

Synthesis and Characterization of Micro- and Nano-Particle Biochar

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Biochar is a solid product that is created from biomass pyrolysis under low-oxygen conditions. It has gained widespread recognition for its ability to help with carbon sequestration and improve soil properties. However, biochar might also contain harmful substances that can accumulate in soil. Furthermore, the breakdown of biochar can result in the formation of smaller particles, which can transport pollutants through the soil and potentially contaminate groundwater posing serious environmental risk. This study involved the pyrolysis of rice straw to produce biochar, which were then separated into micro biochar (<1 μ m). The micro and nano biochar was characterized using FESEM, FTIR, XRD, and DLS. The results obtained from DLS analysis revealed that the size of micro and nano biochar obtained from a bulk BC of a specific size varied greatly. The size distribution range for micro biochar (MBC) was found to be between 1 μ m to 60 nm while for nano biochar (NBC), it was between 400 μ m to 70 nm. The FTIR spectra of micro and nano biochar display variations based on particle size. The bands at 4000 to 3000 cm^{-1} indicate the presence of oxygen-containing functional groups in micro and nano biochar, respectively, with decreasing transmittance. The micro and nano biochar particles had irregular shapes, uneven surfaces, and collapsed pores during grinding, compared to the macro char. The results of the characterization work demonstrated the distinction between bulk biochar and micro/nano biochar. The micro and nano particle biochar leads to a greater number of adsorption sites and functional groups on its surface compared to biochar. The results of this study highlight the characteristics of micro and nano biochar with oxygen-containing surface functional groups, demonstrating their high affinity for contaminants.