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Magnetic sorbents added to soil slurries lower Cr aqueous concentration

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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 a commercial AC sample and BC, respectively and (b) to evaluate the potential use of AC/Fe and BC/Fe to lower Cr concentration that desorb from two soils in their soil slurries. The two soil samples originate from the vicinity of a local metal shop. 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. Our previous studies have shown that both AC/Fe and BC/Fe are effective sorbents for mercury in aqueous solutions but with lower sorption capacity compared to the initial materials (50-75% lower). Batch experiments with all sorbent samples and each soil were conducted at room temperature (25oC) in order to compare the sorption properties of the materials. The soil slurries demonstrated low Cr concentrations (10.9 and 14.6 μg/L, respectively). One month after the addition of amendments AC, AC/Fe, and BC/Fe, Cr concentration in the slurry was lower than the detection limit which was 0.5 μg/L (except of one of the soils with the AC that was 2.1 μg/L). The slurries with BC demonstrated Cr concentrations equal to 4.2 and 7.1 μg/L, respectively. All these properties point to promising materials that can effectively be used for in-situ environmental remediation and also be recovered.