Investigations on Sand-Carbon Mixtures with Spectral Induced Polarisation and Electrical Impedance Tomography

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Investigations with spectral induced polarisation (SIP) and electrical impedance tomography (EIT) on water saturated and moist sand containing charcoal are interesting as well for solving fundamental problems as for applied environmental research. The mixtures exhibit enhanced frequency-dependent impedance compared with mere sand. Hence, they are suitable for systematic measurements with SIP and model studies for EIT.

Elementary carbon (black carbon) regionally often plays an important role in natural soil. Based on this knowledge, intensive investigations on the addition of biochar to soil are being performed since several years. This measure shall provide improved soil properties for agricultural use and long-term storage of carbon in the context of climate protection.

The biochars used for this purpose come from very different biological materials, mostly organic waste or dung, but also from plants specially grown for the production of fuels. The techniques for making biochar may differ drastically. Thus, biochars exhibit strongly varying properties. Characterizing biochar with SIP can provide additional important information about its influence on soil properties.

Several mixtures of sand and commercial active carbons or biochars were initially characterized by SIP. The content of carbon was between 0.5 and 2 % (w/w in relation to dry sand). The mixtures of carbon and sand exhibit distinct induced polarisation in the low frequency range between 1 mHz and 100 Hz. The position of the maximum of polarisation is dependent on the particle size of carbons. The amplitudes vary for different materials. Some mixtures were also investigated with EIT. The mixtures could be clearly distinguished from mere sand in the spatial images of a 2D arrangement. In addition, the evaporation of water from sand with added active carbon was investigated in a 3D experiment.

It can be estimated from the results, that SIP and EIT are capable for contributing to the characterization of charcoal and its behaviour in soil. In particular, it should be possible to investigate the influence on the water budget and long-term processes, like changes of particle size or displacement by cultivation.