

Arsenic adsorption mechanism on palm oil fuel ash (POFA) powder suspension

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ABSTRACT

The contribution of palm oil fuel ash (POFA), an agricultural waste as a low cost adsorbent for the removal of arsenite (As(III)) and arsenate (As(V)) was explored. Investigation on the adsorbency characteristics of POFA suspension revealed that the surface area, particle size, composition, and crystallinity of the SiO₂ rich mullite structure were the crucial factors in ensuring a high adsorption capacity of the ions. Maximum adsorption capacities of As(III) and As(V) at 91.2 and 99.4 mg g⁻¹, respectively, were obtained when POFA of 30 μm particle size was employed at pH 3 with the highest calcination temperature at 1150 °C. An optimum dosage of 1.0 g of dried POFA powder successfully removed 48.7% and 50.2% of As(III) and As(V), respectively. Molecular modeling using the density functional theory consequently identified the energy for the proposed reaction routes between the SiO⁻ and As⁺ species. The high stability of the POFA suspension in water in conjunction with good adsorption capacity of As(III) and As(V) seen in this study, thus envisages its feasibility as a potential alternative adsorbent for the remediation of water polluted with heavy metals.

KEYWORDS

Water and wastewater treatment; Agricultural waste; Low cost adsorbent; Heavy metal; BET analysis

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