Geophysical Research Abstracts
Vol. 20, EGU2018-1334, 2018
EGU General Assembly 2018


# Stabilization of metal(loid)s using amorphous manganese oxide -biochar composites

Petr Ouředníček, Barbora Hudcová, Lukáš Trakal, and Michael Komárek

Faculty of Environmental Sciences, Czech University of Life Sciences Prague, Prague – Suchdol, Czech Republic (ourednicek@fzp.czu.cz)

This study focuses on the stabilization efficiency of novel amorphous manganese oxide(AMO)-biochar composites in soils. Biochar is an activated organic carbon that belongs to the group of stabilizing agents which can effectively immobilize a wide range of contaminants, including metal(loid)s. The main advantages of this stabilizing agent are its large surface area and surface functional groups (e.g. COO–) that enable complexation reactions with metal(loid)s. The affinity of these organic groups is high for metal cations such as Cu(II), Cd(II) and Pb(II) since these groups enable formation of metal chelates. In addition, alkaline elements on the surface and in the structure of biochar can increase cation exchange capacity. Despite of a quite high stabilizing effect for wide range of metal(loid)s, main disadvantages of this material is its low stability in strongly alkaline environments and a very low stabilizing efficiency for metalloids such as As. A modification of biochar could positively enhance these „weaknesses“. Due to a large porous structure, biochar can be easily modified - using various secondary oxides that improves its sorption efficiency. Based on these facts, innovative AMO-biochar composites have been synthesized. In general, biochar was added to the standard synthesis procedure of amorphous manganese oxide (AMO), i.e. a sol-gel reaction using glucose and KMnO4. To make the AMO synthesis more economical, the procedure was optimized to minimize the content of residual water and to maximize the yield of raw AMO by modification of glucose/manganese ratio and/or their concentration. The effect of the AMO/biochar ratio was also tested. Additionally, the glucose that is a reducing agent during the AMO synthesis has been substituted by molasses as a suitable low-cost material. The basic characterization of synthesized materials was performed by XRD, XPS and FTIR analyses. The results showed that Mn-phases such as Mn-oxalates and rhodochrosite coated the surface of pristine biochar. Based on the sorption experiments, AMO-biochar composites were able to remove significantly higher amounts of As(V), Cd(II) and Pb(II) from the solution compared to pristine biochar The sorption efficiency was high not only in the case of Pb(II) sorption (almost 99%) and Cd(II) sorption (51.2%), but also a very high amount of As(V) (despite higher pH of the material) was effectively stabilized using AMO-biochar composites (91.4%). Additionally, AMO-biochar composites were able to reduce the Mn leaching. This can avoid potential post-contamination caused by the dissolution of the less stable Mn-oxalates as has been observed in the case of pure AMO. According to the results of this study, innovative AMO-biochar composites seems to be very effective materials for stabilization of metal(loid)s in the soil and it could be used as a relatively low-cost method for remediation of such contaminated environments.