Gasification biochar as a valuable by-product for carbon sequestration and soil amendment
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Thermal gasification of various biomass residues is a promising technology for combining bioenergy production with soil fertility management through the application of the resulting biochar as soil amendment. In this study, we investigated gasification biochar (GB) materials originating from two major global biomass fuels: straw gasification biochar (SGB) and wood gasification biochar (WGB), produced by a Low Temperature Circulating Fluidized Bed gasifier (LT-CFB) and a TwoStage gasifier, respectively, optimized for energy conversion. Stability of carbon in GB against microbial degradation was assessed in a shortterm soil incubation study and compared to the traditional practice of direct incorporation of cereal straw. The GBs were chemically and physically characterized to evaluate their potential to improve soil quality parameters. After 110 days of incubation, about 3% of the added GB carbon was respired as CO2, compared to 80% of the straw carbon added. The stability of GB was also confirmed by low H/C and O/C atomic ratios with lowest values for WGB (H/C 0.12 and O/C 0.10). The soil application of GBs exhibited a liming effect increasing the soil pH from ca 8 to 9. Results from scanning electron microscopy and BET analyses showed high porosity and specific surface area of both GBs, indicating a high potential to increase important soil quality parameters such as soil structure, nutrient and water retention, especially for WGB. These results seem promising regarding the possibility to combine an efficient bioenergy production with various soil aspects such as carbon sequestration and soil quality improvements.

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