

THE INFLUENCE OF TAILING DUMPS ON THE ENVIRONMENT FROM A CHEMICAL AND PEDOLOGICAL POINT OF VIEW AT THE LEVEL OF THE BERBESTI-ALUNU BASIN

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Abstract: The paper presents the measurements and observations made at the Berbești-Alunu coal basin, where soil samples were taken from different points of the coal basin. Based on qualitative and quantitative measurements of the chemical elements in the soil and its degree of fertility, it was found to be poorly fertile and characterized by an acidic pH. However, the presence of vegetation can be observed on its surface..

Keywords : environment, contamination, mines, pollution

1. INTRODUCTION

The Berbești-Alunu coal basin is located between the Amaradia Valley in the western part and the Cernișoara Valley in the eastern part, having a length of 35 km and a width of 5 km, occupying an area of approximately 20.38 km² on the territory of Valcea Region and 6,911 km² on the territory of Gorj Region.

The exploitation of lignite in the Berbești and Alunu area produced changes on the relief of this area. It was necessary to excavate, transport and deposit in dumps, huge quantities of tailings, which simply made whole hills disappear and others were formed a few kilometers away. For example, in Jiga(ă)i waste dump, where before the tailings were deposited there was a fertile, meadow land, today there is a "tailings hill".

The opening of mining has brought rapid changes in the distribution of labor. If until then the main concern of the inhabitants was agriculture, after the opening of the mining operation many people opted for industry, becoming from mining farmers.

Excavating tailings and extracting coal required labor both from the area and from other parts of the country.

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Due to excessive stripping and inadequate construction of tailings dumps, landslides have often become predictable events, for example after heavy rainfall, in areas prone to these phenomena [1,2]. The sterile dumps come from surface mining works, from open-pit mining operations and from preparation plants and thermal power plants. Most dumps are located near mining units and populated areas. Sterile dumps occupy land for agricultural use, pollute water and air through emissions of dust and pollutants. After the tests performed, it was established that most of the dumps have a deficit of salts compared to the quantity of acids they contain, which is where the insufficiency of calcium, potassium, magnesium, etc. particles come from.

The landscape impact created by mining and tailings dumps is significant. The main effect that the mining exploitations have is the removal from the economic circuit of some large land areas and the reduction of the production capacity of some neighboring lands, by changing the hydrological regime. The tailings dumps are subjected to intense modeling processes, streams, ravines and landslides being frequent phenomena affecting the slopes. Large amounts of material in the dump are caused by precipitation, sometimes leading to clogging of riverbeds affecting aquatic life. [2,4]

The Berbești mining basin is part of CHPP Govora (Mining Division), and within the basin there are 4 open pits: Oltet, Alunu, West Berbești and Panga. The height of the dump steps is variable, being generally between 10 and 20 m. In the process of coal extraction, the tailings from the surface until it reaches the coal layer. The uncovered tailings are transported with the help of conveyor belts and stored in specially arranged dumps, which can be both indoor and outdoor dumps. The Berbesti and Oltet quarries are served by active dumps, the dump being made in steps with a maximum height of 10m. This paper studies the influence of tailing dumps on the environment from a chemical and pedological point of view in the Berbesti-Alunu basin.

2. METHODOLOGY AND RESULTS

For the realization of this work, the amendments of the law no. 246/2020 regarding the use, conservation and protection of the environment were considered. Thus, to establish the level of pollution, soil samples were taken for analysis from tailings dumps belonging to the Berbesti-Alunu basin [5].

Based on qualitative and quantitative evaluations performed in the laboratory, it was established that the soil fertility level is very low, resulting in a poorly fertile soil characterized by an acidic pH, medium humus, significant deficiencies of phosphorus and calcium, but still can be observed traces of vegetation at the level of the dumps.

The measurements were performed at the level of 2021, on the heavy metals in the soil and on the pH. The measurements were made for harvesting depths of different sizes, namely between 5 and 30 cm for soils with a less sensitive use from the perimeter of the dumps.

The less sensitive land includes all existing industrial and commercial uses, as well as land areas provided for such future uses.



Fig.1 Vegetation grown on the outer tailings dump within the Alunu quarry

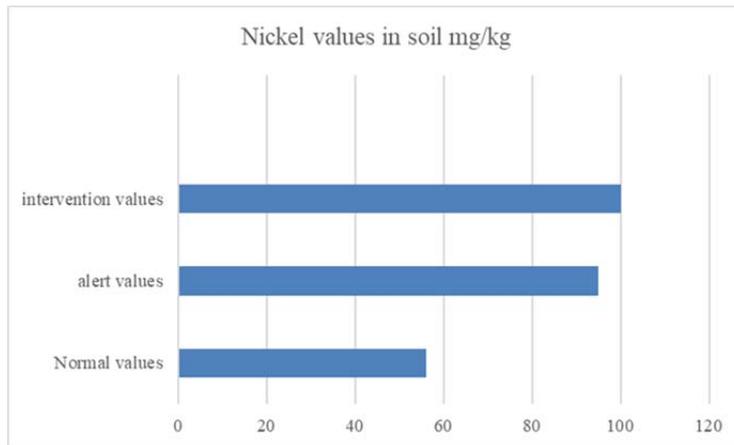


Fig.2 Graphic representation of the level of nickel values in the soil

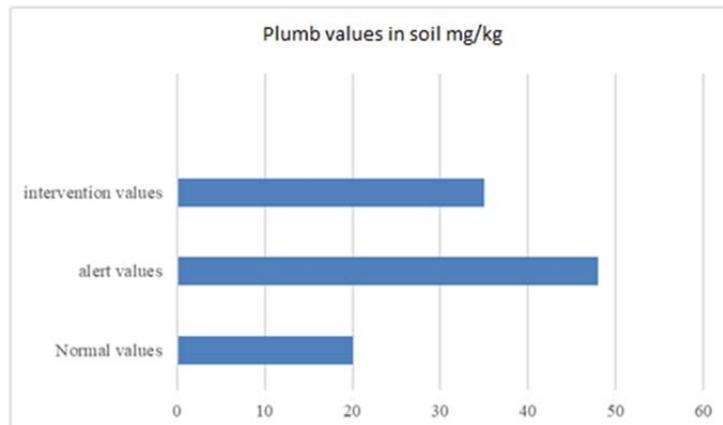


Fig.3 Graphic representation of the level of plumb values in the soil

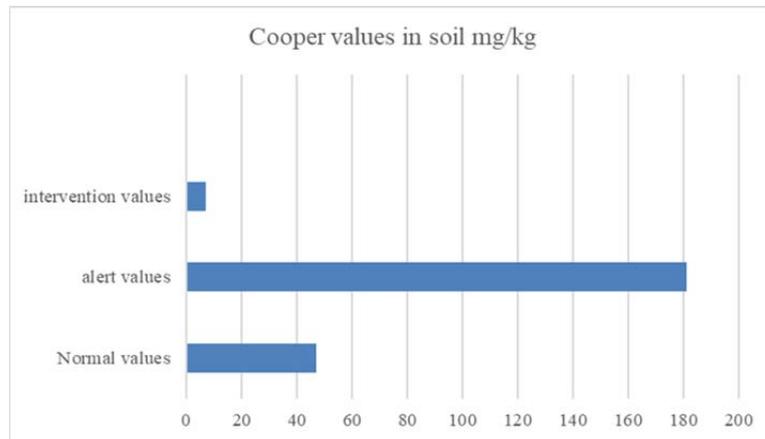


Fig.4 Graphic representation of the level of cooper values in the soil

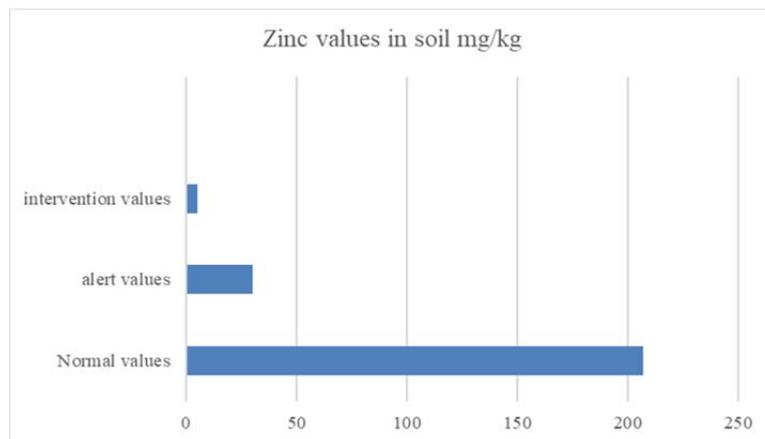


Fig.5 Graphic representation of the level of zinc values in the soil

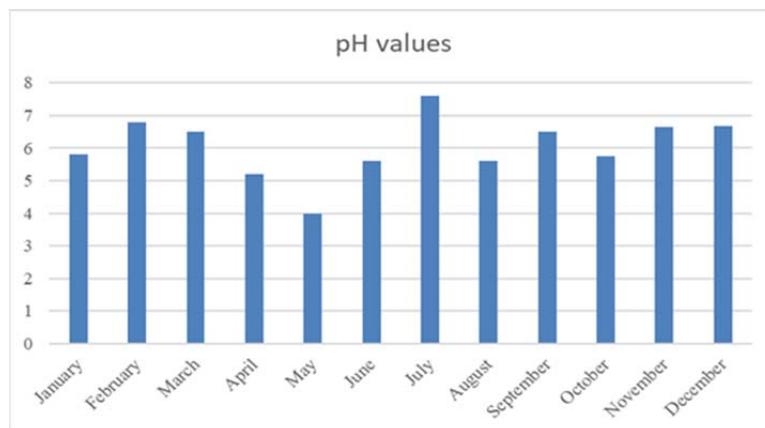


Fig.6 Graphic representation of the level of pH values in the soil

The classification of soil samples was done according to the standard reference values imposed by law, namely normal values, alert values and intervention values.

Following the analyzes performed and the comparison with the reference values, it is found that all metals showed a fairly large deviation from the normal distribution profile, most of the values obtained falling into the category of normal concentrations of metals in the soil, with some exceptions.

Nickel and Zinc have a majority of the concentrations distributed below the normal values imposed by law, while lead and copper have higher values with a majority of the concentrations distributed between the normal values imposed and the thresholds alert.

From the results obtained and presented in the graphs above, the level of lead and copper registers higher values with a majority of the concentrations distributed between the imposed normal values and the alert thresholds.

Most soil samples from tailings dumps fell into the category of weakly acid soils with pH values between 5.81 - 6.80 u.n.t. These are shown in figure number 6.

The Berbesti-Alunu coal basin has six outer dumps and four inner dumps where a volume of 516.614.000 m³ sterile has been deposited so far. The tailings dump in this area are made up of soft rocks, made up of sands, sandy clays, greasy clays, topsoil and less often coal or marl.

Apart from the land occupied for the dump process, a significant area of land remains occupied by the technological lines of excavation and transport, thus the intrinsic development of the exploitation activity in the Berbești mining basin leads to the additional annual occupation of an area of at least 30-35 ha / year.

The effect, sometimes catastrophic, of landslides produced in quarries or tailings dumps requires a more rigorous verification of the geometry and stability of dumps, but also of the final slopes of quarries. The dumps are affected by the following deformations: subsidence, swelling, discharge, landslides, erosions and less often collapses.

According to the pedological studies carried out on the territory of Gorj and Valcea areas where the Berbesti-Alunu coal basin is found, approximately 100,000 hectares of land are affected by landslides.

From a pedological point of view, the purpose of human intervention is the desire to return to use degraded lands due to tailings dumps.

The purpose is to cultivate these lands in the first phase with hayfields, and in the future it will be transformed into arable lands. The need for nutrients being artificially supplemented by man by applying fertilizers based on phosphorus, potassium, magnesium and nitrogen.

3. CONCLUSIONS

As for the deposits that are exploited at the surface, they face both the problem of water from canvases and aquifers, and that of surface water. This is why the drying works play an important role in the technology of surface exploitation. In many cases,

the inadequacy of this problem causes great difficulties in the normal exploitation of the deposits.

The deepening of the quarries, the attraction in exploitation of the deposits with hydrogeological and heavier conditions keep in present the problem of drying and necessitate its improvement. In this field, too, the experience gained in the quarries in Oltenia is useful, as the current exploitations here have had hydrogeological problems and have applied different solutions in concrete situations.

The need to execute in time and in good conditions the drying works at each perimeter and aquifer horizon appeared in the case of putting into operation the coal reserves, so as to ensure the full and optimal exploitation of the deposit

REFERENCES

- [1.] **Faiansi, F.** *Dreptul mediului*, Editura Pro Universitaria, București, 2014.
- [2.] **Dumitrescu, I.** *Poluarea mediului*, Editura Focus, Petroșani, 2002.
- [3.] **Iliăș, N., Radu, S.M., Seraficianu, A.** *Industria minieră din România. Trecut, prezent și scenarii pentru viitor*, Editura A.G.I.R., București, 2020.
- [4.] **Trudinger, J.** *Mining and the environment. From ore to metal*, Taylor & Francis Inc, UK, 2019.
- [5.] **Stanimirescu, A., Radu, S.M., Soica, F.F.** *Measurements made using dsm501a sensors versus measurements made by national air quality monitoring network*, Annals of the University of Petrosani Mechanical Engineering 22, 49-54, 2020.
- [6.] **Stanimirescu, A.S., Egri, A., Radu, M.A., Soica, F.F.** *Research on the negative effects of the "Valea Arsului" tailings dumps on the environment*, MATEC Web of Conferences, 354.
- [7.] **Marc, B.I., Stanmirescu, A.** *Monitoring the quality of the environment in the mining units as a result of the modernization of the equipment*, Innovative Development Of Resource-Saving Technologies And Sustainable Use Of Natural Resources, 2020.