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Use of Chitosan Goethite Bionanocomposites for remediation of water body with multi-pollutants

DR. JING HE[1,2,3], XINXIN FU[1] AND LI LIU[1]

[1]China University of Geosciences (Wuhan)
[2]State Environmental Protection Key Laboratory of Source Apportionment and Control of Aquatic Pollution Ministry of Ecology and Environment of the People's Republic of China
[3]Hubei Key Laboratory of Yangtze River Basin Environmental Aquatic Science

Presenting Author: jhe11@foxmail.com

With different human activities, we encounter water pollution in mixtures that result from different sources of pollution such as heavy metal pollution caused by industries as well as non-point source pollution from agriculture. In this study, we report the synthesis and characterization of a composite material: Chitosan Goethite Bionanocomposites (CGB) composed of biopolymer chitosan and nano-goethite mineral. Goethite nanoparticles are uniformly distributed in the chitosan phase, and the presence of chitosan can prevent the aggregation of goethite nanoparticles. The inorganic mineral goethite is rigid and the organic polymer chitosan is ductile, and the synergistic effect of the two makes the composite show synchronous toughening and strengthening effect. The macrostructure of the composite material determines that it can overcome the difficulties of the separation process in water treatment, and its microstructure retains the superiority of nanomaterials in the aspect of high adsorption efficiency.

The composite material CGB was used to remove a variety of pollutants (copper, lead, cadmium, arsenic, antimony and phosphate) from contaminated water. Batch adsorption and kinetic experiments were carried out for studying adsorption capacities and diffusive-adsorption mechanism. Both single-pollutant and multi-pollutant systems were investigated in order to evaluate the efficiency of CGB on dealing with multiple water pollutants. We also studied the effect of coexistence of different pollutants on each other in terms of adsorption suppression/promotion onto CGB. Adsorption and diffusion behaviors of multiple pollutants onto CGB were investigated by water chemistry experiments, SEM-EDS, FTIR and synchrotron techniques (such as XAFS, μ-XRF). The secondary pollution and service life of composite materials were analyzed by desorption experiment and recycling experiment of CGB, providing theoretical reference and technical support for the remediation of water bodies with multi-pollutants.