

SOIL CONTAMINATION IN THE URBAN AREA IN SERBIA

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KEYWORDS

Contaminated sites, urban soils, heavy metals, contamination level, risk assessment

ABSTRACT

In the territory of Serbia 394 potentially contaminated and contaminated sites have been identified near urban areas. From a total number of sites, 189 belongs to industry, while 181 are municipal waste disposal sites. The presence of heavy metals in urban soils is one of the most common environmental contamination problem usually caused by industrial discharges. Systematic examination of urban soils in Serbia has been done since 1999 to determine the contamination level and potential risk to population health. This paper reports on urban soil contamination near municipal waste sites and industrial facilities in the period 2010-2015. The research was done in eleven cities and nine municipalities. The analysis shows that the degradation of urban soils can be attributed to many factors including: the impacts of urbanization and industrialization, unsupervised communal waste sites, partially uncontrolled agro-chemical practices and low levels of communal hygiene. The results of analysis for 200 samples show that in the majority of samples the prescribed limit values for Cd, Pb, Cu, Zn, Ni, Cr, Co, As and Hg are exceeded. Intervention values are exceeded in a small number of samples for Cu, Zn, Ni, Cr and As. The implementation of environmental protection measures is only possible when stimulated by scientific-technological research carried out in this field.

INTRODUCTION

Due to a rapid urbanization, most of the urban areas in Serbia are built close to roads or industrial areas, where they are under the impact of pollution sources such as industrial emissions. The current knowledge of the pollution of urban soils was reviewed with special reference to heavy metals and this study has demonstrated a serious problem of heavy metal contamination in urban areas.

RESULTS AND DISCUSSION

An important aspect of soil contamination is the level to which the contaminants are present in the soil and those concentrations are expressed in units of the mass of heavy metal per units of the mass of soil (mg/kg). [1] Samples were collected from 0-30 cm depth. The 99 samples are collected near municipal waste sites and the rest of 101 samples are collected near industrial facilities on the territory of Serbia (Figure 1). Percentage of samples that have exceeded the prescribed limit values for 9 heavy metals are presented on Figure 2.

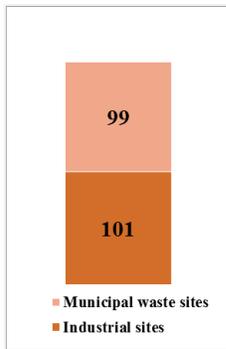


Fig. 1. The total number of samples

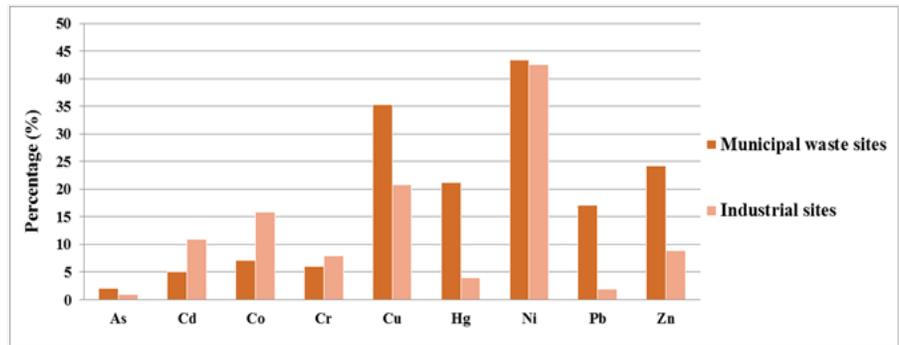


Fig. 2. Percentage of samples exceeding the limit values

The high concentration of nickel found in samples is believed to be of geogenic origin, which is specific for Western Serbia. [4] Results of soil analysis show big differences between samples collected near municipal waste sites and industrial sites. According to the results of exceeding limit values, near municipal waste sites Cu, Hg, Pb, and Zn were found in greater number of samples, while Cd, Co, and Cr near industrial sites.[1]

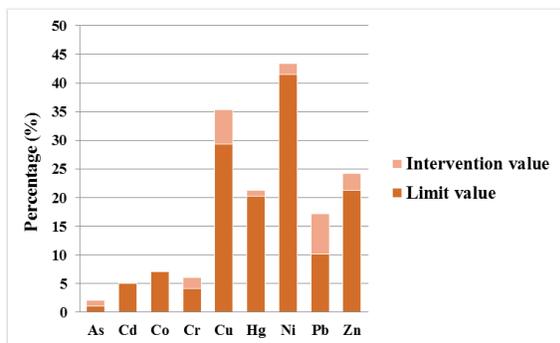


Fig. 3. Percentage of samples exceeded prescribed values collected near municipal waste sites

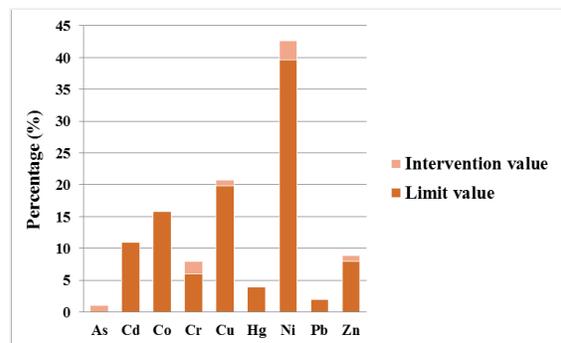


Fig. 4. Percentage of samples exceeded prescribed values collected near industrial sites

The intervention values for soil remediation indicate when the functional properties of the soil for humans, plants, and animals is seriously impaired or is in danger of being so. They are representative of the level of contamination above which a case of soil contamination is deemed to be severe. Samples collected near municipal waste sites exceeded intervention values for As, Cr, Cu, Hg, Ni, Pb, and Zn (Figure 3), while near industrial sites, intervention values are exceeded for As, Cr, Cu, Ni, Zn (Figure 4). [1] The highest percentage of exceeding intervention values were found in samples collected near municipal waste sites. Of the total number of samples that have exceeded the limit values for lead in soils near municipal waste sites, even 40% of the samples exceeded the intervention values.



Fig. 1. Waste disposal sites in Western Serbia (photo: Serbian Environmental Protection Agency)

CONCLUSION

The dominant contaminants in the analyzed urban soils near municipal waste sites are Cu, Hg, Ni, Pb, Zn, while Cd, Co, Cu and Ni are dominant in soils near industrial sites. Results of this study show a bit better status of urban soils near industrial sites. A possible explanation lies in the fact that open dumping and landfilling have represented the

predominant method of waste management in Serbia during the past decades. This practice resulted in over 3085 illegal waste disposal sites distributed all over the country. [5] In most cases, illegal dumps are located in rural areas. They are primarily the consequence of the lack of resources to improve the quality of waste collection systems and of poor waste management organization at the local level. [3] According to the State of the Environment Report for 2014, on the territory of Serbia has so far built seven sanitary landfills, and two are in the process of obtaining permits, which we consider as a progress in waste management practice.[5] A multidisciplinary approach in the assessment of contaminated urban sites is needed to ensure that urban soils are well understood. The implementation of environmental protection measures is only possible when stimulated by scientific-technological research carried out in this field. [2] Contamination of urban soils is our immediate concern relating to potential impact on human health. The health risks of exposure to urban soil contaminants such as heavy metals have not been yet observed and documented. Further analysis of soils in urban areas is needed to assess the potential impact on environmental media and human health.

LITERATURE

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