Geophysical Research Abstracts
Vol. 19, EGU2017-1238, 2017
EGU General Assembly 2017

Concentrations of selected heavy metals in bryophyte tissues at Cu-mine heap Podlipa in L'ubietová (Central Slovakia)

Pavel Širka and Pavol Midula

Department of Biology and Ecology, Faculty of Natural Sciences, Matej Bel University, Banská Bystrica, Slovakia (pavel.sirka@umb.sk)

Mine heaps and wastes created by mining industry belong to one of the most extreme man-made habitat types. In addition to their specific microclimatic conditions mine heaps are also characterized by increased contents of heavy metals and toxic substances in the soil substrate. These substances are transported into plant bodies and create difficult conditions for their growth. However, there are some plants that can cope with extremely high metal contents and are capable of growing on metalliferous habitats. These plants develop unique adaptation mechanisms and basically represent modified ecotypes with specific tolerances to certain heavy metals adapted through microevolutionary processes. The toxic effects of heavy metals on vascular plants are known for quite a long time, however, bryophytes are also known to accumulate certain heavy metals without any visible signs of damage. Because of this ability they have been successfully used in biomonitoring. Chemical analysis of contaminants in samples of bryophytes can reflect the state of environmental pollution.

The aim of this work was to analyze the concentrations of 6 heavy metals (Fe, Cu, Zn, Mn, Pb and Cd) in tissues of 16 bryophyte samples at an abandoned Cu deposit Podlipa in L'ubietová and to compare them with concentrations of these elemens in soil samples and 9 vascular plant species (belonging to different growth forms) in a research performed by Andráš et al. (2014) in the studied area. Bryophytes were collected at 10 sampling sites randomly chosen in the dump-field area and consist of 14 different moss species. Only above-ground parts of bryophyte thalli (separated from rhizoids, gravel, soil, needles etc.) were used for analysis. Samples were dried at room temperature and subjected to microwave mineralization (MWS – 2 Berghof). The detailed procedure is defined in the Application Report MWS - 2 / Food, Pharma, Cosmetics (Berghof). In order to determine the concentrations of studied elements, atomic absorption spectrometry with flame atomization (AVANTA Σ, GBC) was used.

Concentrations of Fe in bryophyte samples were significantly higher compared to those in the soil and on average quite similar to those in vascular plants. Differences in contents of Cu were the most significant from all analyzed chemical elements. The highest concentrations of Cu in bryophyte samples were observed in both samples (9 and 10) of Pohlia drummondii (4010.3 mg.kg-1 and 1900.8 mg.kg-1 respectivelly), which in sample 9 was 18 to 470 times higher than in other bryophyte samples, slightly higher than the average value in the soil (3253 mg.kg-1) and considerably higher than in the leaves of Mentha longifolia (173.3 mg.kg-1), which had the highest concentration of Cu among vascular plants. Concentrations of Zn and Cd in bryophyte samples were on average slightly higher than in soil and vascular plant samples. On average, concentrations of Pb were considerably lower in bryophyte samples than in soil and vascular plant species. No significant differences were observed in Mn.

Given their specific anatomy and morphology, there is a dispute in various studies as to whether a certain heavy metal is indeed the controlling factor for the distribution of bryophytes on metal-contaminated sites. Perhaps the tendency of these mosses to grow on mineralized substrates is a species characteristic, not a mutual one. Detailed study of bryophytes in relation to phytoextraction or phytostabilization of heavy metals may be used in succession management process aimed at restoring the environment, particularly the soil and air.

Aknowledgement: This work was realised with the help of doc. RNDr. Zuzana Melichová, PhD. and Peter Harčár from the Department of Chemistry, Faculty of Natural Sciences, Matej Bel University in Banská Bystrica and financially supported by grant scheme VEGA 1/0538/15.