



TRANSFER OF HEAVY METALS TO SPONTANEOUS FLORA FROM SOIL DEVELOPED ON A MINING AREA (SW ROMANIA)

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Abstract

The steel industry has long time been the main source of major pollution in West of Romania and the consequences are felt today, even if plants do not work anymore. The heavy metals content in surface and groundwater area of Resita town was determinate. The sample points were located inside the former siderurgical plant and in sterile dump area; the methodology in force was used in analyzes. The results show high levels of Cd and Ni in surface water and of Pb, Ni, Mn in groundwater. As consequence, it is necessary the control of drilling wells in the households, because the potable water could be inappropriate as drinking water.

Keywords: heavy metals, surface water, groundwater, toxicity, siderurgy

1. INTRODUCTION

As a result of industrialization, current levels of metals may be elevated relative to levels occurring naturally. Unfortunately, unlike organic chemicals, metals are neither created nor destroyed by biological or chemical processes and their toxicity depend on the metal, the form of the metal or metal compound, and the organism's ability to regulate and/or store the metal. Certain metal compounds are known to bioaccumulate in tissues and this bioaccumulation can be related to their toxicity [1]. Extractive operations, i.e. exploration, mining, mineral and metallurgical processes, usually co-produce large quantities of unmarketable or uneconomic materials and release heavy metals in soil and waste water [2,3]. When associated with colloids, heavy metals may show significantly different transport properties compared to dissolved heavy metals [4]. Over the past decade, groundwater has become an important source of drinking water throughout the world. However, metal pollution in groundwater is one of the most common environmental problems and groundwater contamination has major implications for health in urban areas as well [5,6].

In the Western part of Romania, the steel industry has long time been the main source of major pollution and the consequences are felt today, even if plants do not work anymore. Due to his nature, durability and intensity the mining-metallurgical activities were and still are pollutant. The anthropical mining and metallurgical activities that generate many materials with high content of metals such as steel waste dumb, cinder yards are severely changing the balance and lead to the pollution of contiguous areas with one or more metals: lead, cadmium, copper, zinc, nickel, chrome and others. The 31.5 ha waste dump is situated on the North, North-West of Resita town and contains 5.974.580 tones ironworks residues being a continuous pollution source for vicinity areas, surface and ground waters.

2. EXPERIMENTAL

A large steel factory, TMK Resita, has worked for decades in Resita city. Even if this company does not work anymore, the main source of major pollution and the consequences are felt today. For assessment of heavy metals water pollution, surface waters samples were taken from the river that is bounding one side of the dumb (the Terova River which is a tributary of the Bărzava River) and groundwater samples, as well.

Surface water samples collected from mining waste dump area showed very high concentrations of cadmium (from 2 to 4 times more than the limit allowed) and nickel (five times the allowed limit), but concentrations of lead, copper, zinc and chrome are normal (Table 3).

Table 3. The heavy metal content of surface water samples

Site for water sampling	Metal concentrations mg/L					
	Pb	Cd	Cu	Zn	Ni	Cr
S1-Surface (downstream), pH = 8.3	nd*	0.020	0.05	0.05	0.100	0.065
S2-Surface (damp), pH = 8.05	nd	0.020	0.05	0.05	0.100	0.065
S3-Surface (epitocent), pH = 6.30	nd	0.010	0.01	nd	0.100	0.065
Permissible limit value	0.010	0.005	0.100	5.00	0.020	0.050

The surface water samples were taken downstream, upstream and in front of the dumb (three sample noted S1, S2, and S3). Groundwater samples were taken from 8 locations: samples G1-G5 from groundwater wells situated around the slag dump and samples G6-G8 taken from former land of TMK factory, in Resita Town. The heavy metal content of water samples were made in accordance with the methodology described in Table 1.

Table 1. Methodology in force used in the analysis of heavy metals in water samples

3. RESULTS AND DISCUSSION

Resita town is the oldest steel industry center of Romania and one of the most important industrial cities in southeastern Europe. River contamination near the waste dump area has our attention, because of the improper wastes treatments. The amount of hazardous wastes released from siderurgical operations and transported into surface rivers and ground water can be enormous. The accumulation of heavy metals in water is of increasing concern due to the food safety issues and potential health risks (Table 2).

Table 2. Pollution's source of and heavy metal toxicity [8-10].

4. CONCLUSIONS

Through dumb leaching of contaminated soils, the surface water from vicinity areas is polluted. Some of the metals concentration from the running water is under admitted limit but, their presence in case of a longer consumption is considered a risk (Pb, Cu, Zn, Cr), other are in not allowed concentrations (Cd, Ni). The rain waters are transporting and depositing polluted materials in the depression areas. The surface water is crossing faster the polluted areas so it will be less polluted in comparison to the groundwater that is percolating slower the polluted layers, increasing the metals concentration. Some significant overruns for lead and manganese in analyzed groundwater were found. As consequence, it is necessary a periodic control of drilling wells in the households situated near the sampling points, because the potable water could be inappropriate as drinking water and could cause health issues.

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