Influence of pyrolysis temperature on production and agronomic properties of wastewater sludge biochar

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It is an important challenge to manage wastewater sludge in an environmentally and economically acceptable way. The wastewater treatment industry has a concern to minimize the quantity and transportation costs of its waste management. A possible option for effective management of wastewater sludge is through pyrolytic conversion to biochar. The aim of this work is to investigate the influence of pyrolysis temperature on production of wastewater sludge biochar and evaluate the properties required for agronomic applications. Wastewater sludge collected from an urban wastewater treatment plant was pyrolysed in a laboratory scale reactor. It was found that by increasing the pyrolysis temperature (over the range from 300 ^oC to 700 ^oC) the yield of biochar decreased. Biochar produced at low temperature was acidic whereas at high temperature it was alkaline in nature. The concentration of nitrogen was found to decrease while micronutrients increased with increasing temperature. Concentrations of trace metals present in wastewater sludge varied with temperature and were found to be primarily enriched in the biochar.

The IBI's efforts for defining and characterizing biochar

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Biochar technology has the potential to be a tool for climate change mitigation and for increasing food security. However, the nascent biochar industry must be correctly implemented in order to realize its full benefits, and to date no widely accepted guidelines exist for sustainable biochar systems or safe, effective biochar products. In September 2009, the IBI formed a workgroup to define and characterize biochar. Currently, the workgroup comprises 57 researchers and industry members. Workgroup participants have provided input on a definition for biochar and a basic system for characterizing the material, remotely using IBI's Basecamp website and surveys. IBI has also produced a Pyrolysis Plant Design and Test Guideline which has been reviewed by IBI's Technical Advisory Committee (Production). This document is designed to support the safe and efficient design and testing of pyrolysis plants. Progress made to date will be presented, including IBI efforts to fund this work, and to develop an overarching vision for a biochar certification system including feedstock and overall system sustainability on a cradle-to-cradle basis, pyrolysis unit safety, and safety and effectiveness of the biochar material for application to soil.

Simple method of carbon sequestration analysis in the farm soil added with charcoal

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In order to establish sequestration mechanism of carbon in soil scattered with charcoal, simple analysis method of charcoal carbon amount in the soil was studied quantitatively. Total carbon and inorganic carbon amount was measured with combustion method using SHIMADZU SSM-5000A, organic carbon amount was decided by the Tyurin method. Charcoal carbon amount was estimated by subtracting the inorganic carbon and the organic carbon from the total carbon in the soil. In the sample where bamboo charcoal carbonized at 680 ^oC was mixed with farm soil with 1.0, 3.0, 5.0 and 15.0 wt%, the charcoal carbon amount was estimated with an error of about some %. It was found that the charcoal carbon amount in the soil was easily and efficiently estimated using this method.

Biochar-Ion Interactions: An Investigation of Biochar charge and its effect on ion retention

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The method of measuring exchangeable cations as an approximation for cation exchange capacity was examined using cow manure (CM) and green waste (GW) biochar. Both biochars were pre-treated by shaking with water over a range of times. Leachates were analysed, and the pre-treated biochars were then treated with two solutions (0.1M $BaCl_2$ or 0.1M CsCl) to measure ion adsorption. Pre-treatment water shaking significantly increased monovalent cation and anion adsorption in the GW biochar. Ion adsorption for the CM biochar was not affected by pre-treatment water shaking. The CM biochar did not adsorb the anion at all. Adsorption of moisture was postulated as the cause of the change in surface structure of the GW biochar, enhancing its ability to retain ions. Compulsive exchange of cations to determine the ability of a substrate to retain positively charged ions on its surface may require the use of multivalent solutions to fully neutralise the different forms of charge and varying charge densities that make up some substrates. The relative moisture content of a substrate may also influence the strength and sign of surface charge sites, thereby influencing its Characterization. The pre-treatment of biochars through shaking in water over differing times has manipulated the GW biochar particle-ion structure, thereby changing the potential for the biochar particle to adsorb ions.