2013 3rd International Conference on Energy and Environmental Science
IPCBEE vol.54 (2013) © (2013) IACSIT Press, Singapore
DOI: 10.7763/IPCBEE. 2013. V54. 11

Influence of Wasting Water of the Lead and Zinc Mining Complex in Tekeli (KZ) On the Environment

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Abstract. The aim of the present research is determination of the four heavy metals content (Cu, Cd, Pb, Zn) in a grain of barley, grown in the tailing impact area; the radio nucleus content in the specimen of species indicator and its organ can be judged by a total radioactivity level and relation to the back-dropped level. Water and biosamples test preparation have been conducted according to standard methods. Barley bioindication has shown the back-dropped content exceeding of all the studied heavy metals. A higher level of the lead accumulation in seeds compared with the barley biomass has been observed. The present data show quite satisfactory condition of the area of investigation in accordance with radioactivity.

Keywords: tailings, heavy metals, radioactivity, bioindication

1 Introduction

Tekeli is located at the foothills of the north-western range of Dzhungar Alatau mountain. Its area is 0.1 thousand km^2. The town is situated 46 km to the south-east from its regional centre and 285 km to the north-east from Almaty [1]. Being the industrial leader of country the ground makes an essential contribution to the contamination of the region environment. The waste of production have been slag heap put up in the tailings for a long time. That is why the aim of the present research is the ecological assessment of soil pollution sequences as well as the water with heavy metal and their bioaccumulation in the area adjoined to the tailings of lead and zinc production (picture 1) [2].

(a)

(b)

Fig. 1: Tailings : a) dried up part till 2011 year; b) hydrous part beginning with 2011 year

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2 Materials and Methods

The soil and plants test selection has been carried out according to the following scheme: a mixed sample consisting of 5 test based on the method of an envelope has been picked up. The samples have been selected by a shade as deep as a tilling layer (up to 20-25 cm) [3,4].

Mineralization test has been conducted gradually raising the temperature in electrical furnace up to 50 ℃ every 30 minutes and fraught it up to 460 ℃.

Water and biosamples test preparation have been conducted according to standard methods [5,6].

3 Results and Discussion

The aim of the present research is determination of the four heavy metals content (Cu, Cd, Pb, Zn) in a grain and barley Hordeum spontaneum C., grown in the tailing impact area. For getting biomass stems and leaves of plants have been used. Tests have been taken quite accidentally (fig. 2, 3). The determination has been conducted using the atom-absorption method.

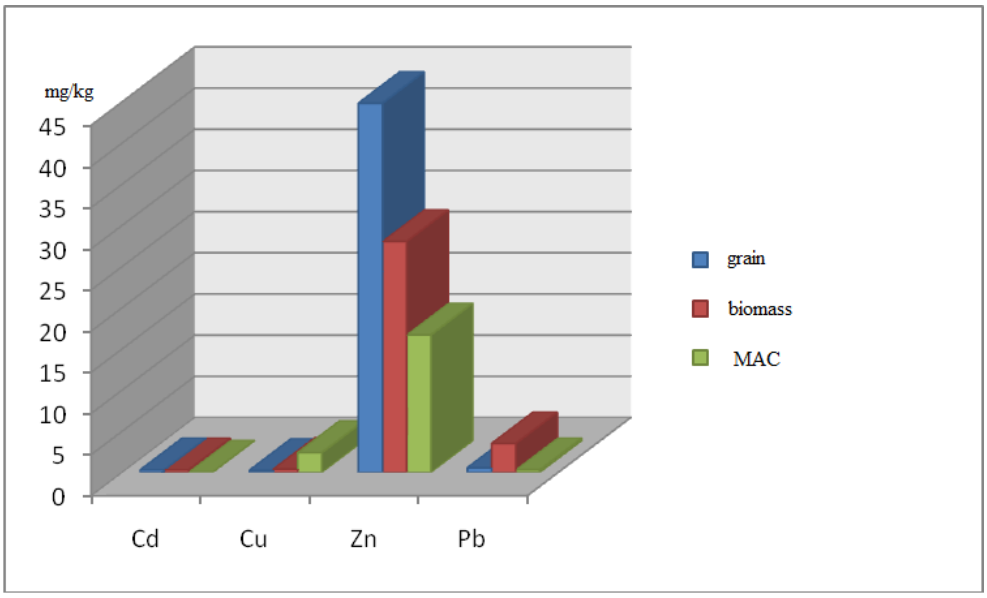

Fig. 2: Comparing the heavy metals content in a grain and biomass Hordeum spontaneum C. (barley) with the back-dropped ones in the samples of 2009 from the shore area of the tailings in Tekeli.

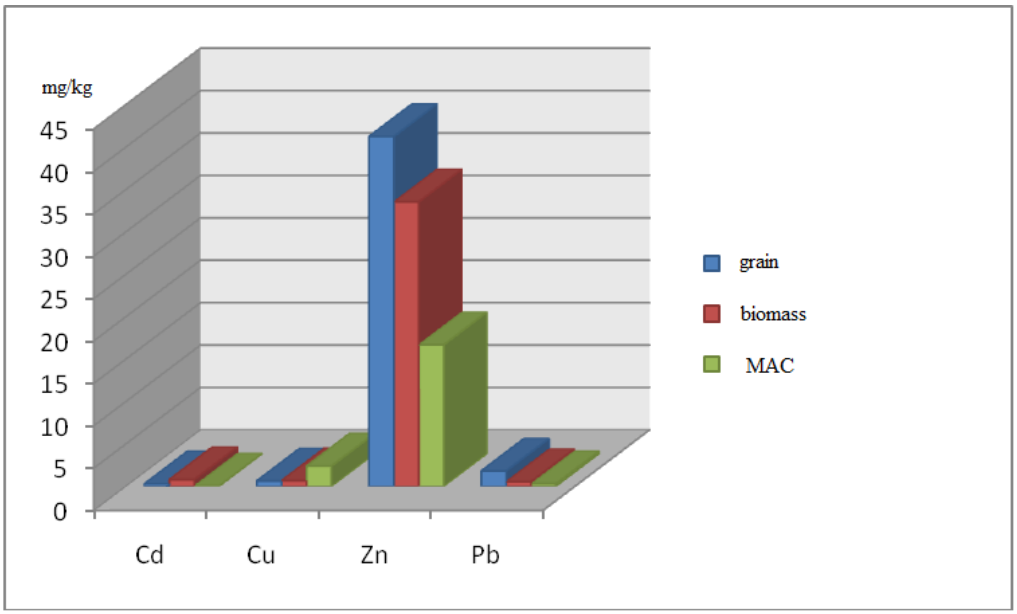

Fig. 3: Comparing the heavy metals content in a grain and biomass Hordeum spontaneum C. (barley) with the back-dropped ones in the samples of 2012 from the shore area of the tailings in Tekeli.

Heavy metals come to the bio-objects mainly from the environment: from the lead and zinc complex tailing water through the shore soil where cultivated plants have been grown. A high lead content in the soil hear the tailings has been recorded. Probably, some part of its heavy metals come to the soils of fields located 100-200 m (tables 1,2).

Table 1: Heavy metals content in the soil from the bottom the lead and zinc mining complex tailing

	Heavy metals content in the soil mg/kg			
	Cd	Cu	Zn	Pb
Control M ±m (average arithmetic mistake)	53 ±11	1965 ±195	11025 ±1575	180 ±1.9
MAC	0.5	3.0	23.0	32.0
Multiple exceeding of MAC	106	655	479	5.6

Table 2: Heavy metals content in the soil from the lead and zinc mining complex tailings area influence

	Heavy metals content in the soil mg/kg			
	Cd	Cu	Zn	Pb
Control M ±m (average arithmetic mistake)	0.93 ±0.15	7.36 ±0.29	79.34 ±2.50	79.57 ±4.29
MAC gross content	0.5	3.0	23.0	32.0
Multiple exceeding of MAC	1.86	2.45	3.44	2.49

The present data testify to the lead accumulation in a soil exceeding this metal MAC according to the gross content more than twice. Barley bioindication has shown the back-dropped content exceeding of all the studied heavy metals. A higher level of the lead accumulation in seeds compared with the barley biomass has been observed.

The radio nucleus content in the specimen of species indicator and its organ can be judged by a total radioactivity level and relation to the back-dropped level (table 3).

Table 3: The total level at alpha and beta radiation concerning specimen and organs of species indicators (Hordeum spontaneum C.- barley)

Name of sample	Total activity (1/min*cm2)	
	Alpha activity	Beta activity
Grain	0,07 ±0,005	0,1 ±0,002
Grain	0,08 ±0,005	0,1 ±0,002
Stems and leaves	0,08 ±0,003	0,1 ±0,002
Admissible content	2	5

The exceeding of alpha and beta radiation back-dropped level in the organs and specimen of species indicators has not been found. Similar samples of 2012 have been studied at the gamma spectr cmplex progress in the board of radiation sanitary and radiology at the Ministry of Health in the Republic of Kazakhstan (table 4).

Table 4: Content of cesium and strontium in species indicator Hordeum spontaneum C. - barley

Index indicator of ingredients	Concentration found	Unit of dimension	Admissible content in food- stuffs and drinking water	
Barley grains			Ci/kg	Bg/kg

Cesium-137	less than 3.0	Bg/кг	$1.0*10^{-8}$	370
Strontium-90	less than 0.7	Bg/кг	$1.0*10^{-9}$	37
Stems, barley leaves				
Cesium-137	less than 3.0	Bg/кг	$1.0*10^{-8}$	370
Strontium-90	9.0 ±0.6	Bg/кг	$1.0*10^{-9}$	37

The present data show quite satisfactory condition of the area of investigation in accordance with radioactivity.

4 Acknowledgements

The authors wish to acknowledge Aliya Nurmuchambetova of the al-Farabi Kazakh National University for the help in the translation of the text of article.

5 References

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