

RESEARCH ARTICLE

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Soil pollution in Mitrovica town surroundings and absorption of heavy metals by carrot plant

AFETE MUSLIU* AND SEIT SHALLARI

¹Agricultural University of Tirana, Faculty of Agro Environment and Ecology, Tirana, Albania

Abstract

In this paper is studied a heavy metal presence in soil in industrial zone surroundings in Mitrovica town and its impact on the vegetable species, referring on this paper to a carrot. The town of Mitrovica, has the largest complex metallurgy and mining in Europe known as "Trepca", known for exploitation of lead, zinc and cadmium, which town is one of the most polluted cities in Kosovo as in air, soil and water, in particular neighbourhood of industrial zone. The purpose of this work is to make research of the impacts of the mining and metallurgical processes on the degree of pollution in industrial zone, determining, in particular, the heavy metals presence in soil and absorption of the metals by a carrot plant. To reach the results of the impact of the soil pollution to the vegetable species, we have conducted the analyses, with sophisticated equipment-UK AAS (Atomic Absorption Spectrometry), of the three samples of carrots grown in the industrial zone surroundings and the results were compared referring to the European Union standards (EC) No. 1881/2006.

Keywords: Mitrovica, Trepca, Soil pollution, Heavy metals, Carrot

1. Introduction

The massive exploitation of "Trepça" mine has started in 1926. Since then, the company has established 10 waste landfills, three of which in immediate surroundings of the Mitrovica town, covering at around 65 hectares, consisting not less than 20 million tons of industrial waste with high concentration of Pb, Zn, Cd, As, Fe, CU etc. thus heavily contaminating the atmosphere in Mitrovica town and surroundings. As a consequence we have considerable concentration of heavy metals in soil [3]. The presence of heavy metals in soil is one of the factors that causes intake of these metals by vegetable species. Heavy metals are of crucial importance for the optimal growth of many plants, however higher concentrations become toxic for plants itself as well as for consumers. In this paper we have studied the heavy metal intake of carrot grown in contaminated areas, referring obtained results to allowable limits as per EU commission regulation [2].

2. Materials and Method

Carrot is as an important agricultural product grown in many locations in Kosovo. Our aim is to examine soil pollution effect on the heavy metal uptake and distribution in the plant. According to Yang, vegetables, such as carrot, can accumulate some heavy metals to such degree that can have toxic

effects on human beings [1]. Sampling of carrots was conducted in three locations of the Mitrovica region, Arradha of Shales Street, Village Shipol and Village Frasher. All samples were taken fresh and clean, and put into a sterile bag, and then preserved in the refrigerator at a temperature of 3 °C. Samples were taken in August and have been analyzed for these parameters: Lead, Zinc and Cadmium. Determination of concentration of heavy metals in carrot have been done applying analytical standard's methods AOAC 999.11, in order to determine the level presence of heavy metals.

Initially we made the sample selection, washing, cleaning and partition. In the beginning we have conducted washing of carrots in order to remove dirtiness, then removing peel and cutting in a mill getting gaining a homogeneous mass, from which are weighted by 10 grams of each sample, which is dried at a temperature of 150 degrees for 48 hours. Then from each sample was taken by 0.5gr and is treated with 4ml of nitric acid (HNO₃ 65%) and 0.2ml hydrogen peroxide (H₂O₂ 30%). Then we made mineralization and decomposition of the samples in the microwave. After filtering the samples were ready for analyzes for Heavy metal presence is determined using Atomic Absorption Spectrophotometer.

3. Results and Discussions

All three samples were analyzed for presence of heavy metals, in particular of presence of Lead, Zinc and Cadmium. In table 1 we present the allowable

limits according to EU commission regulation (EC) No 1881/2006 standards: In tables 2, 3 and 4 we present the results obtained from the carrot sample's analysis in all three locations.

Table 1: Allowable limits for Pb, Zn and Cd as per (EC) No. 1881/2006

Parameters	Standards method	Allowable limits in mg/
Pb	AOAC 999.11	1.0
Zn	AOAC 999.11	10
Cd	AOAC 999.11	0.05

Table 2: Results of carrot sample taken in "Aradha e Shales Street, Mitrovica

Parameters	Standards method	Allowable limits in mg/kg	Concentration in mg/kg
Pb	AOAC 999.11	1.0	0.391
Zn	AOAC 999.11	10	4.897
Cd	AOAC 999.11	0.05	<0.0153

Table 3. Results of carrot sample taken in village Shipol, Mitrovica

Parameters	Standards method	Allowable limits in mg/kg	Concentration in mg/kg
Pb	AOAC 999.11	1.0	0.515
Zn	AOAC 999.11	10	3.846
Cd	AOAC 999.11	0.05	<0.0153

Table 4. Rarrot sample taken in village Frasher, Mitrovica

Parameters	Standards method	Allowable limits in mg/kg	Concentration in mg/kg
Pb	AOAC 999.11	1.0	0.931
Zn	AOAC 999.11	10	4.851
Cd	AOAC 999.11	0.05	<0.0153

According to studies conducted in 2012 [3] on soil pollution in Mitrovica town, heavy metal presence (Pb, Zn and Cd) in all locations resulted with high concentration, exceeding the allowable limits in all locations. However based on the results during this examination we have proved that heavy metal content of the soil does not have any considerable effect on the heavy metal uptake by carrot.

Third sample of carrot taken in Frasher village have resulted in a higher percentage of Pb, Zn and Cd presence comparing to two other samples.

4. Conclusion

We can conclude that all samples have resulted with the presence of heavy metals in carrot but all within the limits allowed under the EU regulation [2], as well as under National Public Health Institute of Kosovo (NPHIK) standards (which corresponds to EU standards), but the difference between samples taken in Mitrovica town and Shipol village with the sample taken in Frasher village are visible, this all as a consequence geographical position of this village which is much closer to the Industrial Park of Mitrovica (IPM) landfill, which covers a surface of

35.2 hectares of industrial waste of around 1520000 tones [4].

References

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