

Kinetic modeling and isotherm studies for copper(II) adsorption onto Palm Oil Boiler Mill Fly Ash (POFA) as a natural low-cost adsorbent.

ABSTRACT

Adsorption characteristics of palm oil boiler mill fly ash (POFA) for the removal of Cu(II) from aqueous solution were investigated using batch adsorption studies. The effects of relevant parameters such as contact time, solution pH, adsorbent dosage, and initial concentration of copper were examined. Fundamental batch investigations indicated that 90% of the Cu(II) was removed in the first 30 min, achieving equilibration after only 270 min of agitation. The Cu(II) uptake mechanism is particularly pH- and concentration-dependant, favoring a pH value of 6.0. A decrease in adsorption capacity (q_e) with an increase in Cu(II) removal efficiency (RE %) was obtained as the adsorbent dosage increased. The adsorption behavior of Cu(II) fit well to the Langmuir isotherm, with a monolayer adsorption capacity of 17 mg/g. The applicability of the Langmuir isotherm suggested the formation of monolayer coverage of Cu(II) ions onto equivalent sites of the adsorbent. Kinetics experimental data followed the trend of pseudo second-order kinetics, which is consistent with chemisorption with intraparticle diffusion as one of the rate-determining steps. Therefore, this study indicates that POFA could be used successfully as a natural low-cost adsorbent for Cu(II) removal from aqueous solutions.

Keyword: Adsorption isotherm; Adsorption mechanism; Copper; Kinetics studies; Palm oil boiler mill fly ash (POFA).