

Influence of feedstock and production conditions on characteristics of biochar and its correlation for the adsorption of oxyanions: A Comprehensive meta-analysis

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Water contamination by oxyanions can be considered as a major environment problem. Biochar (BC) is a carbon rich porous material produced *via* biomass pyrolysis under limited oxygen condition. Biochar has been widely used in remediating both inorganic and organic compounds including anionic compounds. Much research has been carried out to study the effects of feedstock type (FT), modification type (MT) and pyrolysis temperature (PT) on the properties of biochar. However, correlation to BC characteristic in the removal of specific anionic adsorbates are lacking. Thus, this work helps researchers to get a quantitative approach to predict the relationship between BC precreation parameters and the final BC properties to specifically remove anionic contaminants such as nitrate (NO_3^-), phosphate (PO_4^{3-}), chromate ($Cr_2O_7^{2-}$), and arsenate (AsO_4^{3-}). 283 individual data points from 129 peer reviewed articles were extracted. Data were characterized, FT as algae, plant, animal, sludge and wood, MT as acid, base, magnetic and metal impregnation, PT ranges were categorized

in to 5 main ranges to perform the meta-analysis using R-Statistical software. Based on the analysis, with increasing PT, specific surface area (SSA), biochar pH, ash content increase whereas O%, H%, N%, H/C and O/C decrease. Wood based BC generally showed a greater carbon content. Pyrolysis temperature range between 451-650 °C and wood-based BC gave a high stabilize BC. Generally metal impregnation modification results a better sorption ability to adsorb anionic contaminants. Higher SSA of BC might facilitate the adsorption ability. Optimum SSA observed for NO_3^- , PO_4^{3-} , $Cr_2O_7^{2-}$, AsO_4^{3-} respectively for plant, algae, sludge, and wood type biochar. Finding of this study will help future researchers to choose the better FT and production conditions to remove specific anionic compounds from aqueous medium.

Keywords: Biochar, Meta-analysis, Anionic contaminants, Adsorption.