Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29457

Modified biochars for soil remediation: Effects of Mn oxide impregnation on metal(loid) immobilization and plant uptake

ZUZANA VANKOVA[1], MANHATTAN LEBRUN[2], SAYYEDA HIRA HASSAN[3], ZUBDA ZAHID[1], PETR OUREDNICEK[1] AND LUKAS TRAKAL[1]

[1]Czech University of Life Sciences Prague
[2]Université Marie et Louis Pasteur, CNRS
[3]University of Bologna

Biochar is commonly utilized to immobilize metal(loid)s in contaminated soils. However, its effectiveness towards targeted contaminants varies and can be enhanced through various surface modifications. One such possible modification involves impregnating biochar with amorphous Mn oxides (creating thus so-called AMOchars), which has shown potential for improving metal(loid) sorption and immobilization. On the other hand, increased leaching of Mn and dissolution of soil organic matter can occur in the presence of AMOchar, resulting in the phytotoxic effects of released Mn and unwanted loss of soil organic matter. To address this, two new types of AMOchars were synthesized using either molasses (BCM) or sucrose (BCS) as a reducing agent. These were applied to multi-contaminated soil planted with ryegrass and compared with unmodified biochar (BC). Soil solution monitoring revealed that all amendments increased pH by 0.7-1.2 units and effectively immobilized Cd, Pb, and Zn compared to control values. AMOchars further enhanced Cd and Zn immobilization while simultaneously increasing the release of dissolved organic carbon, As, Cu, and Mn. The amendments also influenced metal(loid) accumulation in ryegrass differently. BC reduced shoot concentrations of As (69%), Cd (37%), Cu (42%), Mn (34%), and Zn (45%). Among AMOchars, only BCS significantly reduced plant uptake of Cd (63%), Pb (79%), and As (76%). Regarding metal(loid) translocation, both AMOchars facilitated Cu and Mn movement, with BCM also promoting As and Pb translocation. The BCS thus appears as a promising candidate for aided phytostabilization of soils contaminated with different types of metals and metalloids. Although its application resulted again in increased release of Mn and dissolved organic carbon, their concentrations were significantly lower than for AMOchar composites tested before.