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Cellular concrete-supported cost-effective adsorbents for aqueous arsenic and heavy metals abatement

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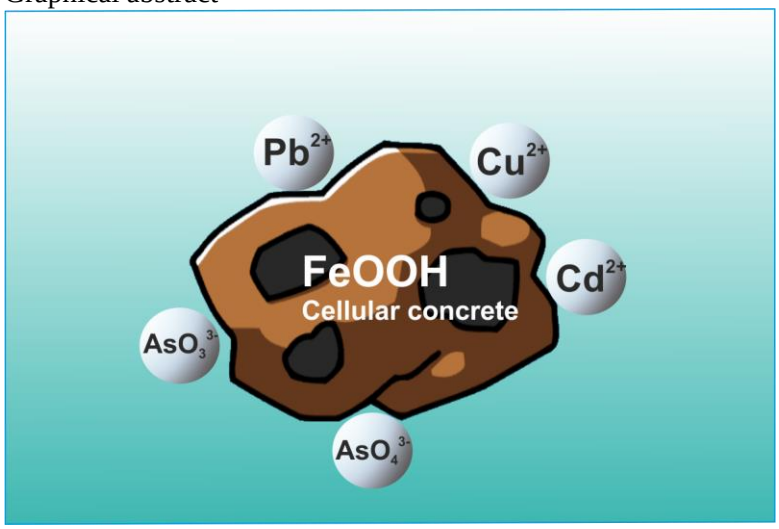
Graphical abstract



Highlights

- The cost-effective disposable adsorbent for heavy metals and arsenic is proposed
- Cellular concrete rejects serve as ferric oxyhydroxide adsorbent supports
- Vermiculite concrete-supported adsorbent surpasses costly activated carbon-supported ones in adsorption capacity
- The cellular concrete-supported ferric oxyhydroxide adsorbents reliably trap heavy metals showing negligible leakage

Abstract

Aqueous arsenic and heavy metals in concentrations exceeding sanitary limits present an acute regional problem. Adsorption is an effective although costly method of pollutants removal. This makes the search for low-cost effective disposable adsorbents necessary. The adsorbents using vermiculite concrete and aerated autoclaved light concrete (aerocrete) modified with iron oxyhydroxide were synthesized and studied. The specimens of adsorbent materials showed the adsorption capacity more than two-fold exceeding the vermiculite-based adsorbents in respect to copper and lead cations, 53 and 195 mg g^{-1}, respectively, having the adsorption capacity for cadmium comparable to exfoliated vermiculite at 35.5 mg g^{-1}. Arsenic anions were adsorbed in amounts comparable to the ones of carbon composites-supported ferric oxyhydroxide adsorbents, up to 16 mg g^{-1} of arsenate. The analysis of adsorption dependent on temperature showed its spontaneous low-energy ion-exchange character. Desorption of heavy metals and arsenic anions from used adsorbents meets the requirements of drinking water standards with the exception of cadmium, meeting the