic models. Mechanism of fluoride adsorption was found to follow a pseudo-second-order rate equation for both adsorbents.