

Activation of Rice Husk Biochar by Sodium Hydroxide for the Removal of Polycyclic Aromatic Hydrocarbons and Phthalates in Water and Sediment

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Polycyclic aromatic hydrocarbons (PAHs) and phthalates (PAEs) are hazardous organic compounds that expose high risk to ecosystems in water and sediment. The use of biochar to remove PAHs and PAEs has received increased interest, but it is a challenging task because of the low sorption capacity. To enhance the sorption capacity of biochar towards PAHs and PAEs, RH-NaOH biochar was successfully synthesized by pyrolysis of rice husk (RH) with alkaline activation using NaOH introduced. Benefiting from high specific surface and high porosity, RH-NaOH markedly improved PAHs and PAEs maximum sorption capacity than that of original RH biochar. The RH-NaOH presented a high sorption performance with a theoretical monolayer uptake for PAHs and heterogeneous sorption for PAEs. Moreover, the effects of contact time and pH on PAHs and PAEs sorption were also figured out. The study showed no effect of pH on the ability of RH-NaOH in removing PAHs and PAEs. The sorption process reached equilibrium after 60 h and 30 h for PAHs and PAEs, respectively. To examine the effect of dissolved organic matters (DOM) presence, different humic substance types and concentrations were utilized. Furthermore, to test the effect of field water conditions on PAHs and PAEs sorption, the sorption reactions were investigated under the groundwater, tap water, and industrial wastewater conditions. The X-ray photoelectron spectroscopy and Raman spectra were applied to identify the main binding mechanisms after sorption process. RH-NaOH was found to be possible sorbent for stabilizing PAHs and PAEs in contaminated sediments. The combination of 3% biochar dose and an aging time of 56 days was the most effective condition to eliminate PAHs and PAEs in the sediment.