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A BIOCHAR-BASED POINT-OF-USE WATER TREATMENT SYSTEM FOR THE REMOVAL OF FLUORIDE, CHROMIUM AND BRILLIANT BLUE DYE IN TERNARY SYSTEMS

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Abstract

A large population worldwide, especially among poor communities, consumes polluted drinking water. Commonly used water treatment methods are ineffective for contaminants removal, while advanced treatment technologies are complicated and expensive. Although some column studies have been reported, most studies use batch experiments, and do not provide design parameters for up-scaling the treatment process. The objectives of this study were to: (1) synthesize and characterize biochars derived from *Brachystegia spiciformis* hardwood, (2) evaluate the adsorption performance in batch experiments, and (3) use column studies to determine the design parameters for a point-of-use (POU) water treatment device. Pristine biochar was the most effective compared to steam activated-biochar, and iron oxide activated biochar. Adsorption data showed that fluoride adsorption was described by the Freundlich model (r^2 = 0.939), while chromium (r^2 = 0.933), and BBD (r^2 = 0.55) data followed the Langmuir model. Column data were described by the Logit (r^2 = 0.99) and Thomas (r^2 = 0.99) models. Layered adsorbents showed more superior fluoride adsorption and required the lowest mass of adsorbent compared to mixed adsorbent columns. While further studies are required to fully optimize this treatment system, the results suggest that biochar based adsorbents can be effectively used in POU water treatment.

Keywords: adsorption, isotherms, remediation, water pollution

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