Table of Contents

In Press

Online First

Article Archive

SWR (13) 2018

SWR (12) 2017

SWR (11) 2016

SWR (10) 2015

Issue No. 1 (1-63)

Issue No. 2 (65-136)

Issue No. 3 (137-205)

Issue No. 4 (207-283)

SWR (9) 2014

SWR (8) 2013

SWR (7) 2012

SWR (6) 2011

SWR (5) 2010

SWR (4) 2009

SWR (3) 2008

SWR (2) 2007

SWR (1) 2006

Editorial Board

Ethical Standards

For Authors

Author Declaration

Instruction for Authors

Submission Templates

Copyright

Guide for Authors

Fees

Submission/Login

For Reviewers

Guide for Reviewers

Reviewers Login

Subscription

Sorption of heavy metals in organic horizons of acid forest soils at low added concentrations

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The individual adsorption/desorption of Cu, Pb, and Zn in six soil samples taken from organic horizons of acid forest soils is studied in batch experiments. These three metals were chosen because of the varying extent of their sorption to the soil organic matter. The initial concentration range for all metals is 0–200 mg/l. 0.01 mol/l $Ca(NO_3)_2$ was used as the background electrolyte. Soil samples were taken at random locations throughout a relatively small area and are characterized by small differences in mineralogical composition. Organic matter content and pH of soils are considered as the key factors causing differences in sorption/desorption behaviour of selected metals. In general, the sorption of all the three metals increased with a combination of higher pH value and increasing organic matter content. Anyway, the extent of the influence of these two characteristics on sorption behaviour of metals is different, for desorption significant differences were not determined. Copper sorption seems to reflect mainly the differences in organic matter content in addition to the differences in pH. The average amount of sorbed Pb was approximately 90%, Cu sorption averaged 60%, and that of Zn 30%. Desorption of Pb into 0.01 mol/l $Ca(NO_3)_2$ remained at approximately 4%, for Zn at 30%, and desorption of Cu reached up to 13% of the amount adsorbed. All the studied soils proved effective at immobilizing lead and copper, but zinc was relatively highly released from these soils, even when the sorbed amount was minimal. Different vegetational background of these samples (either beech or spruce forests) does not significantly influence the sorption extent of these metals as the lower pH of samples taken under spruce stands is probably compensated by higher organic matter content in these samples. The experimental data are fitted by the Freundlich equation and the parameters of this equation together with the adsorption and desorption efficiency are used for comparison of the behaviour of all the three metals among the six soils.

Keywords:

acidic soils; adsorption; desorption; organic matter; risk elements

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