

Column efficiency of fluoride removal using Quaternized Palm Kernel Shell (QPKS)

ABSTRACT

In this research, the adsorption potential of quaternized palm kernel shell (QPKS) to remove F⁻ from aqueous solution was investigated using fixed-bed adsorption column. Raw palm kernel shell waste was reacted with 3-chloro-2-hydroxypropyl trimethylammonium chloride (CHMAC) in order to modify the surface charge. The effects of inlet F⁻ concentrations (2–12 mg/l) and QPKS bed height (2–10 cm) with optimum pH (pH = 3) on the breakthrough characteristics of the adsorption system were determined. In the fixed-bed column, breakthrough time increases with increasing bed height due to increasing amount of active site on adsorbents to adsorb the fluoride ion. Decreasing trend of breakthrough values was obtained with increasing initial fluoride concentration due to greater driving force for the transfer process to overcome the mass transfer resistance in the column. The adsorptions were fitted to three well-established fixed-bed adsorption models, namely, Thomas, Yoon–Nelson, and Adams–Bohart models. The results fitted well to the Thomas and Yoon–Nelson models with correlation coefficient, $R^2 \geq 0.96$.