# THE ROLE OF BIO-CHAR AS AN AGRO-ENVIRONMENTAL TOOL: FORMATION MECHANISM AND POTENTIAL FOR CONTROL WATER RELEASE, BACTERIAL RETENTION AND GREENHOUSE GAS EMISSIONS

Waled Suliman, Biological Systems Engineering, Washington State University
Manuel Garcia-Perez, Biological Systems Engineering, Washington State University
mgarcia-perez@wsu.edu

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In our poster we will present information on the relationship between biochar physico-chemical properties and its performance as a soil amendment. Experimental results will be presented to document how feedstock source and pyrolysis conditions influence biochar bulk and surface properties and what effects these properties have on greenhouse gas emissions, soil water retention and movement of bacteria in sandy soils. Three lignocellulosic biomass feedstocks (poplar wood, pine bark and pine wood) were used to produce biochars at six different pyrolysis temperatures (from 350 to 600 $^{o}$C). The surface study showed that biochars produced at low temperature (<500 $^{o}$C) retained some surface functionalities characteristics of the feedstock. XPS and Boehm titration confirmed that most oxygenated surface functional groups (mainly, carbonyl, carboxyl and hydroxyl groups) are gradually removed as pyrolysis temperature increased. Oxidation by air at 250 oC was able to introduce several oxygen functional groups onto the biochar surface. Particularly, the formation of carbonyl and carboxyl groups is facilitated in biochar produced at low temperature. The formation of these oxygenated functional groups contributes additional negative charges on the biochar surface. Upon biochar application to Quincy sandy soil, it was found that oxidized biochar held significantly more water. Oxidized biochars facilitated the transport of Escherichia coli through soil columns likely due to their negative surface charges that could repel bacteria that often carry an overall negative charge. The production of positively charged bio-chars resulted in an increased retention of Escherichia coil. Comparted to the soil, biochar amendments did not affect the emissions of $N_2O$ but significantly reduced cumulative $CO_2$ emissions.