ADSORPTION OF AMMONIUM NITROGEN (NH_4^+-N) IONS ONTO VARIOUS VIETNAMESE BIOMASS RESIDUE–DERIVED BIOCHARS (WOOD, RICE HUSK AND BAMBOO)

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This study evaluates adsorption of ammonium nitrogen (NH_4^+-N) ions onto various biochars produced from biomass residues in Vietnam as a function of their physicochemical characteristics. Three biochars, including wood biochar (WBC), rice husk biochar (RBC), and bamboo biochar (BBC), were produced under limited oxygen conditions using Top-Lid Updraft Drum technology at temperatures of 450-550^{o}C. Physicochemical characterization (BET surface area, Cation exchange capacity (CEC), Scanning Electron Microscopy, Fourier Transform Infrared Spectroscopy) of the biochars was performed in order to link their porosity and surface functional groups with their NH_4^+-N capture capacities. The adsorption capacity was evaluated using various parameters such as adsorbent dosage, contact time, and initial adsorbate concentration. The equilibrium adsorption data were analyzed by Langmuir, Freundlich and Temkin adsorption isotherm models. The Freundlich model best describes the adsorption of NH_4^+-N onto the three biochars. The ability of the biochars for NH_4^+-N adsorption were in the order RBC>BBC>WBC, which correlates with their overall CEC. The Lagergren-first order and pseudo-second order models were also used to evaluate the kinetics of adsorption, and the adsorption data of NH_4^+-N showed a good fit with the later model. Thus, the data of experiments indicated that all three biochars are good for NH_4^+-N adsorption from aqueous solution, especially rice husk BC. The increased adsorption capacity of RBC correlated with its having the highest CEC despite having the lowest surface area, suggesting that surface chemistry plays the greatest role in the NH_4^+-N adsorption.

Key words: Adsorption, biochar ammonium, physico-chemical characterization, equilibrium adsorption, and adsorption kinetics