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Scientific Research on Soil Presence of Bacteria and Heavy Metals, Middle Albania.

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*Abstract–*For the realization of this scientific work, we have focused on innovative techniques that are used to determine the chemical and bacterial contamination of the soil.

In this scientific study, we have presented data on bacteria and chemical elements that are the cause of the pollution of underground layers. Based on the results obtained, we can confirm the soil pollution for the Elbasan area, reinforcing the fact that the current soil pollution is an important factor that affects the resident's quality of life.

To reach a concrete scientific work, we took five soil championships up to 50 centimeters of depth during the September-November 2022 period. The samples taking was carried out mainly in the areas where the light and heavy industries of Elbasan carry out their activity. We have reached chemical and bacterial data that serve as a soil pollution factor, which for the analyzed period are presented for the first time.

We point out the fact that the Elbasan area has always been considered as the most polluted in Albania, pollution that is mainly dedicated to atmospheric pollution. Among the primary factors of this pollution, we mention the abusive activity to the detriment of the environment, both light and heavy industries.

As a conclusion based on the impressive data obtained, we encounter a level of chemical pollution of the soil, mainly from the nickel (Ni), part of heavy metals, present in rates up to 2.5 times more than the established standards from the EU Regulation. We are of the opinion that the bacterial and chemical pollution of the soil comes mainly from the human activities in agriculture, the mismanagement of waste water and moreover the abusive industrial activity.

Keywords – Bacteria, Heavy Metals, Soil Contamination, Nickel, Industrial Activity, Elbasan.

I. INTRODUCTION

The constant presence of various heavy metals in the soil represents a potential risk for the contamination of the soil surface layer, being in this way a constant risk for human health.

The focus for which this scientific work was undertaken was the fact that the soil is mainly characterized by the bacterial and heavy metal content, having an indisputable influence on the content and quality of the soil, underground water and consequently also on the cultivated plants.

The damage caused to plants and fruit trees by microbiological and heavy metal pollution, adding to the possible soil erosion as well as the poor and poor management of the land by humans, has continuously led to the destruction of natural resources, especially in the centers inhabited near industrial areas [1], [2].

Various diseases such as tuberculosis, typhoid, influenza and various fungal diseases of plants or animals are easily spread through the air [3], [4].

The presence of heavy metals in the soil and because of the food chain in mammals leads to toxic effects on living organisms.

This phenomenon is dedicated to competition and replacement between essential chemical elements, as well as damage to the cell membrane and reactions with phosphate groups [5]-[7].

Heavy metals damage the cell membrane of various plants, inhibit the normal development of roots and shoots, reduce CO_2 assimilation by plants and reduce stomatal conductance and transpiration [8], [9].

The heavy metals present in the subsoil are characterized by a specific pH, and any fluctuation below the predetermined value of this pH leads to a significant increase in their solubility.

Heavy metals are mainly found in the form of ionic and colloid phase particles.

In this paper, data are provided on microbiological and heavy metal pollution of the soil of Elbasan city, during the period August-September 2022, as well as the relationship on the impact on human life is presented. To perform a more accurate analysis of the level of soil pollution for the Elbasan, we performed microbiological and toxicological analyzes for soil samples taken at five stations.

For this scientific research, focusing on the two types of analysis mentioned above, which were carried out on the soil samples taken in the Elbasan, we tried to present a valid information on the possible impacts on human health and the factors that have led to underground pollution.

II. MATERIALS AND METHOD

Four soil samples aretaken at a 25 cm depth during the September-November 2022 period in Elbasan area. For the speciation analysis, determinations in water soil extracts were carried out by applying the colorimetric method diphenyl carbazide [10].

So, 2.5 g soil samples were shaken with 25 ml of demineralized water for 2.5 hours. After centrifugation for 10 min at 3500 rpm, the water was filtered through a 0.45 μm Millipore filters [11]. Instantly after extraction, the sample was acidified with a drop of concentrated ultrapure HNO_3 to bring the pH < 2. Afterward the sample was kept in a refrigerator until analysis.

Soil pH (after standard calibration at pH 4-7) in a suspension of 10 g of soil in 25 ml demineralized water, after magnetic stirring for 30 min, followed by 5 min sediment settling.

Various studies showed that the soils sediments consisted of more than 90% of silt to sand fraction. The clay fraction was about 10%.

The analysis of the grain size performed by taking 10 g of sample were treated first with 1 M HCl to remove the calcareous material, then oxalic acid for iron release and H_2O_2 for organic release.

Crown it all the samples were treated with peptisant for 1 h on hot plates.

III. RESULTS

The analysed soil samples were taken during the period September-November2022 in five strategic points of Elbasan area.

The data obtained for each of the four months and for the five stations are grouped together, this was done with the aim of having a more realistic conception of the progress of soil pollution compared to the basic parameters.

Table 1 shows the microbiological presence in soil samples, where data on the number of Enterococci and Coliform bacteria are given.

Analysis of soil microbial populations in contaminated areas have shown a significant presence of aerobic bacteria, actinomycetes, fungi and nitrogen-fixing agents and various microbial groups [2], [4], [12].

Table 1. Summary table of microbial analysis(average and percentage values) for all five stations.

No.	Microbiological index		Average per 100 g *of dry soil weight*		Total %	
1	Total Coliform bacteria *(group)*	Coliform bacteria - *without E. coli*	51450	**63320**	60	**76**
		E. coli - Part of Coliform Bacteria	11870		15	
2	Enterococci *(genus)*		**19200**		**25**	
Total groups of Bacteria			**82520**		/	

Table 2 shows the presence of chemical elements in the two months analysed for the four stations, as well as the recommended content.

From the data in table 2, we see that except for Nickel (Ni) which appears in values much higher than the allowed rate, becoming a key factor in the pollution of underground deposits, other heavy metals are within the norm.

Table 2.Summary table of soilheavy metals with average values for all four stations.

No.	Heavy metals	Recommended content (mg/kg)	Average(mg/kg)
1	Arsenic (As)	30	0.85
2	Cadmium (Cd)	3	1.4
3	Chromium (Cr)	200	52
4	Cobalt (Co)	75	36
5	Copper (Cu)	140	28
6	Lead (Pb)	300	74
7	Nickel (Ni)	75	**196**
8	Zinc (Zn)	300	72

IV. DISCUSSION

The soil can be contaminated by bacterial factors, due to the discharge of sewage, while from the content of heavy metals, due to the dumping of industrial wastes on the ground.

From the processing of the obtained data, it appears that the underground of Elbasanarea is polluted, mainly from the underground water that comes because of the discharge of raw industrial water from the heavy industries operating in Elbasan.

We believe that the heavy metals that cause soil pollution are mainly released into the environment by smelting and refining industries, technological industries, scrap metal, the plastic industry and by burning waste containing these elements. Heavy metals can then easily reach the food chain through drinking water supply, air inhalation and food consumption [13].Also, the fact that Elbasani considered one of the most polluted cities in Albania is indisputable.

We think that among the main reasons for this pollution may be: high population concentration, busy traffic, infrastructure, lack of green surfaces and above all the development of heavy industrial production activity and poor management in relation to technical control of carried out by the Albanian state, mainly in non-compliance with measures for environmental pollution.

Besides animals can absorb for their own needs a food contaminated with heavy metals, the rest is excreted from the soil through the organic manure that we obtain from animal excrement [14].

We are of the opinion that there is a negative correlation between heavy metals and microorganisms, a phenomenon dedicated to the fact that the presence of heavy metals in the soil helps to reduce the number of gastrointestinal bacteria.From the results obtained in this paper, the presence of nickel above the norm in the surface layer of the soil is clearly seen.

This phenomenon depends on the lithology of the terrain and is a proof that in the studied area the nickel pollution is the result of the natural distribution of nickel [2], [15], [16].

Also, environmental pollution from Ni is mainly caused by refinery discharges and industrial waste, as well as traffic [17], [18].

In conclusion: the soil of Elbasanthroughout the analysed period turns out to be contaminated by the heavy metal nickel.

V. CONCLUSION

•From the results obtained and the analysis carried out, we conclude that heavy metals are present in optimal conditions, except for nickel.

• Heavy metals are present in the underground of Elbasan, the presence of which does not represent a level of pollution, with the exception of nickel, which is at levels about 2.5 times higher, compared to EU standards.

• We are mainly of the opinion that the soil pollution in Elbasan is dedicated not only to human activity in agriculture, but also to the deposits of raw materials from the abusive activity of heavy industries operating in Elbasan.

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