

Biochar-supported nanoscale zero-valent iron tested in dynamic soil leaching experiment

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The use of biochar (BC), nano zero-valent iron (nZVI), and their combination has shown to be efficient for metal(loid)s stabilisation in soils. Biochar, a product of organic matter decomposition under oxygen-limited conditions, is a sorbent and fertiliser at the same time. High reduction ability of nZVI is favourable for the removal of redox-sensitive contaminants. The combination of nZVI and BC give the material unique properties and represents promising sorbent for a wide range of contaminants. In this study, we aimed to assess the effect of the BC composite on the behaviour of metals and arsenic.

The immobilisation efficiency is often tested in static batch experiments; however, dynamic system in soil column leaching experiments provides much better insight to real-scale soil processes and behaviour of both the contaminants and the amendment. Contaminated soil (Zn, Pb, Cd, and As, a result of former mining and smelting activities) was mixed with 2 wt.% of BC, nZVI, and BC-nZVI composite, respectively, and applied into a column. Control column (i.e. soil without an amendment) was run for comparison. Automated system with continuous water flow was used. After initial full saturation of the columns, three experimental stages followed: (i) demineralised water flow, (ii) solution mixture of contaminants (Zn, Pb, Cd, As at pH 5) to investigate the impact of new atmospheric pollution entering the soil, and (iii) demineralised water flow again. The solution samples were collected every weekday and analysed for pH and the content of major/trace elements as well as dissolved organic carbon (DOC). The first results indicated the transport of nZVI particles in the column, while no transport was observed for BC-nZVI composite. The presence of nZVI significantly changed the solubility of DOC and thus the mobility of metals. The functionality of the composite seems to be driven by kinetics, since the immobilisation efficiency was enhanced with increasing time of the experiment.