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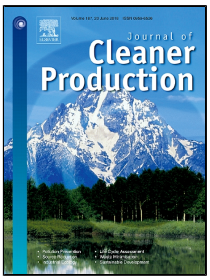

Modification of organic matter-rich clay by a solution of cationic surfactant/H_2O_2: A new product for fluoride adsorption from solutions

Mohamed Mobarak, Ali Q. Selim, Essam A. Mohamed, Moaaz K. Seliem

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Modification of organic matter-rich clay by a solution of cationic surfactant/H_2O_2: A new product for fluoride adsorption from solutions

Mohamed Mobarak[a], Ali Q. Selim[b], Essam A. Mohamed[b], Moaaz K. Seliem[b]*

[a] Physics Department, Faculty of Science, Beni-Suef University, 621 Egypt

[b] Geology Department, Faculty of Science, Beni-Suef University, 621 Egypt

Abstract

The discharge of toxic ions including fluoride into the aquatic environment causes huge large-scale health problems, especially for developing African countries. Defluoridation of solutions by adsorption technique is commonly applied and exhibits helpful results. In this study, natural clay was individually modified by decyltrimethylammonium bromide and a combination of hydrogen peroxide with decyltrimethylammonium bromide. The natural and modified clays were characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), zeta potential, Brunauer–Emmett–Teller specific surface area (S_{BET}), and tested as adsorbents for fluoride from solutions in the pH range of (2.0–10.0) at 25 °C. The new strategy of natural clay treatment by a solution of the used combination gave the highest removal efficiency of fluoride as compared to the other adsorbents at pH 2.0. Fluoride adsorption studies were evaluated under different experimental parameters such as contact time, initial concentration, adsorbent dose, co-existing anions, and temperature. Removal of fluoride was found to be rapid and equilibrium was attained after 60 min of contact time. In the presence of phosphate, sulphate and chloride as competitive anions, fluoride uptake was slightly decreased. Linear and non-linear forms of Langmuir, Freundlich and Dubinin–Radushkevich models were used in fitting fluoride adsorption data. Langmuir model with a maximum adsorption capacity (53.66 mg/g) described well the experimental data at 25 °C. The pseudo-second-order model with a correlation coefficient ($R^2 = 0.999$) fitted well the kinetic data indicating that chemisorption process could be a rate