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Synthesis of magnetic adsorbents for the removal of Hg(II) from aqueous solutions

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Activated carbon (AC) is known to adsorb aqueous Hg (II). AC acts as a strong binding agent that lowers the pollutant concentration and thus, its toxicity. Another promising material in environmental applications such as metal removal is biochar (BC), which is obtained from the incomplete combustion of carbon-rich biomass under oxygen-limited conditions. A draw back of this method is that although the pollutant will be non- bioavailable for many years into sorbents, it actually remains 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 AC (AC1 and AC2), and biochar respectively, and (b) to evaluate the potential use of AC/Fe and BC/Fe to remove aqueous Hg(II) while being magnetically recoverable. The biochar was produced from olive seeds. The surface area, the pore volume, and the average pore size of each sorbent were determined using gas (N_2) 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. Surface area measurements resulted in values of 640 and 790 m^2/g for AC1 and AC2 samples and 433 and 517 m^2/g for AC1/Fe and AC2/Fe samples, respectively. The surface area BC and BC/Fe was 390 m^2/g and 320 m^2/g, respectively. Batch experiments with all sorbents were conducted at room temperature (25^{o}C), at pH 5, and various initial Hg(II) concentrations, in order to compare the sorption properties of the materials. Based on the isotherm data, AC/Fe and BC/Fe seem to be effective sorbents demonstrating lower sorption capacities ranging from 50 to 75% of those of the initial materials. All these properties point to promising materials that can be effectively used for in-situ environmental remediation.