Giant mud crab shell biochar: A promising adsorbent for methyl violet removal in wastewater treatment

ABSTRACT

Giant mud crab (Scylla serrata sp.) shell prepared through pyrolysis at various temperatures without any modification were characterized for physicochemical properties and methyl violet (MV) removal potential. Hence, this paper investigated the performance and mechanism of biochar derived from giant mud crab shell as adsorbent in the removal of methyl violet as well as the potential for regenerating adsorbents via hot water regeneration. The results show that CSB500 (produced through pyrolysis at 500 °C) exhibits a surface area of 59.73 m2/g and mesopore size of 31.3 nm, favorable for methyl violet removal at 3139 mg/g. The equilibrium adsorption data agreed well with Langmuir and Redlich-Peterson isotherm models, indicating a monolayer adsorption of MV. The kinetics data fitted better with both pseudo-first-order and pseudo-second-order models. The intraparticle diffusion and Boyd's models revealed that both film and pore diffusion may be involved in the adsorption process. In hot water regeneration studies, CSB500 shown superior regeneration performance when using water with temperature of 70 °C rather than 30 °C for 9th regeneration cycles, with retained to achieve >90 % MV removal for 6th regeneration cycles. Biochar derived from giant mud crab shell has shown significant promise as a low-cost, effective, and ecologically friendly with reasonably good adsorption capacity and reusability for dye removal, and it can be considered as an environmental sustainability strategy in wastewater treatment.