

## Circuit heavy metals in nature

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### ABSTRACT

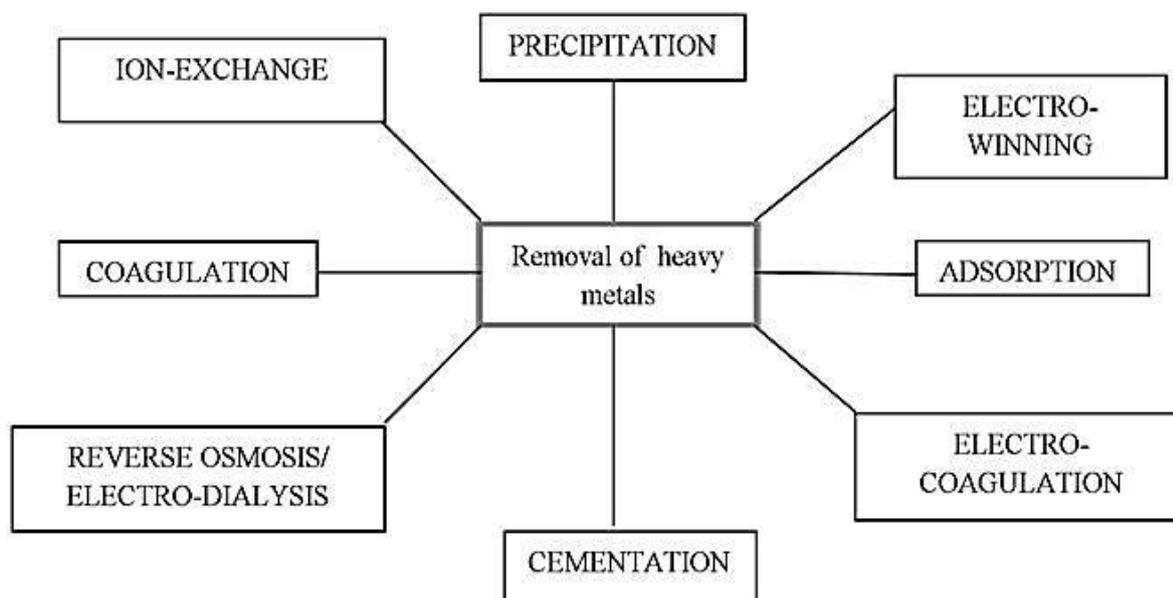
The problem of environmental pollution with heavy metals is still serious, despite numerous activities related to the reduction of anthropogenic emissions of these elements into the environment. There is a growing concentration of many toxic metals in soils and vegetation (remaining in close relation with the state of air quality), and especially in the environment of large urban agglomerations. The paper presents an assessment of the degree of contamination of soil and grass vegetation with heavy metals (Zn, Pb, Cu, Cd) in the vicinity of the communication over Warsaw. Research material obtained from the same locations (samples of soil and grass vegetation) was analyzed (AAS) in terms of the total concentration of metals in soils and its mobile form, while in plants is the total concentration of the corresponding trace the AAS atomic spectrometry. Based on the concentrations of metals in soil and vegetation samples were determined bioaccumulation factors. Methods mobile metals isolated by selective extraction of a 0.05 M EDTA solution. The results obtained were related to the results of similar research conducted two years earlier in 2005. Additionally the effect of leaching of soluble forms of metal particulate pollutants deposited on the surface of vegetation.

**Keywords:** heavy metals, anthropogenic emissions, Zn, Pb, Cu, Cd

### 1. INTRODUCTION

Despite clear in recent years to improve the state of the environment, which is associated with reduced emission of dust and gases into the atmosphere, and the rational management of waste, we still observed a continuous destruction of natural resources. The reason for this state of affairs may be uncontrolled emissions from industrial plants, the dynamic development of automotive and irrational use of pesticides. Consequently, there is an excessive increase in all kinds of contaminants, including various metals. As the Polish energy sector is based mainly on coal and the near future, this situation will not change, the energy industry, which uses both coal and lignite, is considered one of the main sources of the presence of metals in the

environment. Although the combustion of fossil fuels are emitted into the atmosphere primarily sulfur oxides, nitrogen dioxide or particulate matter, it is also present in natural fuels, metals: lead, cadmium, mercury, arsenic, chromium, zinc, copper and nickel. The most important current provision on reducing these emissions in the countries of the European Union Directive 96/61 / EC (known as IPPC) concerning integrated pollution prevention and control.



23 <b>V</b> Vanadium 50.9415	24 <b>Cr</b> Chromium 51.9961	25 <b>Mn</b> Manganese 54.938045	26 <b>Fe</b> Iron 55.845	27 <b>Co</b> Cobalt 58.933195	28 <b>Ni</b> Nickel 58.6934	29 <b>Cu</b> Copper 63.546	30 <b>Zn</b> Zinc 65.38			33 <b>As</b> Arsenic 74.92160
	42 <b>Mo</b> Molybden... 95.96		44 <b>Ru</b> Ruthenium 101.07	45 <b>Rh</b> Rhodium 102.90550	46 <b>Pd</b> Palladium 106.42	47 <b>Ag</b> Silver 107.8682	48 <b>Cd</b> Cadmium 112.411	49 <b>In</b> Indium 114.818	50 <b>Sn</b> Tin 118.710	51 <b>Sb</b> Antimony 121.760
		75 <b>Re</b> Rhenium 186.207	76 <b>Os</b> Osmium 190.23	77 <b>Ir</b> Iridium 192.217	78 <b>Pt</b> Platinum 195.084	79 <b>Au</b> Gold 196.966569	80 <b>Hg</b> Mercury 200.59		82 <b>Pb</b> Lead 207.2	83 <b>Bi</b> Bismuth 208.98040

Guidelines to determine the best available techniques are, however, included in the reference documents (BREF). The main sources of emissions of heavy metals are known. large combustion sources (energy), the most stringent guidelines therefore apply to the combustion of solid fuels. According to the European directives and international conventions most effective method of controlling the reduction of heavy metals from coal combustion can be achieved with the use of electrostatic precipitators and fabric filters in combination with flue gas desulfurization processes. It is also believed that to reduce the load of heavy metals emitted

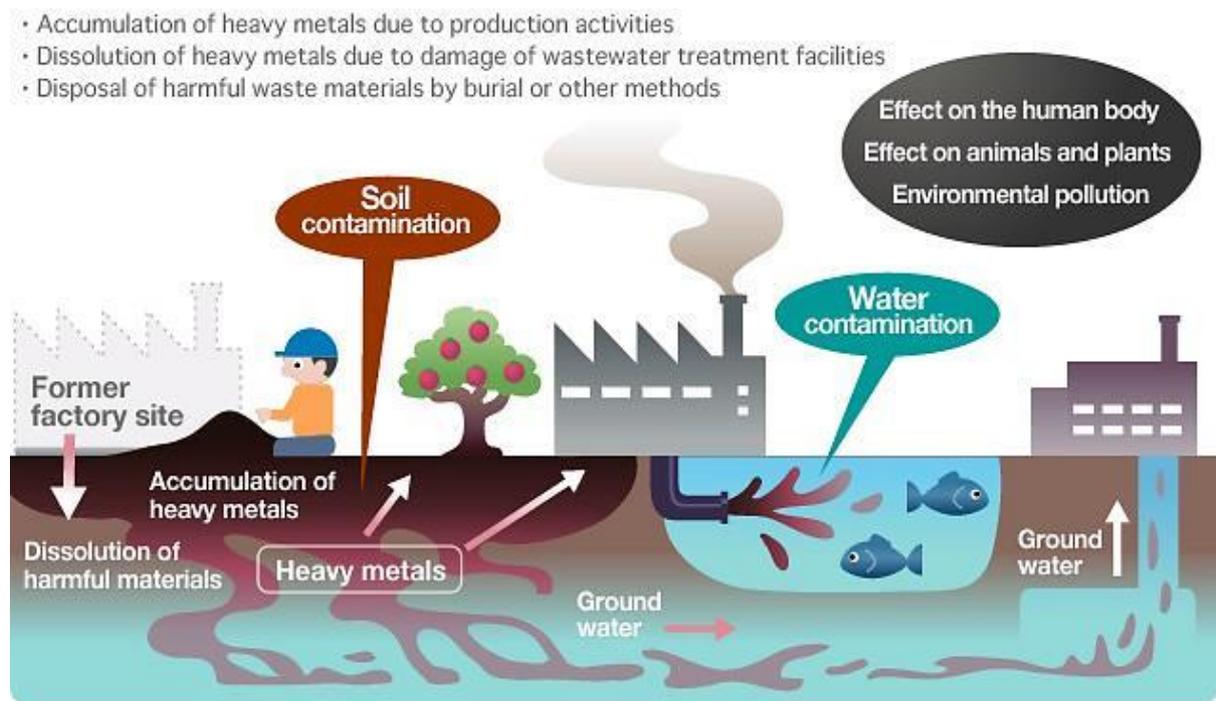
into the atmosphere can contribute to both a reduction in greenhouse gas emissions by large energy facilities, which determine the method of the Kyoto Protocol and Directive 2001/80 / EC. Develop and implement these methods have reduced the emission of many metals to the atmosphere. Over the years 1996-2003 were observed 3 times reduced emissions of arsenic, copper 4-fold and 5-fold over zinc.

The source of heavy metals to plants grown both contaminated soil and atmosphere. The amount of heavy metals from soil taken root system depends on the degree of accumulation of the individual elements and immobilization capacity of the soil sorption complex. Sorption capacity of the soil is determined by the quantity and quality of soil colloids forming absorbent complex.

As the soil content of floatable (mostly colloidal clay) and organic matter (especially decay), and the pH, the availability to plants of heavy metals is significantly reduced. Metals are the preferred binding buffer system through the soil and become inedible plant roots. Heavy metals present in the soil and soluble forms of removable considered to be readily available to plants, easily moving in the trophic chain, thereby presenting the greatest threat to humans.

The availability of these forms of metals depends largely on the severity of soil processes of adsorption and desorption. The most important factors that affect the bioavailability of heavy metals by plants are:

- the total content of "potentially" bioavailable metals in the soil,
- metal concentrations in the soil solution and their relative proportions quantitative
- the flow of metal from the solid phase to the liquid phase of the soil (soil solution) and then to the roots.



Mechanism for collecting metals by plant roots is complex and is the result of several processes, such as cation exchange across cell membranes, intracellular transport, as well as the

processes occurring in the rhizosphere. A rich source of heavy metals for plants grown in the vicinity of the steel plants is also the atmosphere, namely precipitation of dust emitted into the atmosphere directly on the surface of metal-ground plant organs. The amount of metal retained on the aerial parts of the plant depends to a large extent on the type of surface and the type of plant organ, where the dust settles derived emissions. The level of pollution also determined by factors such as distance from the crops tested emitters of pollutants, as well as weather conditions, especially the amount of rainfall and the direction, strength and frequency of winds in the area of emissions. The mobility of individual heavy metals in soils determined by the following factors: the origin of metals, their physico-chemical properties of soils themselves.

The increased mobility of the metals in the environment is very often caused by improper use of agricultural technology, whereby there is in the soil environment for transformation of different forms of heavy metals increase their solubility, actuation, and migrate to other components of the natural environment.

The toxicity of heavy metals depends primarily on the degree of contamination, but also on the species and age of the organism, the route are put into the body, the form of the chemical, the type of interaction with other metals, or the physiological condition of the body. Metals penetrate into the body by inhalation or gastrointestinal tract, and skin sometimes, and then transported by the blood to the tissues and organs, where they are concentrated and stored. Part of the cells in which they are stored mainly nucleus, mitochondria and cell membrane. Chronic exposure to heavy metals negatively affect the morphological parameters of the blood, the action of enzymes, the activity of transport proteins as well as the structure and function of cells, tissues and organs.

From the point of view of human health and animals (including poultry) are relatively small source of heavy metals. To the greatest extent this affects marine fish. It is true that it is possible a large accumulation of heavy metals by crops, which later will go for animal consumption, but after 1989, where the national industrial production is relatively small issue this is only a hypothetical dimension.

The presence of heavy metals in products of animal origin is more economical dimension and even political - because according to the principle "if you want to find something, it will be found." Currently there are raised voices from the neighboring countries for increased inspections of poultry meat from Polish precisely in the direction of heavy metals, because our country is still very low-cost producer and exporter of food. Nevertheless, one should doubt the effectiveness of these measures.

## **2. CONCLUSIONS**

The problem of environmental pollution with heavy metals present in Poland locally and relates primarily to industrial areas, but in some areas, in the vicinity of the former or current sources of emissions, water, soil and sometimes show a considerable degree of contamination. Heavy metals in soils may be a potential source of danger to plants and groundwater, and consequently - can be incorporated into the food chain. Downloading trace elements from contaminated soils by plants often exceeds their physiological needs, with the result that an excess of these elements in the soil can act phytotoxic.

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