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Removal of Selected Heavy Metal Ions from Industrial Wastewater Using Rice and Corn Husk Biochar

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Abstract

This study investigated the removal of heavy metal ions from industrial wastewater by using rice and corn husk biochar. The choice of the materials was influenced by their large surface area, abundance of functional groups as well as their availability in the local environment. Rice and corn husks were pyrolyzed at 500, 600, and 700 °C to make biochars that were used to treat low-quality industrial wastewater. Initial metal ion levels in wastewater and residual levels after the application of biochars were measured using an atomic adsorption spectrophotometer. Carbonization of rice husks at 600 °C produced the best removal efficiencies for Cr (65%), Fe (90%), and Pb (> 90%). The carbonization of corn husks at 600 °C produced the worst removal efficiencies for Cr (only 20%) and Pb (slightly > 35%). Regardless of the carbonization temperature, rice husk biochars performed better than corn husk biochars. Experimental data fitted well the Langmuir and Freundlich isotherm models (R2 values ranging between 0.82 and 0.99). The Langmuir separation factor, RL, had negative values, probably due to the low initial concentration of the adsorbates in the raw wastewater. All the biochars showed a relatively short contact time (20 to 30 min) to attain maximum adsorption efficiencies and are a promising feature for future industrial applications. The studied biochar materials from rice and corn husk have the potential to remove heavy metal ions from industrial wastewater; rice husk biochar showed higher removal capacity than corn husk biochars.

Keywords