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Biochar Amendment Associated to Compost and/or Iron in Order to Improve Lead and Arsenic Soil Stabilization and *Salix Viminalis* Growth

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Extended Abstract

More than one million of sites are potentially contaminated in Europe, mostly by metal(loid)s [1]. Such soil pollution constitutes a major problem, as it is a threat to both the environment and the human health. Therefore, polluted areas need to be remediate. Phytoremediation, the use of plants and associated microorganisms to reduce the contaminants risks, is a technique chosen nowadays over chemical and physical ones since it is an environmental friendly and cost-effective solution [2]. Phytoremediation process relies on the establishment of a plant cover that will stabilize the soil and prevent wind erosion and water leaching. Moreover, the plants will take up the contaminants and store them in their tissues. *Salix viminalis*, a woody species, has shown potential in phytoremediation. Indeed, it is characterized by (i) high biomass production, (ii) deep and wide root system, (iii) high capacity to tolerate and accumulate metal(loid)s [3]. However, contaminated soil conditions being extremes, amendment application is recommended in order to permit plant establishment.

Among amendments, biochar, a carbonaceous product obtained from the pyrolysis of biomass under low oxygen conditions, was shown as a good soil conditioner to ameliorate soil fertility, thus to promote plant growth [4]. Additionally to biochar, compost also has been demonstrated to improve soil conditions; this product is formed through microbial degradation, it is rich in humic substances, microorganisms and inorganic components [5]. However, both biochar and compost showed efficient sorption capacities towards metal cations but not to metal anions [6]. This can be problematic in the case of multi-contaminated soils. A solution is to use Fe based amendments, like iron grit, whose oxidation after soil incorporation will provide sorption surfaces for both metal cations and anions [7].

The objectives of the study were to evaluate, with a focus on the rhizosphere area, the effects of biochar, compost and iron grit, applied alone or combined, on the: (i) soil physico-chemical properties, (ii) *Salix viminalis* growth and metal(loid)s accumulation/tolerance, (iii) soil metal(loid)s stabilization.

A mesocosm experiment was set up, using a former mine technosol, located in Pontgibaud (France) amended with biochar (5%), compost (5%) and iron grit (1.5%), alone or in combination, and non-rooted cuttings of *Salix viminalis* grown for 69 days in greenhouse conditions.

The soil pore water and soil analyses showed an improvement of the soil physico-chemical properties following amendment addition, i.e pH and electrical conductivity increases together with a decrease of Pb concentrations. Such ameliorations led to a better plant growth, except in the case of the iron amendment, alone and in combination with biochar, which can be attributed to a too high application dose. In addition, plant root enzyme activities rose in the case of biochar and/or compost amendments. It was also observed that metal(loid)s were mainly accumulated in the roots with low translocation towards aerial organs, which demonstrated the phytostabilization potential of *Salix viminalis* plants. Moreover proteomic profiles were analyzed to better understand the mechanisms/network associated to plant metal(loid)s accumulation and/or stabilization. Finally, based on those results, we will define the best amendment or combination for future large-scale stabilization of metal(loid)s contaminated areas, using *Salix viminalis*.

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