BIOCIDAL ACTIVITY IN SOILS BY BIOCHAR FROM PYROLYSIS BIOREFINERY PROCESS

AA Boateng, USDA-ARS Eastern Regional Research Center, USA
akwasi.boateng@ars.usda.gov
JB Gurtler, USDA-ARS Eastern Regional Research Center, USA
CA Mullen, USDA-ARS Eastern Regional Research Center, USA
Y. Han, USDA-ARS Eastern Regional Research Center, USA
DD Douds, USDA-ARS Eastern Regional Research Center, USA

Useful soil applications of biochar, the biocarbon solid coproduct of biomass pyrolysis, will likely improve the economics of pyrolysis biorefineries. Adding biochar to soils to achieve any number of goals should also consider unintended effects upon soil biology. Herein, we explored two biocidal activities of fluidized-bed fast pyrolysis biochars (FPBC) created over a temperature range of 450-700 ^{o}C on the survival of pathogenic E. coli O157:H7 and beneficial arbuscular mycorrhizas (AM) symbioses in soils. For pathogen decontamination, FPBC created at < 500°C proved microbiologically inert, while that created at 600°C proved biocidal over 7 weeks of sampling ($P < 0.05$) with populations significantly reduced at 3% and 3.5% concentration (5.34 and 5.84 log CFU/g, respectively) compared with concentrations of 0.0-2.0%. Ageing of FPBC created under similar conditions for 2 years resulted in loss of efficacy. FPBC greatly reduced colonization of roots by the AM fungus when we examined the interaction of biochar addition and arbuscular mycorrhizal (AM) fungus inoculation upon growth and phosphorus (P) uptake by Allium porrum L. These responses could be related to physicochemical properties of the biochars as higher surface areas were accompanied by higher AM fungus colonization. The findings are pertinent to selecting pyrolysis biorefinery biochars for application to agricultural soils for purposes such as inactivation of pathogenic bacteria while being mindful of potential impacts upon the AM symbiosis if applied.

Biochar II: Production, Characterization and Applications. Cetraro (Calabrial) Italy, September 15-20, 2019.