

Abstract

“Study of the impact of non-ferrous metal foundries on the nearby forest ecosystem: impact of heavy metal emissions on soil and fungi”

Martyna Saba, MSc

The production of industrial goods is of fundamental importance for everyday human life. According to the law and good production practice (the principle of sustainable development), industrial plants should use environmentally friendly technologies that support human life and do not harm the environment. Nevertheless, industrial production is often associated with introducing pollutants such as heavy metals into the environment. These are generated during the production process and are burdened with the stigma of negatively impacting living organisms. Thus, the control of industrial emissions is critical to sustainable development and human health. The research project supporting this thesis involved recognition and assessment of the scale of impact of heavy metal emissions from the non-ferrous metal foundry operating in Sobowidz, on the ecosystem – in particular, edible and other mushrooms (eaten by animals), and the soils of the Sobowidz forest and village.

The scope of the work included the collection of representative material for research: top (0-10 cm) soil layer (Sobowidz village) (i); top layer (0-10 cm) of forest soil (Sobowidzki Forest) (ii); soil profiles (iii) and fruiting bodies of macrofungi from the Sobowidzki Forest (iv) and analysis of the content of elements: Ag, Al, As, Ba, Be, Bi, Ca, Cd, Co, Cr, Cs, Cu, Fe, In, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Rb, Sb, Se, Sn, Sr, Tl, U and Zn (by ICP-MS) and total mercury (THg) and methylmercury (MeHg) measured by CV-AAS.

The surface horizons of soils and fungi from the area of the Sobowidz village and the Sobowidzki forest were tested for contamination with methylmercury (MeHg) and selected metallic elements, metalloids and non-metals (Ag, Al, As, Ba, Be, Bi, Ca, Cd, Co, Cr, Cs, Cu, Fe, Hg, In, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Rb, Sb, Se, Sn, Sr, Tl, U and Zn). The results indicated clearly elevated Hg content in the majority of soil samples, which may be related to the earlier activity of non-ferrous metal foundries, as no other source on such a large scale was identified. The examined soil material, specifically the top layer (0-1 cm) of the soil profiles, in several cases was characterized by a significant accumulation of Ca, Mn and Zn. The content of Se in the surface horizons of the soils of the Sobowidzki forest was high (the median value was 0.71 mg kg⁻¹) if compared to soils in the country.

The slightly elevated contents of Cd, Pb and Ni in some of the mushroom material (edible mushroom species) may be related to the contamination of the surface soil levels in the Sobowidzki forest. The results of fungal analyzes for MeHg indicated a relatively high proportion of this highly toxic form of mercury in relation to THg in some species of mushrooms (yellow buttercup, chanterelle) from the forest. According to the available literature, popular methods of culinary processing, such as blanching, pre-cooking, pickling or fermenting, but not necessarily stewing, frying or grilling (sometimes also marinating), have a beneficial effect of reducing the content of metallic elements in mushroom dishes. If so processed, mushrooms obtained in the Sobowidzki forest do not appear to pose a toxicological risk.