CHARACTERISTICS OF SEWAGE SLUDGE BIOCHAR PRODUCED AT A WIDE RANGE OF PYROLYSIS TEMPERATURES

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Biochar produced from waste biomass pyrolysis has been shown to be of immense utility in many applications. However, the specific characteristics of the biochar produced, which are dependent on the feedstock characteristics and pyrolysis conditions, significantly impact its viability in particular applications. This study investigated the properties and potential of biochar produced from sewage sludge pyrolysis in an auger reactor. The pyrolysis experiments were performed at a temperature range of 400-600 °C. The product biochars have been analyzed to obtain vital characteristics relevant to their applications as a solid fuel, fertilizer, catalytic, and sorption material. In comparison to woody biomass, the sewage sludge biochar has been found to possess a low heating value (HHV 10.0-13.5 MJ/kg), high ash content (55-66 wt.%) and a relatively high-water holding capacity (0.37-0.50 ml/g-biochar). Despite the increase in HHV with increasing the pyrolysis temperature, these characteristics suggest that the sewage sludge biochar is of low value as a solid fuel and is favorable for soil amendment application due to the increased availability of organic and inorganic (ash) nutrients associated with soil fertility beside the excellent potential of water retention, mainly when applied in low fertility sandy soil. The ultimate analysis has shown that the molar H/C ratio of the biochar is high (1.47-1.5) and almost remains independent of the pyrolysis temperature. This puts the sewage sludge biochar above the threshold (H/C<0.7) set by the European Biochar Certificate guidelines for stability and long-term carbon sequestration. The biochar mineral content analysis revealed the existence of high amounts of some elements (4.7-5.7 wt.%), such as Fe, Ca, Mg, and K, which are valuable for their catalytic effect in chemical reactions. The biochar surface area was found to significantly improve with increasing the pyrolysis temperature; however, it remains moderate (~20 m2/g at 600 ℃) compared to other types of biochar. Further analysis is needed to test the heavy metal content of the biochar and assess its long-term impact if applied in the soil.