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Magnetic adsorbents for the removal of Hg (II) and phenanthrene from aqueous solutions

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Activated carbon (AC) acts as a strong binding agent that lowers the pollutant concentration and, thus its toxicity. Another promising sorbent material in environmental applications is biochar (BC) which is obtained from the incomplete combustion of carbon-rich biomass under oxygen-limited conditions. Both of these materials could be used as soil or sediment amendments that would lower the toxicity in the aqueous phase. A draw back of this technique is that although the pollutant will remain non- bioavailable for many years being sorbed into these sorbents, it actually stays into the system. The objective of this study was (a) to synthesize a magnetic powdered activated carbon (AC/Fe) and magnetic powdered biochar (BC/Fe) produced from commercial AC1 and AC2 samples and biochar respectively and (b) to evaluate the potential use of AC/Fe and BIO/Fe to remove aqueous Hg (II) or phenanthrene while being magnetically recoverable. The BC was produced from olive pomace. The surface area, the pore volume, and the average pore size of each sorbent were determined using gas (N2) adsorption-desorption cycles and the Brunauer, Emmett, and Teller (BET) equation. Isotherms with 30 adsorption and 20 desorption points were conducted at liquid nitrogen temperature (77K). Open surface area and micropore volume were determined using t-plot method and Harkins & Jura equation. For both AC/Fe, surface area measurements resulted in 66% those of corresponding AC. For BC/Fe, the surface area was 82% that of BC. Batch experiments with all sorbent samples and mercury solutions were conducted at room temperature (25oC) and at pH 5 in order to compare the sorption properties of the materials. Similar tests were performed with phenanthrene solutions. Based on mercury isotherm data, AC/Fe and BC/Fe are effective sorbents but with lower sorption capacity compared to the initial materials (50-75% lower). All these properties point to promising materials that can effectively be used for in-situ environmental remediation and also be recovered.