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Efficiency of biochar produced from agricultural residues for the remediation of trace element-contaminated soils

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Several studies have shown that biochars have a high potential to stabilize trace elements in soils [1]. However, different feedstocks and pyrolysis conditions result in biochars with contrasting properties [2, 3]. This study aimed to evaluate the effect of two different biochars used as amendments of trace-element contaminated soils.
Biochars were produced from rice husk (RH) and olive pit (OP) by pyrolysis at 400 and 500 ºC for 1 and 4 hours at a steel batch reactor. The remediation potential of these biochars was tested in a contaminated Typic Xerofluvent soil from Aznalcóllar (SW, Spain), which was affected by the breaching of the tailings dam in 1998, flooding 4,286 ha of land located downriver. The soils used for this study have two different levels of contamination: a) moderately polluted (MPS), with pH 6.5 and a Water Holding Capacity (WHC) of 51.5 %, and b) highly polluted (HPS), with pH 3.6 and a WHC of 32.7 %. Each soil was mixed with 0, 2, 5 and 10 % of the two biochars and incubated for 65 days at 25 ºC, 60 % of WHC and 12h light/day. Subsequently, seeds of Brassica rapa spp. pekinensis were sowed. Plant germination rates, dehydrogenase enzymatic activity and the bioavailability of selected trace elements (As, Ba, Cd, Cu, Fe, Ni, Pb, Sr and Zn) were determined.
Soil pH slightly increased with the addition of biochars. The application of 10 % of RH biochar produced at 500 ºC during 4h significantly increased soil pH in HPS and MPS. After the incubation period, all biochars significantly increased the soil carbon contents when compared with the untreated soils (control samples). The relative abundance of trace elements in the least available fraction of the biochar amended soils increased, showing a lower toxicological risk than the untreated soils. Dehydrogenase activity was higher in the biochar amended soils than in the un-amended ones, and about 10 times greater in the MPS than in the HPS. Biochar increased the germination rates of Brassica rapa spp. pekinensis in the HPS. The pots amended with RH biochar obtained a greater plant growth and root development than the OP amended soils. This difference may be related to the sharp increase of WHC in the soils amended with RH biochar.
Our data showed that RH biochar produced at 500 °C is a promising amendment for the recovery of soils moderately contaminated with trace elements.

References:
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