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Changes in the Physicochemical Properties of Biochars as Influenced by Feedstock Type and Pyrolysis Temperature

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Abstract

The interest in the use of biochar as a soil amendment to improve soil productivity and therefore mitigate climate change has been receiving attention in recent times. However, our understanding of the effects of feedstock and pyrolysis conditions on biochar properties is limited and the exploration of waste biomasses as potential feedstocks continues. In the quest to explore other potential biomass and deepen our understanding of the properties of biochars as a function of feedstock and pyrolysis temperature, we characterised 12 biochars made from 3 feedstocks; corn cob (CC), rice husk (RH) and mahogany saw dust (MG) at 4 pyrolysis temperatures of 400, 500, 600 and 700 °C, using muffle furnace. Parameters investigated included biochar yield (%),volatile matter, ash and fixed carbon (FC), BET surface area, pH, EC, hydrophobicity (molar ratio and contact angle method), and total macro and micronutrients (Ca, Mg, N, P, K, Cu, Zn, Mn and Fe). The CC biochars had the highest pH, EC, FC values and the highest total nutrient concentrations of K and N. Rice husk biochar (RH) had the highest average biochar yield (43 %), ash content (50 %) and total P. Generally, the MG biochars had the highest volatile matter content, BET surface area, total nutrient concentrations of Ca, Mg and Fe. Biochar properties significantly influenced by both biomass and pyrolysis temperature were pH, EC, ash, biochar yield, volatile matter, BET surface area, total Ca and Mg. Biochar properties significantly ($p < 0.05$) affected by biomass only were total K, Na, Cu and Zn. Hydrophobicity generally increases with higher pyrolysis temperature and decreased in the order MG > CC > RH. The results indicated that most biochar properties were influenced by feedstock and pyrolysis temperature and RH biochars have the potential for correcting acidic soils CC and MG biochars with particularly high C sequestration potentials.

Keywords: Amendment, biochar, BMBF-GlobE, soil, UrbanFood Plus

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