DEFLUORIDATION OF DRINKING WATER USING HEXADECYLTRIMETHYLAMMONIUM IONS (HDTMA+) AND L-LYSINE MODIFIED ZEOLITE-NANOCOMPOSITE

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Abstract: High fluoride intake (>1.0mgL^{-1}) can cause a variety of fluorosis-related diseases that are common in some tank cascade systems. However, removing excess fluoride from water is still a pressing global concern. Nanotechnological approaches, among many emerging defluoridation techniques, showed high efficiency and simplicity of usage. This study is mainly focused on the defluoridation of drinking water using the Zeolite minerals-based -nanocomposite; that is modified with hexadecyltrimethylammonium ions (HDTMA+) and L-lysine. Modified zeolites were characterized by Fourier-transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), Thermos-gravimetric analysis (TGA), and differential scanning calorimeter analysis (DSC). Batch sorption studies were demonstrated to determine the performance of the developed Zeolite nanocomposite material, based on different parameters, such as pH, contact time competitor anions, and initial fluoride concentration. The maximum fluoride removal was reported at an initial pH of 5.0 and 9.0 respectively for HDTMA-modified and L-lysine-modified zeolite. The maximum sorption capacity of fluoride by Langmuir isotherm was found to be 33.40 mg g^{-1} and 10 mg g^{-1} respectively for HDTMA-modified and L-lysine-modified zeolite. It is demonstrated that initial fluoride concentration (1–10 mg L^{-1}) to fast fluoride uptakes at a potency of 6.0 g L^{-1} for both modified Zeolite nanocomposites, and significant fluoride removal capacity with the 45-min contact time. Studies on regeneration with NaCl were effective after the 18-20 cycle of use.

Keywords: Defluoridation; Hexadecyltrimethylammonium ion; Nanocomposite; Regeneration; Zeolite