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Electrospinning polyvinyl alcohol/silica-based nanofiber as highly efficient adsorbent for simultaneous and sequential removal of Bisphenol A and Cu(II) from water

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Abstract

Sulfydryl-functionalized mesoporous polyvinyl alcohol/silica-based nanofiber (MNF-SH) was prepared as efficient adsorbent to simultaneously/sequentially remove Bisphenol A and Cu(II) from their binary solutions. Scanning Electron Microscope (SEM) and Transmission electron microscope (TEM) images showed the mesoporous structure of MNF-SH. X-ray photoelectron spectroscopy (XPS) and Fourier transform infrared (FT-IR) spectra further confirmed sulfydryl groups on MNF-SH. It also indicated that Cu(II) adsorption on MNF-SH was mainly attributed to the chelating interaction, while adsorption of BPA was due to the intermolecular force and hydrogen bond. In addition, the loaded BPA on MNF-SH by intermolecular force, could act as bridge molecular to adsorb Cu(II), and showed synergistic effects on Cu(II) removal in simultaneous/sequential adsorption. However, the coexistence of Cu(II) or preload Cu(II) decreased the uptake of BPA because of competition for MNF-SH sulfydryl groups. The coexistence of Cl^- and NO_3^- increased the adsorption of Cu(II) while decrease the adsorption of BPA. Multiple adsorption-regeneration experiment indicated that more than 97% of BPA and 98% of Cu(II) could be sequentially desorbed by ethanol and HCl (4.0 mol/L) solution, respectively. Even after 10 times cycles, MNF-SH could still remain more than 90% adsorption capacity for Cu(II) and BPA. Thus, MNF-SH was a promising adsorbent for simultaneous/sequential removal of Cu(II) and BPA in environmental protection.

Keywords: Polyvinyl alcohol/silica-based nanofibers; competition; synergistic; adsorption; Bisphenol A; Cu(II)

1. Introduction

As a typical type of endocrine disruptor compounds (EDCs), Bisphenol A (BPA) has been widely used in the manufacturing of poly-carbonates, polymer plastics, epoxy resins, and other plastics [1]. Because of its low biodegradability and highly resistance to chemical degradation even in low concentration, BPA can cause endocrine