The influence of conditions of the biomonitoring study using mosses on its results

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Abstract

The aim of the study was to evaluate the effect of the conditions of the experiment (wind direction, the exposure time and the distance from the emission source) on the biomonitoring study using mosses results. Additionally, was analyzed the level of contamination of the studied area due to low emission. The study of atmospheric aerosol contamination was performed using active biomonitoring (moss-bag method) using *Pleurozium schreberi* moss. Following the exposure period (November 2015 - February 2016), in the mosses were determined concentrations of heavy metals: Mn, Cu, Zn and Pb using atomic absorption spectrometry with excitation flame (*FAAS*). The determined relative accumulation factors (*RAF*) in the exposed moss samples indicate the close correlation between increases in concentrations of the analytes and the conditions of the carried out experiment.

Keywords: *Plerozium schreberi* mosses, heavy metals, active biomonitoring, relative accumulation factor *RAF*

Materials and methods

Samples of mosses *Plerozium schreberi* of a weight approx. 10 g d.m. (d.m. - dry mass) were placed in perforated polyethylene containers to be used in active biomonitoring (moss-bag method). The moss samples were exposed during 1-, 2- and 3 months in the village Janow in the Swietokrzyskie Province (south-eastern Poland). The exposed samples of *Plerozium schreberi* were hung at a distance of 3, 6 and 9 meters from the emission source of pollution being the chimney of one of the households in this village. The moss samples were hung at a 1,5 m height.

Fig. 1. *Plerozium schreberi*

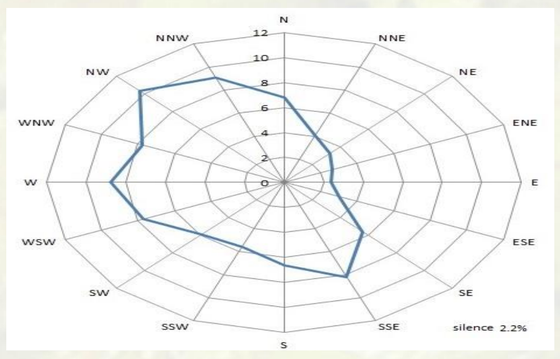


Fig. 2. Windrose for the Janow village

Interpretation of the results

To determine the increases in analyte concentrations in samples of mosses used in active biomonitoring applies the relative accumulation factor *RAF* defined as :

$$RAF = \frac{C_{i,1} - C_{i,0}}{C_{i,0}}$$

where:

$C_{i,0}$ – concentration of the analyte before the exposure [mg/g d.m.]

$C_{i,1}$ – concentration of the analyte after the exposure [mg/g d.m.]

Description of symbols:

$1.E3_1$

where:

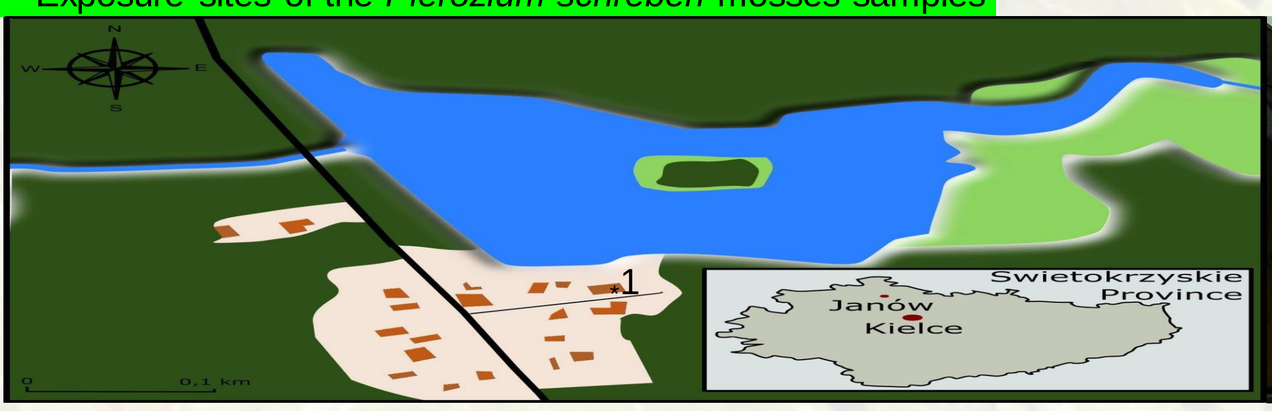
1 – numer of the sample

E – compass direction (E- east, W- west)

3 – distance form the emission source: 3, 6, 9 [m]

$_1$ – exposure time: 1, 2 or 3 months

Exposure sites of the *Plerozium schreberi* mosses samples



Analysis of the studies results

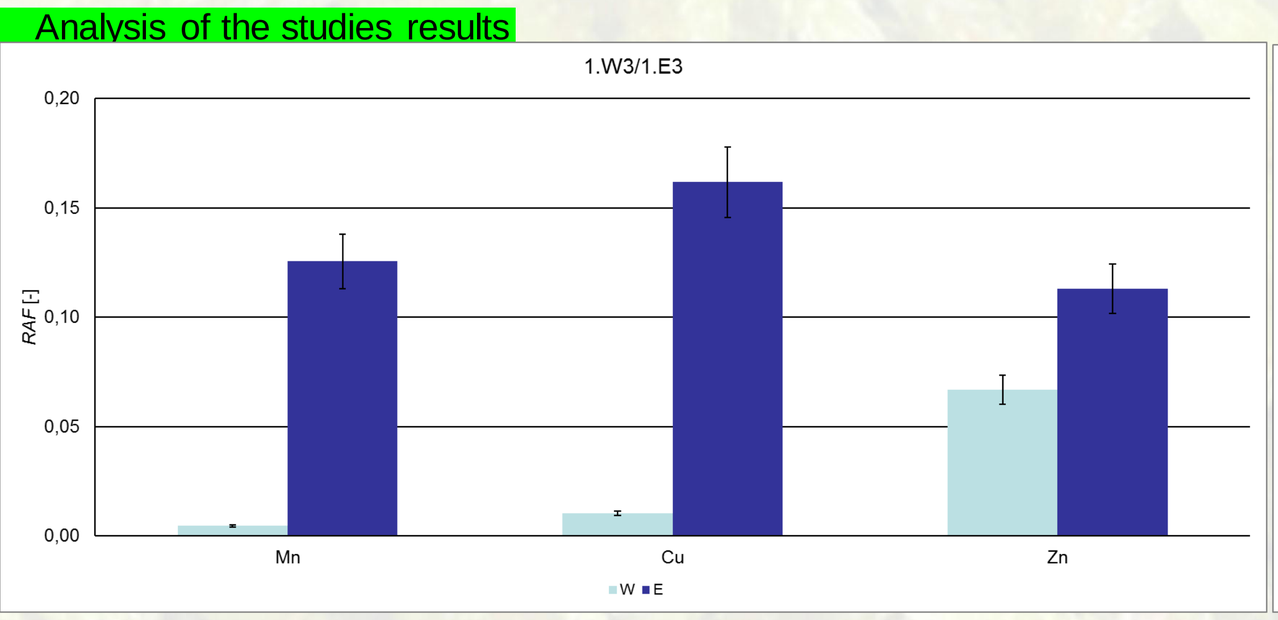


Fig. 3. The influence of the wind direction on the study results

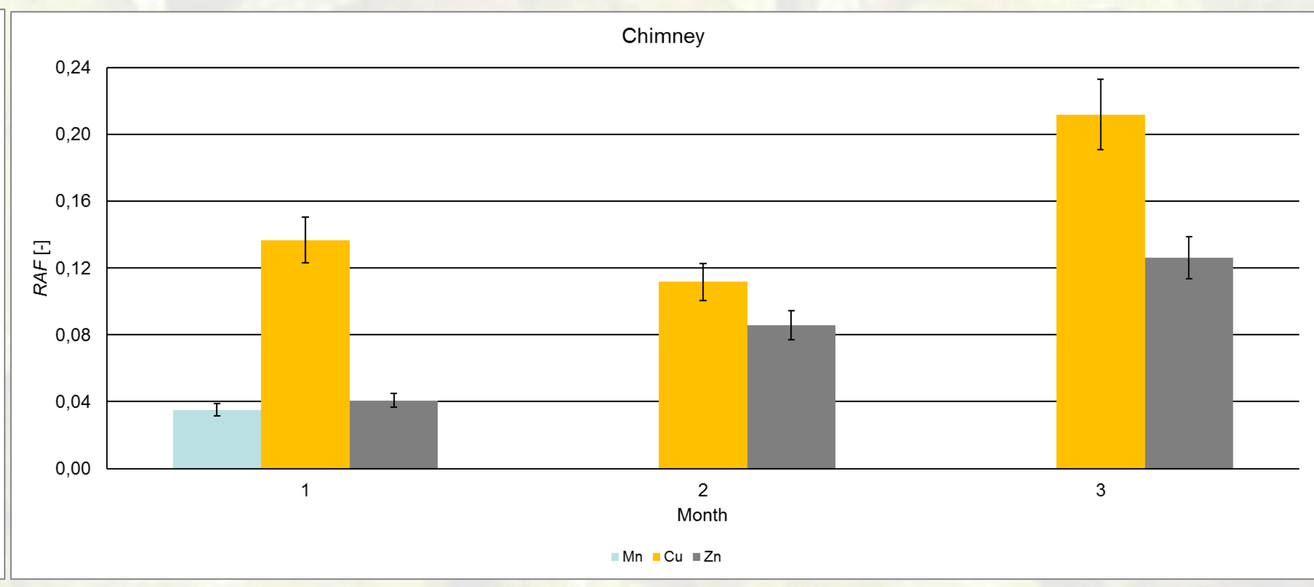


Fig. 4. The influence of the exposure period on the study results

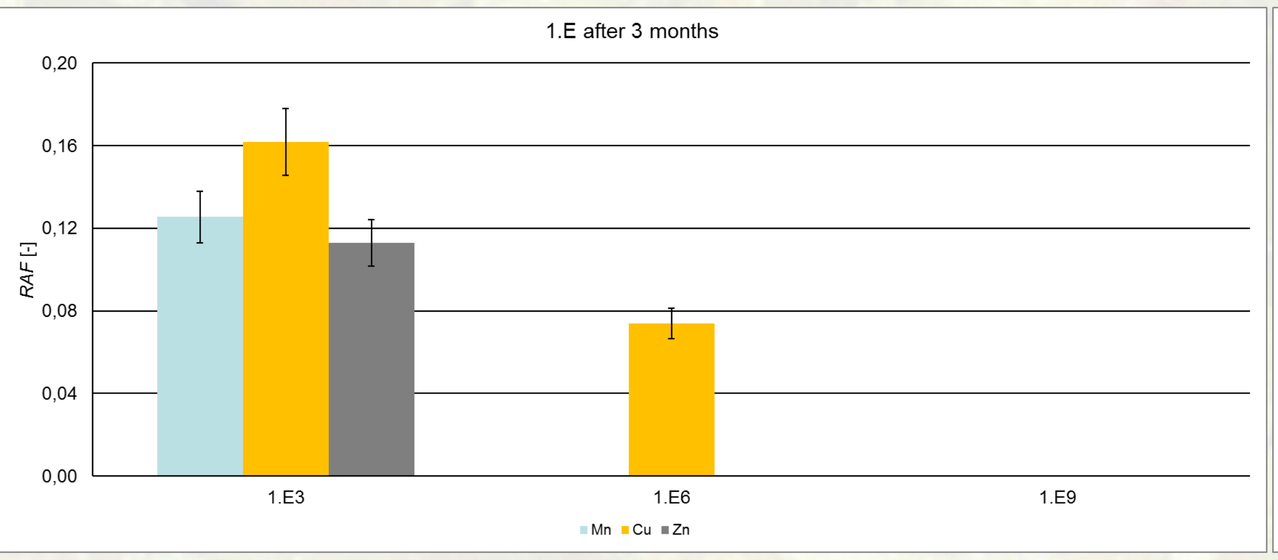


Fig. 5. The influence of the distance from the emission source on the study results

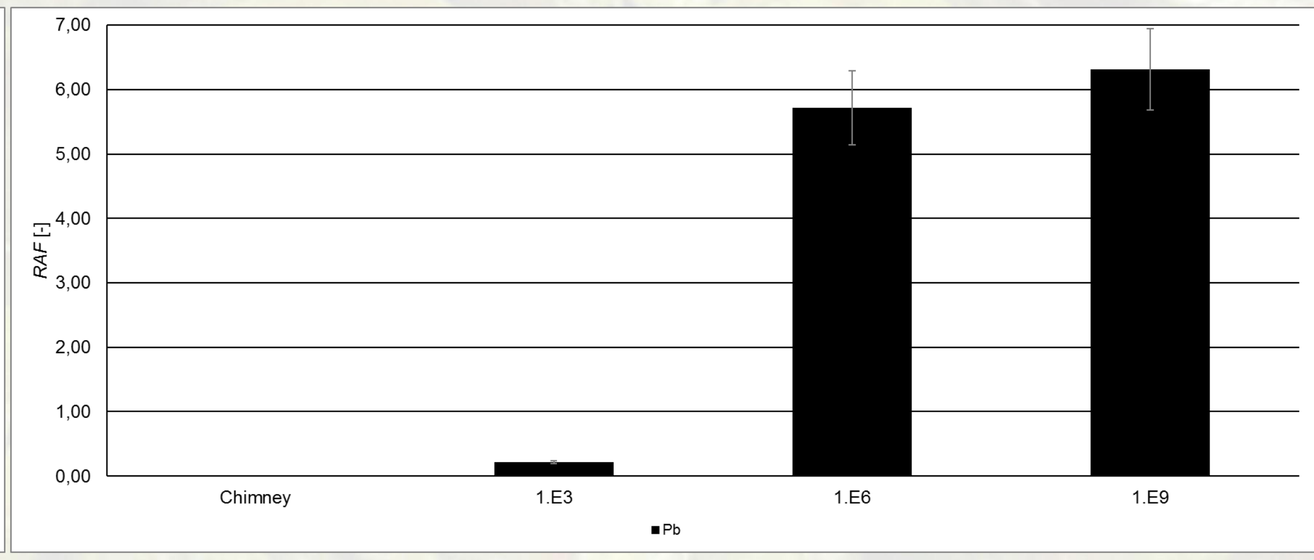


Fig. 6. The influence of the distance from the emission source on the increase in concentration of Pb in the moss samples

Conclusions

Wind direction is crucial for the distribution of surface deposition of contaminants from individual sources of low emission. The largest increases in the concentrations of manganese, copper and zinc were found in samples located 3 meters away from the emission source, after the 3-month exposure period. The largest increases in lead concentrations were found in samples exposed at a distance of 6-9 meters from the emission source, also after 3-month exposure period.