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Removal of fluoride using quaternized palm kernel shell as adsorbents: Equilibrium isotherms and kinetics studies (Article)

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Abstract

Palm kernel shell (PKS) core fibers, an agricultural waste, were chemically modified using N-(3-chloro-2-hydroxypropyl) trimethylammonium chloride (CHMAC) **as** a quaternizing agent. The potential of **quaternized palm kernel shell** (QPKS) **as** an adsorbent for **fluoride** in an aqueous solution was then studied. The **quaternized palm kernel shell** (QPKS) core fibers were characterized using Fourier transform infrared spectroscopy (FTIR) and a scanning electron microscope (SEM). The effect of various factors on the **fluoride** sequestration was also investigated. The results showed that with an increase in the adsorbent amount and contact time, the efficiency of **fluoride removal** was improved. The maximum **fluoride** uptake was obtained at pH 3 and a contact time of 4 h. The adsorption behavior was further investigated using **equilibrium isotherms** and **kinetics studies**. The results from these **studies** fit well into Freundlich, Redlich-Peterson, and Sips isotherm's with a coefficient of determination (R2) of 0.9716. The maximum **fluoride removal** was 63%. For **kinetics studies**, the pseudo-second order was the best fit for **fluoride**, with an R2 of 0.999. These results suggest that QPKS has the potential to serve **as** a low-cost adsorbent for **fluoride removal** from aqueous solutions.

Author keywords

Adsorption; **Fluoride removal**; **Isotherms**; **Kinetics**; Quartenized **palm kernel** shells

Indexed keywords

Engineering controlled terms: Adsorbents; Adsorption **isotherms**; Agricultural wastes; Enzyme **kinetics**; Fluorine compounds; Fourier transform infrared spectroscopy; **Isotherms**; **Kinetics**; Scanning electron microscopy; Shells (structures); Solutions

Adsorption behavior; Chemically modified; **Equilibrium isotherms**; **Fluoride removal**; **Kinetics studies**; Low-cost **adsorbents**; **Palm kernel** shells; Pseudo second order

Engineering main heading: Adsorption

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