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Assessment of Soil on Some Heavy Metals and its Pollution in Roodsar-Iran

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ABSTRACT

Increased concentrations of heavy metals in the air, soil, or water threatens human health both directly and indirectly via accumulation in the food chain. In countries with high ecological awareness the risk of acute exposure has been minimized thanks to the enforcement of restoration laws and policies. This paper presents results of chemical analysis of soil samples to total content of Pb, Ni, Cr and Cu. Samples were collected at site of Roodsar, at two depths in November 2019th year. These heavy metals were analyzed using three methods of sample preparation. Method of sample preparation, which defines the standard ISO 11047:2000 proved to be best. Results show that content of these heavy metals exceeding limit values. Analyses were done on device, Atomic Absorption.

Keywords: Soil; Heavy Metals; Sample; Atomic; Contamination

Introduction

Over the past several decades, industrial activity in the mining and smelting sectors has caused serious environmental pollution by heavy metals on a global scale. Increased concentrations of heavy metals in the air, soil, or water threatens human health both directly and indirectly via accumulation in the food chain. In countries with high ecological awareness the risk of acute exposure has been minimized thanks to the enforcement of restoration laws and policies. The risk of chronic effects, however, is still there [1-13]. Heavy metals are chemical elements whose relative density is greater than $5gdm^{-3}$. Heavy metals are classified as essential microelements which include Cu, Fe, Mn, Zn, Mo, Ni and potentially toxic or non-essential elements as Cd, Cr, Pb, Hg and As. In soil coming through rain, dust and soot. Plants can also be deposited heavy metals from deeper soil layers in upper layer. Also, fertilization of soil comes a certain amount of heavy metals. However, major anthropogenic sources of soil pollution with heavy metals are intense traffic, metal industry, mining, organic and mineral fertilizers and municipal waste. Environment region of Guilan in Iran is several decades exposed to emissions of heavy metals and other pollutants emitted from metallurgical and thermal power plants [5-7]. It is known that atmospheric deposition of heavy metals due to soil in which maximum reserve in relation to other components of environment. Usually linger for years in upper layer and very difficult to amounts of soil [1,8-11]. Heavy metals can accumulate in large quantities in soil and can cause multiple ecological consequences of which are considered major polluters of environment [5,12,13].

Experimental Sections

a. Conducted an experiment had two objectives which are: To analyze heavy metals in soil samples using different digestion methods to determine most effective methods,

b. To assess soil contamination by comparing results of limit values of heavy metals as defined in the Regulations that are defined [14,15].

Samples were collected in some various parts because it

is a location near industrial plants. Samples of soil mass by approximately 1.0 kg were prepared for analysis in laboratory of Faculty of Biology in Payame Noor university of Roodsar. Primary soil samples were taken with an area of $9m^2$, so that surface is divided into nine equal plots and each of them has taken about 110g soil [16-18]. Reducing size of primary sample of size suitable for laboratory work was carried out after primary sample dried 24h at 105°C, chopped and sieved. Samples were prepared in two ways: wet and dry digestion [5,17,19,20]. In wet digestion are used two types of reagents, table 1. Samples were prepared with super pure acids. In both cases, 1 g sample was added 10 ml of reagent. When digestion is carried sediment diluted with distilled water to 50ml. For dry digestion was 1.5 g sample is gradually heated to 450°C. Ash was obtained by annealing was dissolved in 5 ml of concentrated HCl and solution was evaporated to dryness. Sediment is then dissolved in 0.1 M HNO_3 to 50ml. Analysis of samples was performed by flame technique on device, "Atomic absorption spectrophotometer, Perkin Elmer, A Analyst 800".

Results and Discussion

Results of analysis of investigated heavy metals in soil defined location are given in Table 1. From results, Table 1, it is evident that as best method of sample preparation using wet digestion with HCl: HNO_3=3:1. Above method is a standard method for preparation and analysis of soil samples, standard ISO 11047:2000. Examining influence of soil depth on content of heavy metals, Table 1, it is evident that content of all investigated heavy metals slightly decreases with increasing depth, which is to be expected [21,22]. Results of many studies show that highest concentrations of heavy metals detected exactly at depth 0-5 cm, because greatest amount of heavy metals after arrival and migration in soil to retain a depth of 5cm [3,5,6,13]. Metal transport is not only dependent on physiochemical properties of metals but mostly on physical and chemical properties of soil, like for example: soil organic matter content, clay fraction content, mineralogical composition, pH, and more, all of which collectively determine binding ability of soil [8,12,17,19]. Based on results in Table 1 can be concluded that contents of Pb, Ni, Cr and Cu in almost all samples, prepared using three techniques of preparation, in both investigated depths, significantly higher than limit value. It is therefore necessary to take measures to reduce emissions of heavy metals from primary metallurgical plants and soil remediation measures for protection of human health [4,7,12,17].

Table 1: Concentrations of heavy metals in soil.

Heavy metals	Depth of soil sampling	Digestion technique			Limits values, $mgkg^{-1}$
		Wet digestion		Dry digestion	
		Reagents for digestion		Reagents for digestion	
		$HCl:HNO_3$ 3:1	HNO_3	HCl+0,1 M HNO_3	
		Concentration of heavy metal, $mgkg^{-1}$			
Pb	Depth of 5 cm	153,85	153,15	141,13	100
	Depth of 15 cm	146,6	144,7	136,63	
Ni	Depth of 5 cm	111,45	119,5	103,03	50
	Depth of 15 cm	119,7	80,55	100,09	
Cr	Depth of 5 cm	103,4	104,9	70,4	100
	Depth of 15 cm	99	100,2	67,77	
Cu	Depth of 5 cm	104,05	90,05	129,15	80
	Depth of 15 cm	101,85	83,85	111,87	

Conclusion

For analysis of heavy metals in soil, as a method of sample preparation is best to use a wet digestion with HCl:HNO_3=3:1. Examining influence of soil depth on content of heavy metals it is evident that content of all investigated heavy metals slightly decreases with increasing depth, which is to be expected. Contents of Pb, Ni, Cr and Cu in almost all tested samples of soil at the region of Roodsar was significantly higher than limit value [23-27].

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