# NOVEL BIO-AMENDMENTS FOR PHYTOTOXICITY REDUCTION OF HEAVY METALS IN CONTAMINATED SOILS

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Serpentine surrounding soils containing excessive concentrations of heavy metals, create an unfavourable environment for agriculture and human health. Application of biofilm and biochar were evaluated as potential bio-amendments on the reduction of bioavailable Ni, Mn and Cr in serpentine soil. Bacteria were isolated from serpentine soil combined with a garden soil fungus to form a fungal bacterial biofilm. Biochar (BC300, BC500 and BC700) were prepared by slow pyrolysis of *Gliricidia sepium* biomass at three different temperatures (*i.e.* 300, 500 and 700 $^{0}$C) with a holding time of three hours. A pot experiment was conducted with tomato (*Lycopersicon esculentum* L.) plants by adding biochar at three different percentages; 1, 2.5 and 5% (w/w) with and without biofilm. Soil without amendments served as the control, where all treatments were triplicated and arranged in a Complete Randomized Design. Bioavailable concentrations of metals were assessed by 0.01 M $CaCl_2$ extraction whereas sequential extraction method was conducted to determine the geochemical partitioning of heavy metals in mineral and organic phases. After five weeks, tomato plants were harvested and analyzed by digestion. The most effective treatment for metal removal was 5% BC700 as indicated by immobilizing efficiencies for Ni, Mn and Cr with 92, 94 and 100%, respectively, compared to the control. Tomato plants grown in the 5% BC700 treatment showed the highest biomass (seven-fold) than the control. Application of biofilm and biochar together had no significant difference *($p>0.05$)* compared to the biochar amended soils for metal immobilization. Sequential extraction method indicated that the amounts of Ni, Mn and Cr in the exchangeable fraction of serpentine soil had reduced significantly *($p<0.05$)* in 5% BC700 treatment. Results suggested that the addition of 5% biochar treatment produced at 700 $^{0}$C is capable of immobilizing heavy metals and thereby reducing the phytotoxicity in serpentine soil, whereas the application of biofilm together with BC700 is better for plant growth.

***Keywords***: Biochar, Biofilm, *Gliricidia sepium*, Pyrolysis, Serpentine soil