

ACCUMULATION OF HEAVY METALS IN SAMPLES OF BIOTA GROWING IN THE FOREST AREAS OF SOUTHERN AND NORTH EASTERN POLAND IN THE YEARS 2014-2015

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Introduction

Mechanisms of bioaccumulation and translocation of heavy metals in the environment have been the subject of research for several decades, including for the possibility of using living organisms as biomarkers and biomonitors of environmental quality.

The presented results concern the comparison of the accumulation levels of selected heavy metals Mn, Ni, Cu, Zn, Cd and Pb in different elements of biota: epigeic moss *Pleurozium schreberi*, epiphytic lichen *Hypogymnia physodes*, birch *Betula* L. leaves and spruce *Picea abies* L. needles, growing on areas of different intensity of anthropogenic impacts. The research is focused on the assessment of the sources (primary and secondary) of contaminants accumulated in plants and the assessment of the impact of ecosystems contamination, and seasonal changes on the concentrations of heavy metals in the studied biota samples.

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Methods

The samples were collected on the areas of the southern Poland: in Beskidy, where for more than a decade is observed a gradual degradation of forest ecosystems under the influence of emissions from the Upper Silesian Industrial Region (PL) and the Ostrava-Karviná Coal Basin (CZ); in Karkonosze Mountains, an area which in the 70s was under strong influence of emissions from utility power plants, deployed in the so-called "Black Triangle", on the border areas of former Czechoslovakia, the German Democratic Republic and Poland; and on slightly contaminated forest areas in the north-eastern Poland: Borecka, Knyszyńska

and Białowieska Forests in 2014 and 2015 (three sessions each year: Spring, Summer, Autumn). After manual removal of impurities and drying in 323 K, the collected material was stored in closed polyethylene containers. The 0.4 g of subsamples taken from homogenized material were mineralized in mixture of nitric acid and hydrogen dioxide (1:3) in microwave mineraliser Speedwave Four (Berghof, Germany). Concentrations of Mn, Ni, Cu, Zn, Cd and Pb were determined with FAAS method, using iCE 3000 (Thermo Electron Corporation, USA).

Results

The two-year biomonitoring study indicate that among the studied areas the greatest accumulation of heavy metals in the studied species of biota is present in the Beskidy Mountains, mainly Zn, Cd and Pb. On the other areas the mean concentrations of the metals are formed diversely, depending on the analyzed biological material, sorbed metal and season. The largest concentrations of heavy metals were determined in samples collected at the beginning of the growing season. This is probably the result of low emission during the heating season. Such trends have not been observed in the Knyszynska Forest, which may indicate the full-year impact of emissions from the nearby city of Białystok. It should be noted that the accumulation of heavy metals in the moss, lichens and needles and leaves of trees is the result of wet and dry deposition, wherein the atmospheric aerosol may be re-enriched with contaminants elevating from the soil with dust, in the case of moss the transport from soil can also be accessed via water wetting mosses (Kłos et al., 2012). The most important direction of transport of metals, in the case of trees and other root plants, is the translocation from rhizosphere.

Conclusion

So far an unsolved problem of biomonitoring methods the impacts of abiotic and biotic factors affecting the equilibriums and kinetics of translocation of contaminations between the environmental matrixes and the elements of biota, making it difficult to validate these methods. Despite this, the current level of knowledge allows the biomonitoring studies to provide much information concerning environmental contamination, sources of contaminants and the directions of their spread.

References

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