

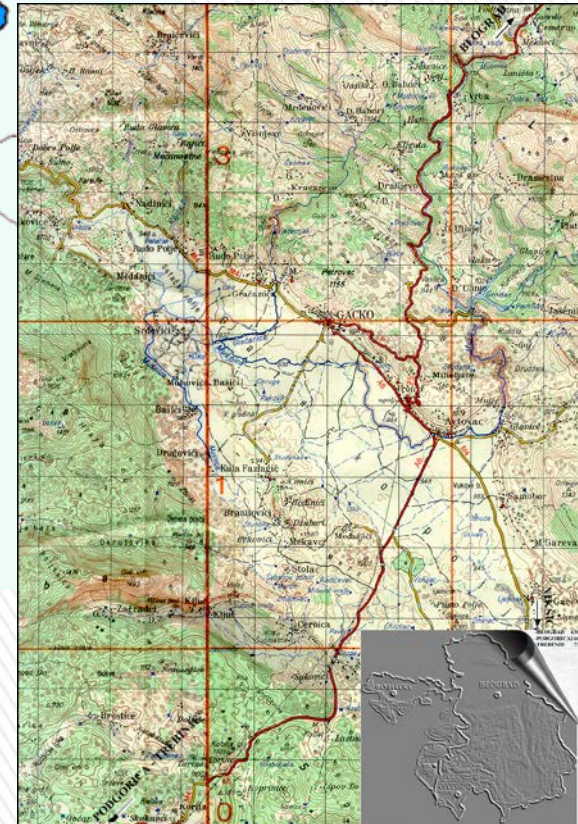
THE CONTENT OF HEAVY METALS IN THE SOILS OF DUMPS IN THE PROCESS OF RE-CULTIVATION, EASTERN HERCEGOVINA

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Thermal power plants is one of the major sources of environmental pollution





The subject of this research is the site of "Dražljevo" where the ashes have been deposited since the first day of the commissioning of the mine and thermal power plant Gacko, eastern Hercegovina.



Re-cultivation on the territory of BiH started to be applied during the second half of the fifties. The largest volume of re-cultivation was achieved in BiH in mines of Tuzla region.



The aim of this study is to determine, by pedological researches, the total content of heavy metals: cadmium (Cd), lead (Pb), copper (Cu), zinc (Zn), nickel (Ni) of soils of dumps in the process of re-cultivation for the purposes of obtaining an **objective insight into the type, degree and damage to the soil.**



Used FBiH legislation according to the Law on Agricultural Soil (Official Gazette of FBiH, no. 52/09) i.e. the Instructions on determining the allowable amount of harmful and dangerous substances in soil and methods of their investigation (Official Gazette of FBiH no. 72/09) **treats pollution i.e. soil contamination with heavy metals in terms of growing the crop plants, i.e. as agricultural soil, based on textural characteristics.**

In Serbia, the criteria for the assessment of soil contamination with heavy metals (MAC) are given in the Regulations on permitted amounts of dangerous and harmful substances in soil and water for irrigation and methods for their investigation (Official Gazette of RS, no. 23/94) and the Regulation on the program for systematic monitoring of soil quality, indicators for risk assessment of soil degradation and methodology for development of remediation programs (Official Gazette of RS, no. 88/2010).



Soils of dumps

Profile 35

Relief: slightly wavy

Vegetation: spontaneous natural vegetation

Location: within the thermal power plant

On the pedological map of BiH R 1:50000 soil described as:

The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)

MO+OG



External morphology of soils of dumps in the process of re-cultivation

I (0-33 cm) - a layer of brown color (10 YR 3/3) when dry and when wet dark brown color (10 YR 2/4). Texture is silty clay loam soil, lumps structures, calcareous.

II (33-68cm) - a layer of brown (10 YR 3/3) when dry and when wet dark brown color (10 YR 2/4). Texture is silty clay loam, prismatic structure, calcareous.

III (68-100 cm) – a layer of grey color (10 YR 5/1) when dry and when wet dark gray (10 YR 4/1). Texture is loam, powdery structure, calcareous.



Internal morphology of the soils of dumps in the process of re-cultivation

Pedological researches

The total content of heavy metals (mg/kg) of soils of dumps in the process of re-cultivation

Heavy metals (mg/kg)	Sites				MAC (mg/kg)	Corrected limit value (mg/kg)	Remediation value (mg/kg)
	1	2	3	4			
Cadmium (Cd)	0.96	1.48	0.38	1.72	3	0.66	9.96
Lead (Pb)	63.90	61.20	67.63	59.50	100	80.75	503.50
Copper (Cu)	44.20	58.60	26.92	58.56	100	33.48	176.70
Zinc (Zn)	98.00	133.50	35.01	135.12	300	137.20	705.60
Nickel (Ni)	142.40	184.70	128.08	182.20	50	37.80	226.80

In all investigated samples of the content of total Pb and Zn is **below** the corrected limit value. The content of total Cd and Cu is **above** the corrected limit value in samples at sites 1, 2 and 4

In all investigated samples, the total Ni content is above the corrected limit value.

The contents of all investigated elements in the soil dumps in the process of re-cultivation are under remediation values.



Mineralogical composition of the limestone substrate can be the source of the presence of Cd, Cu and Ni of geochemical origin, while the ashes of thermal power plants can be the cause of anthropogenic origin. Origin of high concentrations of Cd, Cu and Ni can be objectively explained only after determining readily available content which requires further research.



Profile 38

Location: within the thermal power plant

Relief: more conical elevations with diameter of about 200 m

Vegetation: no vegetation

Date of study: Summer 2010

On the pedological map of BiH R 1:50000 soil described as:

The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)

MO+OG



External morphology of slag dump



Internal morphology of slag dump

I (0-20 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is loamy sand, powdery structure, calcareous.

II (20-40 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is sandy, powdery structure, calcareous.

III (20-40 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is loamy sand, powdery structure, calcareous.

IV (20-40 cm) - a layer of dark gray color (10 YR 3/1) when dry and in the wet state almost black color (10 YR 2/1). The texture is loamy sand, powdery structure, calcareous.

Profile 41

Relief: flat

Vegetation: no vegetation

Location: within the thermal power plant

Date of study: Summer 2010

On the pedological map of BiH R 1:50000 soil described as:

The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)

MO+OG



External morphology of ash dump



Internal morphology of ash dump

I (0-20 cm) - a layer of grey-yellow color (10 YR 6/4) in the dry state and in the wet state darker gray yellow (10 YR 5/3) Texture is sandy loam, powdery structure, calcareous.

II (20-40 cm) - a layer of grey-yellow color (10 YR 6/2) in the dry state and the in wet state darker gray yellow (10 YR 5/2) Texture is sandy loam, crumb structure, calcareous.

III (20-40 cm) - a layer of grey-yellow color (10 YR 6/2) in the dry state and in the wet state darker gray yellow (10 YR 5/2) Texture is sandy loam, powdery structure, calcareous.

IV (20-40 cm) - a layer of grey-yellow color (10 YR 6/2) in the dry state and in the wet state darker gray yellow (10 YR 5/2) Texture is loamy sand soil, powdery structure, calcareous.

Pedological researches

Profile 44

Relief: more conical elevations with diameter of about 50 m

Vegetation: no vegetation

Location: within the thermal power plant

Date of study: Summer 2010

On the pedological map of BiH R 1:50000 soil described as:

The mineral-marsh gleyic and organo-mineral gley soils (70%+30%)

MO+OG



External morphology of mullock dumps



Internal morphology of mullock dump

I (0-20 cm) - a layer of light gray color (10 YR 7/2) when dry and in the wet state darker gray (10 YR 6/3). Texture is silty loam, powdery structure, calcareous.

II (20-40 cm) - a layer of gray color (10 YR 6/2) when dry and in the wet state darker gray (10 YR 5/2). Texture is clays, crumb structure, calcareous.

III (20-40 cm) - a layer of gray color (10 YR 6/2) when dry and in the wet state darker gray (10 YR 5/2). Texture is silty loam, powdery structure, calcareous.

IV (20-40 cm) - a layer of gray color (10 YR 6/2) when dry and in the wet state darker gray (10 YR 5/2). Texture is loamy sand, crumb structure, calcareous.

Pedological researches

RIVER ZALOMKA



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