

EFFECT OF DIFFERENT BIOCHAR TO REDUCE METAL(LOID)S AVAILABILITY IN CONTAMINATED MINING SOILS AND TO PROMOTE POPLAR GROWTH

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Introduction

One of the main environmental current concern is the metal(loid)s contaminated soils. It is hazardous for the environment and public health. Due to the cost of conventional techniques to remediate such contaminated sites, the attention is now turned toward phytoremediation techniques, particularly phytostabilization. *Salicaceae*, willows and poplars, have been shown to be efficient for phytostabilization (Vamerali et al. 2009): they have a high and rapid biomass production and metal(loid)s confinement in their roots which provides them a metal(loid)s tolerance. Furthermore, phytostabilization can be enhanced by using organic or mineral amendments, which improve plants development and metal(loid)s stabilization in the soil. Many studies like Paz-Ferreiro et al. 2014 showed a biochar positive effects on soil characteristics as well as plant growth and metal(loid)s soil stabilization.

The goals of this study were (i) to investigate the effects of a various set of biochar (0%, 2 % and 5%), obtained from different origin (hardwood, lightwood and pinewood) and presenting different granulometries on soil properties, soil pore water characteristics and metal(loid)s availability and (ii) to assess the tolerance of *Populus euramericana* Dorskamp to As and Pb.

Methods

A former silver-lead mine extraction site located at Pontgibaud (France) was investigated. This site contains no vegetation cover and is mainly contaminated by high concentration levels of lead (11453 mg.kg⁻¹) and arsenic (1539 mg.kg⁻¹). This technosol was amended at 0, 2 or 5% (w/w) with 8 different biochars (La Carbonerie, France) produced from different wood origins and presenting different

granulometries. For each treatment, 5 replicates of soil-biochar mixtures were prepared and potted soils were vegetalized by one cutting of *Populus euramericana* Dorskamp. Soil pore water (SPW) was collected using soil moisture samplers (Rhizon™). pH, electrical conductivity (EC) and DOC (Dissolved Organic Carbon) concentration in SPW were determined. Total dissolved metal(oid)s (As, Pb) concentration in SPW were determined by ICP-AES. Cuttings were grown for 48 days. Plant growth was calculated by measuring the plant height weekly. At the end of the growth period, all formed organs were collected (leaves, stems and roots) and dried to measure the dry weight (DW). Metal(oid)s concentrations in the different organs were measured by ICP-AES.

Results

SPW characteristics (pH, EC, DOC, total dissolved metal(loid)s concentration), *Populus* biomass and metal(loid)s plant repartition were determined. Thus we show that all tested biochars help mainly to immobilize Pb while As tend to be mobilized. These biochars enable a better plant growth allowing to vegetate the polluted tested area. Metal pollutants are mainly found to accumulate into the root systems of the tested trees avoiding the invasion of the trees aerial parts by metal(oid)s.

Conclusion

We identified which biochar in terms of wood origin and granulometry, combined with *P. euramericana* Dorskamp, was the most suitable remediation tools for Pb phytostabilization in such post-mining contaminated soil.

References

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