Solution Synthesis of Iron (Ⅲ)-Containing γ-Alumina Nanoparticles for Arsenic Adsorption

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Iron (Ⅲ)-inserted γ-alumina nanosorbents were prepared by all-green solution chemistry without the use of any organic solvent for the removal of arsenic. An environmentally benign method described herein consists of ionothermal process for the fabrication of morphologically controlled γ-alumina nanoparticles as host solid and sonochemical method for the entrapment of iron (Ⅲ) as guest material. Depending on the types of aluminium precursors, aligned bundled and randomly debundled γ-alumina nanorods as well as mesoporous alumina were synthesized, using 1-butyl-3-methylimidazolium chloride via a simple ionothermal process. The crystalline phases, thermal properties, molecular structures, and textural properties of the fabricated γ-aluminas were characterized by XRD, TGA, 27Al NMR, and N2 sorption/desorption analysis, respectively. Iron (Ⅲ)-inserted γ-aluminas with the randomly debundled rodlike structure revealed better removal capacities of As (V) and faster adsorption rates due to larger surface areas and pore sizes. Therefore, this synthetic method is a clean and effective route to fabricate the advanced adsorbent based on host-guest system for the application into the removal of environmentally hazardous chemicals.