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STUDY ON PEDOLOGICAL SOIL PROPERTIES IN THE "HANEȘ" MINE AREA FOR ITS REMEDIATION

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ABSTRACT. Pollution has become an issue of current concern for all humanity, because of the negative impact on the environment and human health. One of the most affected by environmental factors due to human activities is the soil, which is a sponge for contaminants. Soil contamination with heavy metals presents a major concern both global and national levels, in order to control resulted pollutants from industrial activities and finding different methods of eco-friendly and effective remedy. In the present paper is presented the Haneș mine area, the soil from here being very acid due to mining activities performed in the past

Key words: *environment, pedological parameters, mining activities, soil pollution, "Haneș" mine*

INTRODUCTION

Due to development of urbanization and industrialization, soils have become increasingly pollute, which threaten ecosystems, surface waters and ground waters, food safety and human health (Băbuț et al., 2012; Li et al., 2009; Oh et al., 2014). The soil serve as one of the most important sink for trace metal contaminants in the terrestrial ecosystem, seen as indicators that reflect the quality of the environment (Vereștiuc et al., 2016; Yeung et al., 2003). Soil contamination represents a worldwide concern due to the serious risks for human health and ecosystem quality (Gagiu et al., 2017; Sur et al., 2016; Norra and Stuben, 2003; Braz et al., 2013).

Soil pollution by mining we could say that is the worst form of soil pollution. Firstly, the fertile soil layer is lost and then it cannot be used in agriculture (Keri et al., 2010). Haneş mine is located in Almaşu Mare area, from Alba county. It was opened in 1930 and was closed in 2003. Next to the Haneș mine, at a distance of about 150 m is Haneș dump of steril which is located on the left bank of the Ardeu brook and has a length of about 100 m, width 50 m, height of 25-30 m. It is inactive, disobedient process of conservation and reforestation is not covered by soil. In rainy days in its center forms a small puddle (Hulpoi, 2008; Stancu, 2013).

The informations about the pedological properties of soils is needed for evaluating soils in terms of their quality (Mbagwu et al., 1998).

Therefore, the purpose of this paper is to analyze pedological parameters of the "Haneș" mine area for to choose than the most appropriate method of soil remediation.

MATERIALS AND METHODS

From „Haneş" mine area were taken for analysis six samples. Three samples were taken from the Haneş dump, at a distance of about 150 m from mine and of three different depths, such as: 0-10 cm, 10-30 cm and 30-100 cm. The other three samples were taken from a distance of about 100 m from the Haneş mine (between the dump and mine), the same depth.

Sample analysis was performed in the analysis laboratory of soil quality and abatement processes in the Technical University from Cluj Napoca.

Soil sampling for pedological analysis is present in figure 1.

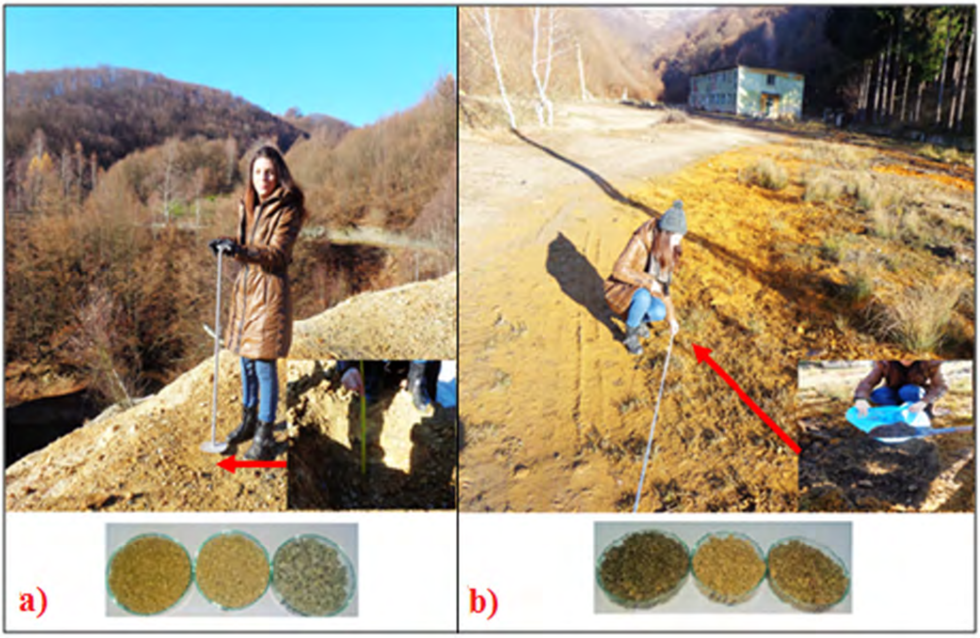

Fig. 1. *The sampling points image: a) soil samples taken from the dump, situated at 150 m distance of the "Haneș" mine; b) soil samples taken from 100 m distance of the Haneș mine.*

Soil samples were brought to the laboratory the next day, where they were analyzed.

The texture of the soil samples and the sterile material was determined using the RETSCH (EP 0642844) AS 200 sifting device. This device operates on an electromagnetic propulsion system and has the role of separating the granulometric fractions by sifting with different dimensional sites: 4 mm, 2 mm, 1 mm, 500 μm 250 μm and <250 μm. Practically, 500 g of soil/sterile material from each sample was then passed through the device for 10 minutes and then the remaining amounts in each sieve were measured.

The pH *was determined by* WTW 2FD47F Multi 3430 Multiparameter Meter *(figure 2).*

Fig. 2. *The Determination of pH in laboratory*

The humidity content of soil samples was determined by gravimetric method. Practically, in each sample was weighed with analytical balance about 100 g of soil was placed in trays (Peri dish). Then they were placed in an oven at 105 °C until they reached constant weight.

The soil structure was determined with Seker method, which consists of dissolution (dispersion) in water the soil aggregates and assessment results after a dash helpful (Micle and Sur, 2012).

RESULTS AND DISCUSSION

The pH values obtained from analysis are present in figure 3.

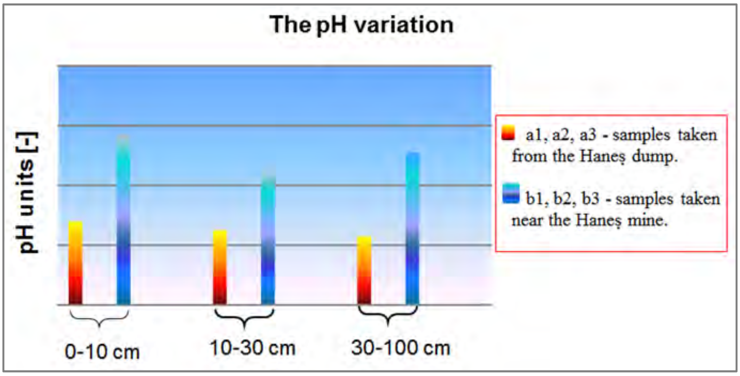

Fig. 3. *The pH values obtained from analysis of soil samples taken.*

pH values obtained indicate that the pH of the dump material and soil which is near the Haneş mine is acid to very acid.

pH of the dump material is in the range 2.3 - 2.8 pH units and in the range of 4.5 - 5.7 is the soil samples taken near the mine.

The results obtained at the determination of soil humidity content from soil samples and waste material from the sampling points 1 and 2 (near the „Haneş" mine and the Haneş sterile dump) are presented in figure 4.

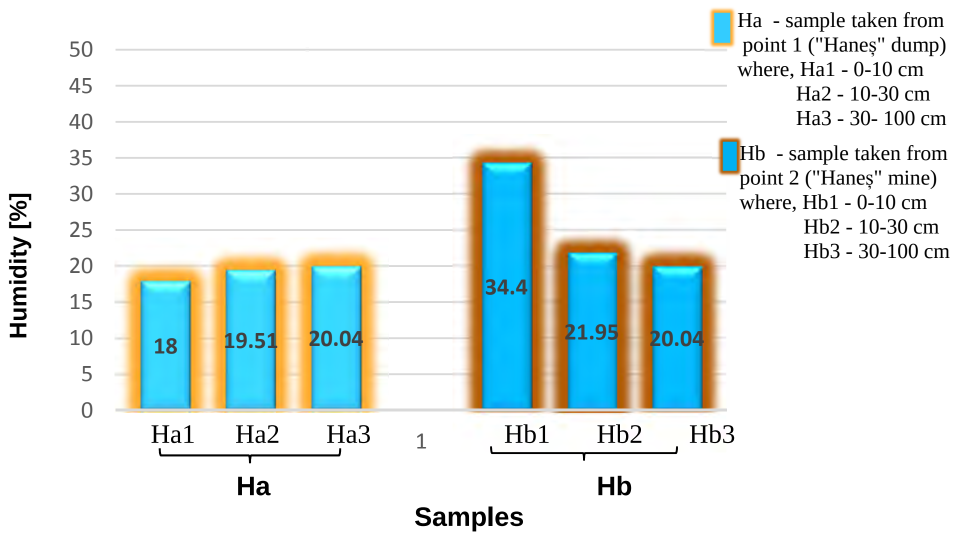

Fig. 4. *The moisture content in point 1 and 2*

The results at the determination of soil humidity content showed that the moisture content of the sterile material taken from point 1 increases with the depth, since on a depth of 0-10 cm the humidity indicated a 18% value, on a depth of 10-30 cm 19.51%, and on a depth of 30-100 cm this indicated a value of 20.04%.

For samples taken from point 2, soil moisture decreases with depth. This indicates a value of 34.4% on the first sampling layer (0-10 cm), 21.95 on the second sampling layer (10-30 cm), and on the third sampling layer (30-100 cm) soil moisture indicated 20.04%.

After performing analysis regarding soil structure, the sterile materie taken from Haneş dump is very poorly structurally. Whereas aggregates are opened almost entirely in small parts (figure 5a).

Regarding of the soil samples taken from 100 m of the mine Haneș (between the sterile dump and mine) this is poorly structured because most of the aggregate are opened in small parts and fewer in large parties (figure 5b).

Therefore soil and sterile material samples analyzed is poorly or very poorly structured, because most aggregates are opened in small parts and less large or only small parts.

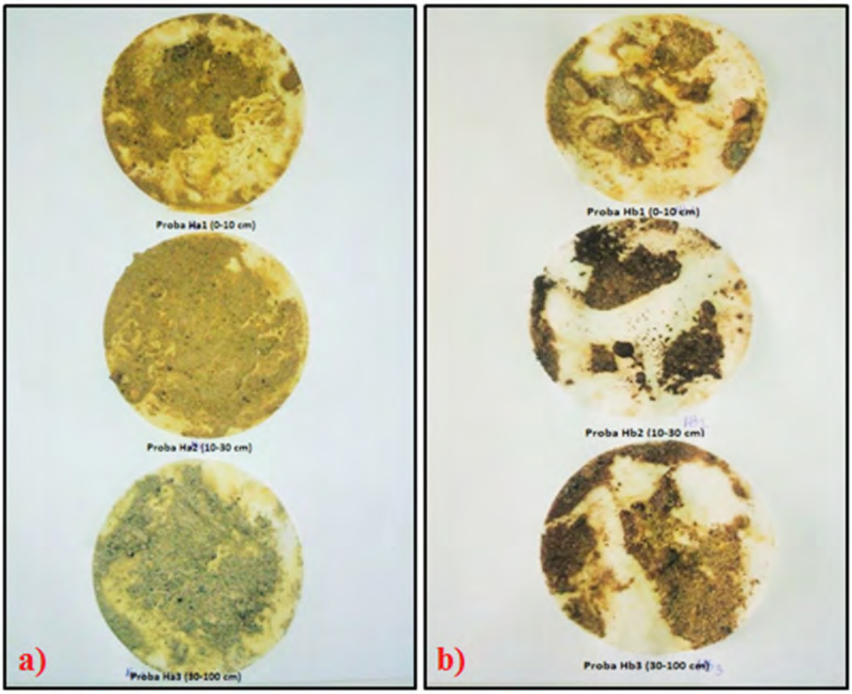

Fig. 5. *The soil structure of samples analyzed on the three sampling depths a) the soil structure of the samples taken from the dump, situated at 150 m distance of the mine "Haneș"; b) the soil structure of the samples taken from 100 m distance of the mine "Haneș".*

Granulometric fractions (%) were calculated using the following calculation relationships (Micle and Sur, 2012):

$$\textit{Coarse sand } (> 0.2 \text{ mm}) = (100 \times a) / m \ [\%] \quad (1)$$

$$\textit{Fine sand } (0.2\text{-}0.02 \text{ mm}) = (100 \times e) / m \ [\%] \quad (2)$$

where:

m - the quantity of dry soil;
a - the amount of coarse sand; [G]
e - the amount of fine sand;
100 - percentage reporting factor.

The following granulometric distribution curves (figures 6 and 7) characteristic of each point were obtained following the analysis of the determination of the soil texture and sterile material from the samples taken sampling.

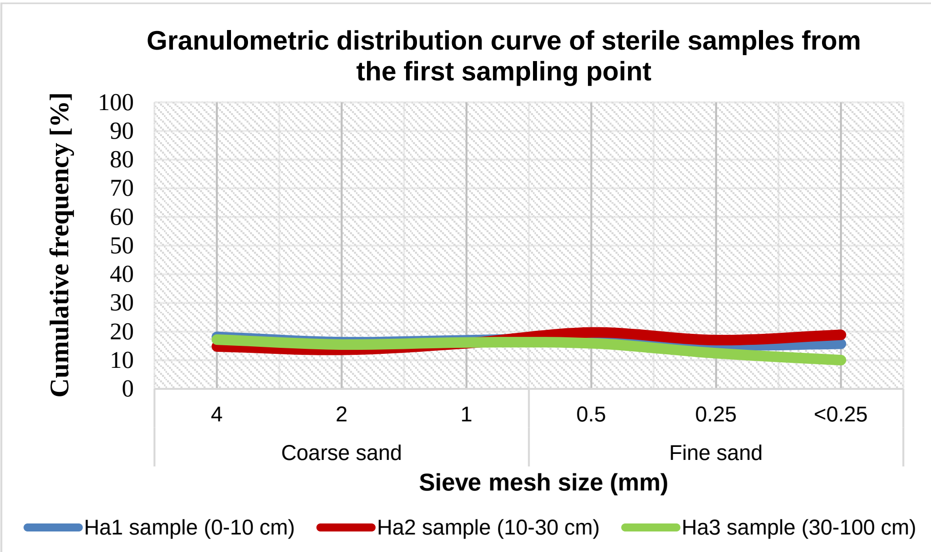

Fig. 6. *The granulometric distribution curve characteristic of the first sampling point*

The results obtained by analyzing the texture of the sterile material in the samples taken showed it to be a clayey sandy texture consisting of a good water retention capacity.

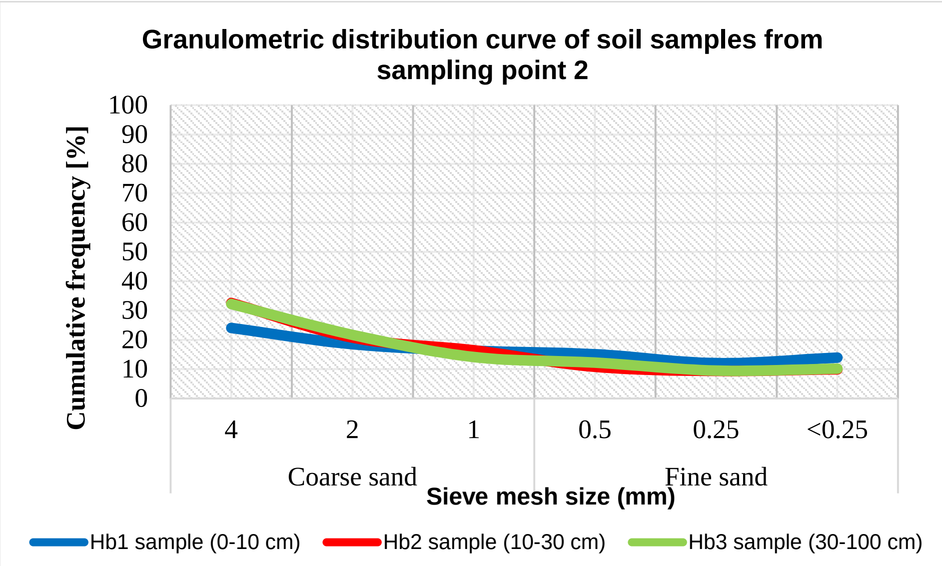

Fig. 7. *The granulometric distribution curve characteristic of the first 2 sampling*

The results obtained in the soil texture analysis from the samples taken showed that the soil has a coarse sandy texture reflecting poor water retention and low fertility.

CONCLUSIONS

The general conclusion that emerges from the study performed on the soil of the Haneș area is that the soil is very acid and is necessary to determine the heavy metals concentrations for to establish the degree of pollution and adopt the most appropriate method of soil remediation.

Ecological restoration of polluted perimeter can be achieved only through complex interventions which can contribute to improving factors of environment: soil and water.

For to accomplish these measures is necessary to conduct complex of studies whose purpose is finding efficient and economic solutions to stabilize ecological reconstruction of dumps, building a treatment plant for mine water and streams.

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