Sorption of benzene, toluene, ethylbenzene from aqueous phase onto carbon nanotubes and the mutual effects of humic acid

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ABSTRACT

The adsorption behaviors of benzene (B), toluene (T), and ethylbenzene (E) onto carbon nanotubes (CNTs) were investigated in this study. To better disclose its sorption mechanism, the influences of aquatic conditions, including concentration, pH and temperature were studied. It was found that the adsorption capacity for BTE follows the order of B<T<E, which is mainly due to their water solubility. Langmuir model fitted adsorption isotherms well and was better used to quantify their adsorption capacities. In comparison, pH was found to influence the adsorption rather than temperature, which was mainly attributable by the π-π electron-donor-acceptor mechanism between the aromatic ring of benzene, toluene, and ethylbenzene and the functional groups on carbon nanotube surface. A higher adsorption for BTE achieved at higher pH values. When there exists B, T, and E, CNTs was more preferred to adsorb E, due to their water solubility. The addition sequences of BTE and humic acid (HA) sorption could affect their sorption mechanisms, with their competition effects occurred stronger at lower HA concentration. It was found that CNTs would be easier to bond HA molecules than BTE. The current study is of important to fully understand the adsorption behavior of BTE on CNTs and their mutual effects with HA, thus to better understand their co-existing effects in ecosystems.

Keywords: Carbon nanotubes; BTE; Adsorption; Humic acid