

Optimizing biochar-based column filtration systems for enhanced pollutant removal in wastewater treatment: a preliminary study

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Abstract

Sustainable development aims to ensure universal access to water as a main objective and reduce waste. An innovative approach is the treatment and reuse of wastewater in combination with the recycling of agricultural waste. By converting these residues into biochar, we can not only reduce agricultural waste but also use the biochar to treat wastewater, creating a circular system that promotes resource conservation and environmental protection. In this study, the removal of pollutants from wastewater was compared using a column filtration (CF) based on sand (CFS), olive pomace biochar (CF.BOP), orange waste biochar (CF.BOW), filao biochar (CF.BF), and cypress biochar (CF.BC). The results showed that biochar-based CF provided higher removal efficiencies for total nitrogen (TN), ammonium ($\text{NH}_4^+\text{-N}$), chemical oxygen demand (COD), and absorbance (ABS 254 and 420 nm). Notably, CF.BOW has the best removal rates compared to CFS for TN (45% vs. 27%), $\text{NH}_4^+\text{-N}$ (87% vs. 78%), COD (63% vs. 47%), ABS 254 nm (40% vs. 34%), and ABS 420 nm (35% vs. 34%). The higher removal of $\text{NH}_4^+\text{-N}$ was accompanied by a high release of nitrate ($\text{NO}_3^-\text{-N}$) due to nitrification. However, no significant effect of biochar integration was observed for phosphorus removal. In addition, biochar-based CF showed higher removal of bacteriological indicators, such as total coliform (TC), fecal coliform (FC), and fecal streptococci (FS), compared to CFS for the removal of TC, FC, and FS.

Keywords: biochar type, biochar properties, wastewater treatment, column filtration

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