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Sorption interactions of biochars and pyrogenic carbonaceous materials with anionic contaminants

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Biochar as a highly porous and carbon-rich material with a large surface area is a new player in the system of environmental remediation techniques. A wide range of valuable sorption properties of this carbonaceous pyrolysis product provides new options to solve contaminant problems in soil and water and thus may reduce the number of contaminated sites. The sorption capacity of agricultural wastes and wood processing-derived biochars has been found to be excellent due to high surface area, pore volume, and surface functional groups. However, sorption interactions and separation of xenobiotics from waste water, soil solutions or polluted surface water is very often affected by the concentration of contaminant, contact time, effects of competitive substances and mainly by the chemical form of the respective contaminant. The negative surface charge of biochar-based sorption materials supports significant sorption in particular for cationic forms of pollutants. On the other hand many environmentally critical substances occur in anionic forms (e.g. As, P, Mo, Tc). Therefore their retention and immobilization by biochar is frequently considered as problematic or limited. Besides, details about the mechanism of biochar interactions with anionic compounds and the options for surface modification are largely unexplored. This contribution presents a comparative study about production and characterization of unmodified, chemically pre-treated and post-treated biochars with respect to sorption processes of model anionic compounds (PO43-, AsO43-). The obtained results confirmed the crucial role of altering biochar properties (pH) and of surface modification for improving biochar sorption efficiency for anionic contaminants.