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Complex conductivity for efficient biochar characterization

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Biochar is the solid, carbon-rich product of the pyrolysis of biomass. The pyrolysis conditions and feedstock characteristics (e.g. particle size and composition) control the physicochemical properties of the resulting biochar, which in turn, determines the suitability for a given application. The primary use of biochar currently is as a soil amendment, but there is increasing research on its use as a remediation agent with very promising results. The versatility of biochar enables treatment of a variety of contaminants, from PFAS, to metals, to hydorcarbons. The same versatility makes biochar characterization and performance monitoring challenging, especially in large scale applications, typical of biochar use. In biochar containing media, geophysical methods can be used to characterize biochar concentration and/or monitor biochar-related processes, such as contaminant sorption. This work explores the use of the complex conductivity method (aka spectral induced polarization - SIP) for biochar characterization focusing on a variety of commercially available biochars, dispersed in porous media. Standard geochemical characterization, such as carbon content, particle size distribution, and surface area measurements, were made to support the complex conductivity measurements. Preliminary results on the complex conductivity signals for biochar-amended columns show promising results for characterization, among different types of biochar, and when compared to the control (sand only). Biochar surface properties appear to have a profound effect on the complex conductivity signals, with characteristic spectral signatures associated to different types of biochar. This research further suggests the potential use of the complex conductivity method as a characterization tool with potential implication for large-scale operations including long term remediation monitoring.