

Potential of biochar for long-term metal stabilization in moderately contaminated sandy soils

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ABSTRACT

Anthropogenic soil contamination by metals, at low to moderate levels, are observed in many parts of the world, covering vast areas of land. The presence of these metals in soils poses serious environmental risks especially with regards to food chain transfer. Applying conventional remediation strategies on such soils are prohibitively expensive and are often not feasible. Recent studies have shown that in situ stabilization of the metal concentrations in soils may be possible by applying certain organic materials such as biochar. This approach represents a potentially long-term and cost-effective soil management solution to the problem of metal contamination.

In a three-year study, the effectiveness of three amendments – biochar, compost, and peat, for the stabilization of Cd in soil from the Campine region of Belgium was investigated. Incubation pot experiments were made by mixing the amendments independently at 2% and 4% (w/w) and pore water Cd concentration in the mixtures was monitored by means of rhizon soil moisture samplers (SMS). The results showed that biochar was able to significantly and consistently adsorb and retain the available Cd over the three-year period. In contrast, compost and peat led to increased Cd availability.

The study was able to show that application of biochar is a potentially viable strategy for metal stabilization in diffusely contaminated soil. However, it is currently difficult to determine how biochar will influence the soil metal concentrations over longer periods or when certain environmental conditions change. Future research should investigate the mechanisms and kinetics of biochar-metal adsorption and interactions with environmental factors such as rainfall, temperature and carbon/nitrogen cycling. Furthermore, long-term field studies are necessary to demonstrate the practicability of this soil management strategy so that biochar use recommendations can be made, and final strategies implemented in the field by landowners.