

STUDY ON THE SOIL CHEMICAL POLLUTION IN THE AREA OF THE RESIDUAL BAUXITE LAKE "MINERI" – TULCEA

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ABSTRACT

The paper presents a study on the impact of chemical pollution of the soil, from residual bauxite lake, from "Mineri", in the areal of Tulcea. Soil samples were taken from the lake, and from the immediate area of the lake, where there are agricultural crops. We analyzed the samples in order to determine the chemical elements and pH of the soil, and the bioremediation methods that could be applied to diminish the effects of chemical soil pollution.

KEYWORDS: bauxite, chemical soil, pollution

1. Introduction

At present, pollution is an international issue of humanity because pollutants have reached high values and disturbances are strong and cross-border.

The causes for the occurrence of pollution can be summarized as follows:

- chaotic use of natural reserves;
- accumulation of unusable substances in the environment;
- emergence of new substances where the rate of consumption and recycling by organisms is much lower than the rhythm of occurrence;
- rapid demographic growth, especially in the last two centuries;
- intensive development of industry, transport and agriculture;
- emergence of overcrowded urban areas.

Industry pollutes absolutely all environments (air, water, soil), causing damage to the health of people and creatures, to agriculture, transport, construction and culture [1, 3].

A large number of studies are being carried out on pollutants emitted by industrial branches, on immediate and long-term effects of pollution, on the effects of measures to reduce pollutant emissions. The industry pollutes through harmful materials on soil, underground, by biological and radioactive contamination, by risks both in exploitation and in the possibility of accidents (explosions).

Around industrial plants, toxic elements for plants and animals can be found in the air, water and soil.

Soil contamination consists in: physical degradation (compaction, structural degradation); chemical degradation (increased content of heavy metals, pesticides, pH modification); biological degradation (with pathogenic germs) [6, 7].

As soil is a much more complex system than air and water, pollution affects its properties, therefore fertility. In addition, pollutants can pass from soil to plants, water or air, and depollution is a difficult and sometimes even impossible to achieve.

Soil resistance to heavy metal pollution differs depending on the nature of the soil. Thus, clay soils retain more pollutants, neutral and carbonate soils retain strongly, and sandy soils retain the least (leaching is strong, except Mo and Se). Also, the finer the soil texture, the more the pollutants retained in the soil, which further pass to plants [2, 4].

Soil pollution with heavy metals causes: imbalance of physical, chemical and biological processes in the soil; decrease in biological activity; - inhibition of nitrification processes; toxic action for plants.

Particularly toxic to plants and animals are Hg, Cd, B, As. It has been forbidden to produce mercury-containing fungicides, usable for seed treatment, because it has resulted in deaths of both animals and humans. Cadmium causes decalcification of organisms. Arsenic in the human body causes vascular diseases, which may even lead to limb amputations [5].

2. Experimental Results

As part of this research, a study was carried on the impact of chemical soil pollution in the area of the residual bauxite lake Minerii in Tulcea county.

We used soil samples taken from the area of the residual bauxite lake Minerii in Tulcea, as well as adjacent soil samples from the agricultural area to determine the pH and the chemical composition.



Fig. 1. Residual bauxite lake "Minerii"- Tulcea

From this area, soil samples from 3 distinct points were collected from a depth of 50 cm using a sampling probe.

2.1. Determination of pH in soil samples

In the laboratory of the faculty, the pH was determined for the soil samples taken from the lake and the agricultural area in the lake using a HQ40d type multi-parameter (Fig. 2)



Fig. 2. Multi-parameter HQ40d

The amount of sample soil (samples a and b) is mixed with distilled water (pH distilled water = 5) by a steering rod for 4 minutes (Fig. 3).

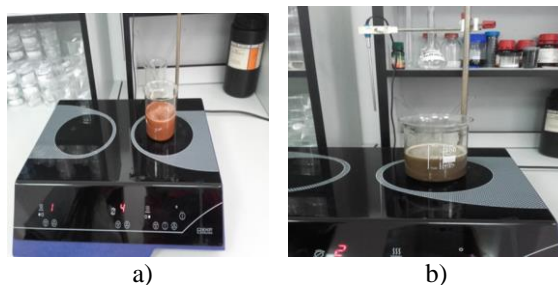


Fig. 3. Soil taken from residual bauxite lake (a), and soil taken from the agricultural area (b)

With a filter paper, the solution required to measure the pH is obtained. The pH was determined using a HQ40d device, obtaining the values shown in the graph of Fig. 4.

After pH determination in the samples of soil and lake and the agriculture area, a higher pH was noticed in the soil sample from the lake, respectively 9.8, the soil being strongly alkaline, while in the agricultural area soil samples the pH was 8.1, implying a slightly alkaline soil.

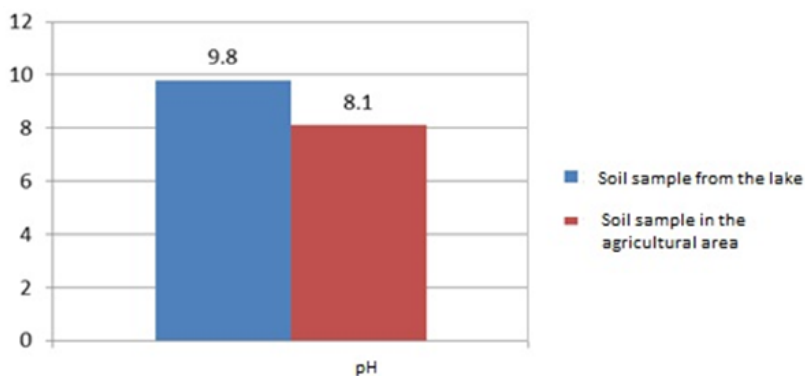


Fig. 4. PH values of soil samples, from the lake and the agricultural area

2.2. Determination of soil chemical composition

Determination of the chemical composition of the soil was carried out as follows: the soil samples were crushed in a crucible and then inserted into the X-ray Spectrometer (Fig. 5).



Fig. 5. X-ray Spectrophotometer The chemical elements detected in the soil samples are shown in Table 1

Table 1. Chemicals elements detected in soil samples

Chemical elements detected in soil samples	Soil sample from the lake [ppm]	Soil sample from the agricultural area [ppm]
Lead	77	19.33
Strontium	56.33	126.33
Rubidium	14.33	65.33
Zirconium	511	307.67
Titanium	68.677	4.365
Barium	209	5.340
Chromium	3.049	-
Iron	21400	-
Zinc	567	49
Cobalt	16.4	2.573
Manganese	-	440

3. Conclusions

In plants, lead accumulates in parts containing chlorophyll, thus blocking the photosynthesis process, and in the most severe forms changes the mechanism of the reproduction process. The lead present in the human body causes anemia, affects the nervous system, and, in cases of severe intoxication, it causes lead poisoning.

Zinc has a role in chlorophyll synthesis, plant growth, increased resistance to drought and frost, fertilization, nitrogen fixation in the case of legumes. Zinc lack causes: whitening of corn leaves; "small leaves" disease in tobacco, live, barley, sunflower.

Manganese has a stimulating role in plant growth, flower formation, vitamin and carbohydrate synthesis. Lack of manganese causes large losses in oats, spinach, wheat, beans, potatoes, peas. Yellow spots appear on the beet leaves.

The soil sample taken from the residual bauxite lake according to Order 756/97 shows exceedances of the admissible limits for lead (SR ISO 11047-99), barium (SR EN 11885-09), zinc (SR ISO 11047-99), cobalt (SR EN 11885-09).

At the soil sample taken from the agricultural area, the detected elements fall within the permissible limits, but there are no essential elements for plant development, such as chromium and iron.

Therefore, it is necessary to apply soil bioremediation methods, such as the use of bacteria for soil decontamination, so that they can be used as agricultural land.

After the determination of pH in soil samples taken from the lake and the agricultural area, a higher pH resulted in the soil sample in the lake. This was 9.8, which means the soil is highly alkaline. At the sample in the agricultural area the pH was 8.1, that is a weak alkaline soil. Most grown plants prefer weak acid and neutral soils.

Analysis on the quality of determinations carried out soil samples investigated, highlights that an alert threshold has been exceeded at Zn, Pb, and Fe, requiring for bioremediation activities of these soils.

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