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Arsenic sorption in a packed bed column loaded with iron oxide nanoparticle embedded waste wood biochar.

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Abstract

The need of eliminating arsenic (As) from aqueous media is becoming a challenge as a large part of population in many countries consume groundwater for drinking purpose. The aim of this study is to make effective technique through which arsenic separation is simple in real-world conditions and will help the public health. This study investigates the use of biochar produced from waste wood and impregnated with iron oxide nanoparticles for arsenic adsorption in a continuous packed bed column system. Breakthrough properties of the column were investigated by varying the column bed depth, initial adsorbate concentration and flow rate. The adsorption process and corresponding design parameters were investigated using Thomas, Adams-Bohart and Yoon-Nelson Models. The results from the BDST model revealed that minimum bed depth of 0.6 cm and 0.11 cm for the breakthrough concentration of 10 μgL^{-1} and 50 μgL^{-1} is required respectively. And associated service times of 134 and 136 hours respectively of the column under optimal conditions (initial concentration 1.0 mgL^{-1} and 0.5 $mLmin^{-1}$ of flow rate of the influent) were investigated by BDST model. Maximum adsorption capacity of 91.34 mgg^{-1} was achieved for As ions. Regeneration investigation was also carried out where the adsorbent material showed 5 cycles of reusability and efficiency up to 78% for As ions hence proving the sustainability of the column study.

Keywords: Arsenic removal, iron-oxide nanoparticle, packed-bed column, water remediation, kinetic modelling.