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Efficiency and mechanism of water defluoridation by mixtures of Jordanian Zeolite, Pozzolana, Feldspar, and Tripoli

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ABSTRACT

In this work, removal of fluoride (defluoridation) was investigated using mixtures of Jordanian zeolitic tuff, pozzolana, feldspar, and Tripoli. Triploi was used to increase the silica content of the column material. The flow rate values decrease with decreasing the particle size (from 250+ to 53+). The percentage (%) removal of fluoride ion decreases with increasing the particle size. The size of the powder used in the experiments was <50 μm to ensure the highest removal and to make the comparison acceptable. The correlation between the fluoride removal and the content of SiO_2, Al_2O_3, CaO, MgO, Na_2O, and K_2O were presented and interpreted. The % removal of fluoride ion decreases with increasing the content of silica. Both CaO and MgO have positive influence with correlations of 0.6416 and 0.637, respectively. The relatively high correlation means that there is a significant influence of CaO and MgO contents on the fluoride removal efficiency. While Ca^{2+} and Mg^{2+} ions are converted to insoluble salts, Na^+ and K^+ ions form soluble salts and then can be easily detected in the treated water. Published literature data on fluoride and phosphate ions removal by zeolitic tuff can be re-interpreted in light of our finding. The purpose of this work is to correlate Ca and Mg exchange capability to the removal of fluoride in order to prove that the mechanism of fluoride removal by zeolitic tuff is resulting from Ca and Mg insoluble precipitating salts.

Keywords: Defluoridation; Zeolitic tuff; Adsorption; Ion exchange; Precipitation

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