

COMPOSITE OF BIOCHAR AND NANO ZERO-VALENT IRON FOR REMEDIATION OF METAL-CONTAMINATED SOIL: SIMULATED SOIL PROFILE CONDITIONS

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Biochar (BC; pyrolysed waste biomass) represents an efficient sorbent, which may improve soil properties and the overall soil quality. However, its sorption ability is limited to selected metals only. In contrast, high reduction ability of nano zero-valent iron (nZVI) is favourable for the removal of redox-sensitive contaminants. Recent research on nZVI, BC and their modifications has shown promising results towards metal(loid)s immobilisation in soils. Moreover, the combination of BC and nZVI give the material unique properties including large specific surface area and high reduction ability, which enables efficient sorption of a wide range of contaminants.

The immobilisation efficiency of amendments is often tested in static batch experiments. In this study, we aimed to assess the effect of the BC composite on the behaviour of metals in a dynamic system of simulated soil profile using column leaching experiments. This approach, i.e., water infiltrating through a column, provides much better insight to real-scale soil processes and allows more appropriate assessment of the metal behaviour as well as the amendment efficiency.

Soil contaminated with Zn, Pb, Cd, and As was tested. Firstly, the soil was mixed with 2 wt.% of BC, nZVI, and BC-nZVI composite, respectively, and applied into a column. The following scenarios were investigated: (i) continuous water flow using demineralised water, (ii) new atmospheric pollution entering the soil using a solution mixture of contaminants (Zn, Pb, Cd, As at pH 5), and (iii) demineralised water flow again. The leachates were collected every weekday and analysed for pH and chemical composition. Solid phase analysis of the amended soil was performed to investigate the mechanisms of metal-contaminant immobilisation. The leachate composition showed a decrease in Cd and Zn concentrations with increasing time of the experiment, indicating a long-term efficiency of the BC-nZVI composite for metal immobilisation.