Bioavailability of Carbon from Corn Stover Biomass and Fast Pyrolysis Biochars in an Amended Soil

Biochar Production & Characterization: All three biochars were produced at CSET, and their production conditions are provided in Table 1. The biochars were characterized using solid-state 13C NMR spectroscopy to determine the relative degree of pyrolysis completeness.

Hypotheses: A degree of relative carbon bioavailability can be determined through measuring CO2 evolution rates from an amended soil and the carbon composition by quantitative solid-state 13C nuclear magnetic resonance spectroscopy (NMR).

Amended soils would have higher or lower degrees of pyrolysis completeness. Biochars that had reached different temperatures during the fast pyrolysis process. The biochars were thoroughly characterized to compare the properties of “completely” and “incompletely” pyrolyzed chars. After 8 weeks, three replicates from each treatment were destructively sampled for soil analyses and microbial population estimations. Soil water retention capacity was measured at the end of the study.

Soil Incubation Study: For each soil treatment, nine replicate incubation jars were prepared, and 30% water was added to maintain 10% soil moisture.

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Soil Incubation Study Results:

Conclusions:
- A decreasing trend in amount of bioavailable carbon with increasing reaction completeness can be seen, even at relatively low reaction temperatures.
- The relationships between biochar characteristics, carbon bioavailability, and amended soil CO2 respiration kinetics are complicated.
- There are multiple types of carbon in biomass, each with its own decay kinetics.
- Soil organic matter oxidation and microbial metabolism convolute source of CO2 emissions.


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