

Suitability of pressmud as an adsorption material in wastewater treatment and as a booster in soil fertility and productivity

ABSTRACT

Press mud is one of the most abundant wastes produced by the sugarcane industry. However, it has received far too little attention as a reactive material for pollutant removal, although its beneficial effect on soil fertility and crop productivity is well established. This paper investigates the potential of press mud to minimize heavy metal migration while boosting soil fertility and productivity. Firstly, the adsorbent was characterized by Fourier Transform Infrared Spectroscopy (FTIR) and Field-Emission Scanning Electron Microscopy (FESEM) analyses, which showed the presence of functional groups such as carbonyl, hydroxyl, and silica capable of adsorbing metal ions. The cation exchange capacity (CEC) of press mud is very high, ranging between 44.9 and 45.2 meq/100 g. Along with removal efficiency testing and evaluating breakthrough curves, characterization, and adsorption analyses (batch equilibrium and column test) were carried out. The press mud reveals promising adsorption characteristics, including a high organic content (17.62%) and the presence of carbon, which significantly affects its excellent removal effectiveness. Based on the removal efficiency test, press mud successfully removes metal ions at the highest value, such as zinc (Zn), at 99.7%. Meanwhile, its breakthrough curve reveals that it efficiently retained all heavy metals, as these metals do not reach 1 to 10 pore volumes (p.v.), indicating that press mud is a good material for heavy metal adsorption and soil productivity. This possible use establishes a new cyclical flow for the material and contributes to its minimization and reuse, adhering to circular economy ideas. However, press mud must be disposed of properly to avoid adverse effects on humans and the environment.