

Modified biochar amended phytostabilization of selenium in contaminated soil under cold climate in northern Québec (Canada)

Selma Etteieb¹, Flavia Braghiroli², Émilie Robert¹, Sara Magdouli³, Satinder Kaur Brar³, and Jean-François Blais⁴

¹Centre Technologique des Residus Industriels

²Université du Québec en Abitibi Temiscamingue

³York University

⁴Institut national de la recherche scientifique

May 18, 2023

Abstract

The strategy of combining phytostabilization and biochar amendment was suggested as an alternative for selenium (Se) bioremediation in contaminated soils. The current study aimed to test the performance of activated biochar as an amendment for the phytostabilization of selenium in soil by *Phleum sp.* For this, *Phleum sp.* had been grown in Se-contaminated soil mixed with activated biochar which was produced by the pyrolysis of wood residues and the activation of biochar at 900°C in presence of superheated steam. Results showed that Se immobilization in soil was enhanced by the addition of activated biochar owing to its improved physicochemical structure compared to non-modified biochar. In parallel, activated biochar contributed to the improvement of soil fertility by increasing pH and organic matter. The bioaccumulation factor (BAF) of Se in absence of activated biochar and biochar amendment was 8.7, which suggests the suitability of *Phleum* plant species as Se secondary accumulator species to be further used in a Nordic context. Se plant uptake was positively correlated to Se level in soil, pH, redox potential, organic matter, cations, metals (Al, Cr, Fe, Mn, Co, Pb) and anions (Cl, SO₄). However, Se bioavailability for plant uptake was reduced due to Se immobilization in soil by activated biochar which reduced the translocation of Se from soil to plant and then its bioaccumulation in plant. Thus, combination of activated biochar and *Phleum* Se-accumulator plant was validated as an efficient solution for Se remediation in contaminated soil which could be applied at large scale under cold climates.

Hosted file

Manuscript-Etteieb et al.docx available at <https://authorea.com/users/619800/articles/644132-modified-biochar-amended-phytostabilization-of-selenium-in-contaminated-soil-under-cold-climate-in-northern-qu%C3%A9bec-canada>