IMMOBILIZATION OF HEAVY METAL IN CONTAMINATED MINE TECHNO SOLS USING BIOCHAR: A PHYTOMANAGEMENT STRATEGY

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Key Words: Biochar, Metal(loid)s, Mining, Technosol, Phytomanagement

Soil contamination by metal(loid)s is one of the most important environmental problem. It leads to loss of environment biodiversity and soil functions and can have harmful effects on human health. Therefore, contaminated soils could be remediated, using phytomanagement. Indeed, plant growth will improve soil conditions while accumulating metal(loid)s and modifying their mobility. However, due to the poor fertility and high metal(loid)s levels of these soils, amendments, like biochar, has to be applied. Phytomanagement is a technique for rehabilitating these soils and reducing the spread of pollutants. To this end, it is advisable to stabilize the mobility of pollutants in the soil before planting plants. Biochar, produced by the pyrolysis of biomass under low oxygen conditions, has gathered attention in the last few years due to its capability to reduce metal(loid)s bioavailability and mobility in soils, as well as its beneficial effects on soil fertility. Indeed, biochar amendment to polluted soil induced usually an increase of pH, water holding capacity, and nutrient contents, associated with a decrease of metal(loid)s concentrations in soil pore water, through sorption on biochar. We tested different biochar concentrations from different wood feedstock in mesocosm and then on a field experimental plot presenting a significant arsenic (500 to 1000 mg/kg) and lead (15000 to 20000 mg/kg) pollution. Biochar from hardwood feedstock and more particularly the one obtained from bark and presenting the finest grain size (Lebrun et al. 2018) has shown good efficiency by reducing the availability of lead in soil pore water by more than 90% and keeping arsenic levels in the soil pore water below critical environmental concentrations. For the all plant species tested (Phaseolus, Populus, Salix, Ailanthus altissima, Alnus, Agrostis, and Trifolium) in biochar amended soils we show that biochar has allowed the establishment of a dense vegetation whereas until then the soils were bare and unsuitable for any plant development (Lebrun et al 2019, Nandillon et al 2019).

In conclusion, we can affirm from mesocosm and field tests that biochar obtained from bark and having a fine particle size is an efficient material for the stabilization of metal(loid)s pollutants in the soil allowing the decrease of As and Pb phytoavailability. The beneficial effect of biochar on the vegetalisation of soils contaminated with heavy metals has been improved by the addition of other amendments such as compost or red mud.

References:

Fig: Effect of different biochar feedstocks (Ba = bark, Sa = sapwood, He = heartwood) and granulometry (0.2 to 0.4 mm, 0.5 to 1 mm and 1 to 2.5 mm) on Pb soil pore water concentration of a mining technosol (PG).