Tagungsnummer
V67

Thema
Kommission II: Bodenchemie

Schicksal, Wechselwirkungen und Wirkung von bodenfremden Stoffen im Boden

Autoren
J. Rinklebe[1], S. M. Shaheen[1], A. El-Naggar[2], F. Tack[3], Y. S. Ok[2]
[1]Universität Wuppertal, Boden- und Grundwassermanagement, Wuppertal; [2]Kangwon National University, Korea Biochar Research Center, Chuncheon, Korea; [3]Ghent University, Belgium, Department of Applied Analytical and Physical Chemistry, Ghent, Belgium

Titel
Speciation of vanadium in the dissolved, colloidal, and sediment phase under dynamic redox-conditions in a V contaminated soil treated and untreated with biochar

Abstract
Vanadium is a redox-sensitive toxic element and can exist in a variety of oxidation states: ?1, 0, +2, +3, +4, and +5. Vanadium (+5) is considered as a potentially dangerous pollutant. Biochar (BC) can be used to remediate soils contaminated with potential toxic elements (PTEs) including V. However, the efficiency of BC to immobilize V and its on speciation of V in the dissolved and colloidal phase and its mobilization and phytoavailability in the sediment phase under dynamic redox-conditions in highly contaminated soils under dynamic redox conditions has not been studied up to date. Thus, we have i) quantified the impact of pre-definite redox conditions on the speciation and release dynamics of V in the dissolved and colloidal phase as well as on the mobilization and phytoavailability of V in the soil sediments phase in a highly contaminated alkaline soil (CS) (non-treated) (pH = 7.44 and total V = 1,040 mg kg^{-1}) collected from China and in the same soil treated with BC (CS+BC), and ii) assessed the impact of rice husk biochar as soil amendment on the same parameters. The impact of redox potential (E_H), pH, dissolved organic carbon (DOC), dissolved inorganic carbon (DIC), iron (Fe), manganese (Mn), and sulfate (SO_4^{2-}) on speciation and release dynamics of V was also determined under dynamic redox conditions. In addition, the used biochar was characterized using scanning electron microscopy (SEM) coupled with energy dispersive X-ray spectroscopy (EDX) and nuclear magnetic resonance spectroscopy (NMR). The experiment was conducted in stepwise from moderate reducing (-30 mV in CS and -12 mV in CS+BC) to oxidizing (+218 mV in CS and +333 mV in CS+BC) soil conditions in different cycles using a highly sophisticated automated biogeochemical microcosm apparatus.
Flooding of the CS and CS+BC caused significant changes of pH values which varied from 6.15 to 8.33 in the CS and from 5.14 to 7.91 in the CS+BC and the E_H correlated negatively with pH. The dissolved concentrations of V varied from 15.2-46.4 mg L^{-1} in the CS to 14.9-50.2 mg L^{-1} in the CS+BC, while the colloidal concentrations of V varied from 39.5-49.9 mg L^{-1} in the CS to 31.8-50.2 mg L^{-1} in the CS+BC.
Different redox cycles affected significantly the speciation and release dynamics of V in the dissolved and colloidal phase and its mobilization and phytoavailability in the sediment phase.