Native Soil Charcoal as a Model for Designing Biochar for Carbon Sequestration

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Under changing climate a variety of mechanisms for removing carbon from the atmosphere and sequestering it elsewhere are being considered to reduce the forcing of the atmosphere. Amending soils with biochar has been proposed as one long-term means of sequestering carbon originating from the atmosphere. Biochar can be a very stable form of carbon that is intentionally made by heating biomass in the absence of oxygen, but residence times of biochar in soil depends on a number of factors. We hypothesized that since native charcoal, a product of forest and range fires and commonly found in soils, has frequently been shown to have long residence times, from hundreds to thousands of years, it likely has properties that govern this stability. By quantifying these properties native charcoal can serve as a model for designing biochar for long-term carbon sequestration. We sampled 7 forested soils along a forest-type and elevation gradient in Western Oregon. Native charcoal was separated from the top three mineral horizons and characterized using elemental analysis, ^{14}C age dating, FTIR, XPS, NMR and NMR ring current analysis. In general, mean ^{14}C age increased with depth and averaged 4700 years for all samples. Trace amounts of Al, Fe and Si were present on the surface of the charcoal. The most common C and O bond on the surface is C-O. NMR indicates a high degree of aromaticity, but ring current measurements suggest that the charcoal surface has been oxidized. The detailed results and implications for designing biochar will be presented.