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Combination of electrokinetics and nano zero-valent iron-based adsorption enhances Sb(V) removal from feed water in the batch and column mode processes

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ABSTRACT

Disorder mining and massive consumption of Sb-bearing ores have caused a dramatic rise in the accumulation of Sb related pollution in China over the past decade. The combination of iron-based adsorption and electrokinetics was applied in the batch and column experiments to enhance removal of Sb(V) anions from the feed water. Activated carbon supported nano zero-valent iron (AC-nZVI) was prepared as the filling adsorbent for the adsorption experiments. The maximum monolayer-adsorption capacity of AC-nZVI was 20.49 mg/g according to the Langmuir isotherm results. Sufficient dose of adsorbent with sufficient dose and pH ranging from 4 to 5 were favored in the equilibrium adsorption. Electrokinetics clearly had enhanced Sb(V) removal from the feed water with the maximum removal efficiency of 96.42% being achieved in the coupling system. The variable changes significantly affected the removal results of Sb(V) ions in the coupling experiments at a batch mode. The antimony species can be effectively removed from the stock solution in the continuous process. The flow rate of 40 mL/min was favored in facilitating the excellent performance of the assembled units at a minimum operating cost. The adsorbent regenerated within three cycles is still reliable in terms of removing Sb in a continuous treatment process.

Keywords: Nano zero-valent iron; Electrokinetics; Sb(V) removal; Activated carbon; Continuous process

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