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ENVIROMENTAL AND ECOLOGICAL IMPACTS OF ILLEGAL DUMPING

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Abstract: *My chosen topic is the environmental and ecological impacts of illegal dumping because today it is a very big problem in Hungary and around the world. During my research I studied the impacts done to the soil using Hungarian standards to determine soil quality. Within this, I used organic and inorganic chemical test methods such as e.g. analysis of heavy metals, detection of inorganic compounds or organic compounds by spectrophotometric methods. Soil pollution is a global problem that affects both humans and the wildlife around them. Contamination entering the soil can spread to other environmental elements, so its investigation is also important for human health. The results show that illegal dumping not only causes social problems, but also the impact of soil as an environmental element based on the performed studies. I established these results with the help of Hungarian and European Union regulations and pollution limit values. In conclusion, we can talk about the fact that in each casethe degree of pollution depends on the waste deposited and its amount, which is reflected in the ecological effects as well as in the measured results.*

Keywords: *Illegal, waste, pollution, soil, health, environment*

INTRODUCTION

General soil characteristics

The concept of soil, a conditionally renewable natural resource, which is also a basic means of agricultural production, forestry, a living medium of the Earth's solid surface, the most important characteristic of which is fertility [1] under Act CXXXIX of 2007, but in the ordinary sense the soil is the highest solid envelope on Earth. The soil is home to animals, people, and a place to grow plants. Its basic property is fertility, which means that it is able to supply the vegetation on it with enough nutrients and water at the right time. This allows for the production of primary biomass. Soil is involved in the natural cycle, both biologically and chemically. Because the energy and chemicals that come to the earth's surface appear in the cycle and either appear as an initial or intermediate or final destination in the soil, from which they canbe utilized in some way by the appropriate living organisms. Due to fertility, we can say that soil is a product of fertility. Examined from this point of view, the condition of the soil is authoritative and guidingthe ecology of the surface formed on it. With this in mind, it can be said that soil plays a multifaceted role globally. In part, it can be an indicator, a place of production, a habitat, but even the soil can be all of them. Furthermore, soil is a fundamental element with several functions, its function is the space of humanactivities and life, but it can be considered as a physical medium, a source of raw materials, but also as a medium with archival functions. In terms of physical medium, man can use soil as a "area" for construction. These include roads, houses, social facilities, and everything our built environment needs for
life. As a source of raw materials, the soil can be said to provide some of the raw materials for the

construction industry (sand, gravel, clay), but it also contains water, minerals, many types of oil, and also a deposit of raw materials. Its function as an archive is nothing more than the carrying of archaeological and paleontological information, which is essential for contemporary history in order to draw conclusions from the changes of the past regarding the development of our future.

Soil structure

In the extent of the soil, we can speak of two directions. Its horizontal extent is the part of the earth's surface that we can also see, as well as the vertical part, which is the depth direction of a given soil profile,which is the section that can be examined by moving towards the center of the earth. As they are built up by different soil formers at different depths of the soil, certain physicochemical properties will also change(spatial change). Another feature of soils is that their physical, chemical and morphological properties can change over time. Such as: temperature, which is a periodic change, a trend changes in a certain direction, such as: accumulation of organic matter. The change can be random, which is mostly man-made pollution.The duration of the change over time also varies, from a change of a few hours to a change of seasons. During soil surveys, monitoring surveys provide a complete picture of changes affecting the soil. Its Hungarian collection system is the TIM, the Soil Protection Information System, which records the measured data, which is public and can be retrieved. This is based on the 2007 CXXXIX. law, which covers arable land, land protection and soil protection. The core points of the TIM system are 865 points nationwide, we can find 183 of the measuring points in forestry, and we can also find a nice number of special measuring points, exactly 188 points. [2]

Chemical and physical properties of soil

Soil types appear in very varied forms on Earth. They may vary from continent to continent, but also from region to country. Terrain and weather conditions largely determine its quality and, consequently, the composition of the soil. In general, soils contain humus, minerals, water, gases, and, of course, organic matter. The quality and general characteristics of the soil can also be greatly influenced by the flora covering the soil. One of the most important chemical characteristics is the pH, which can be clearly seen in the figure shown here, what is typical in Hungary.

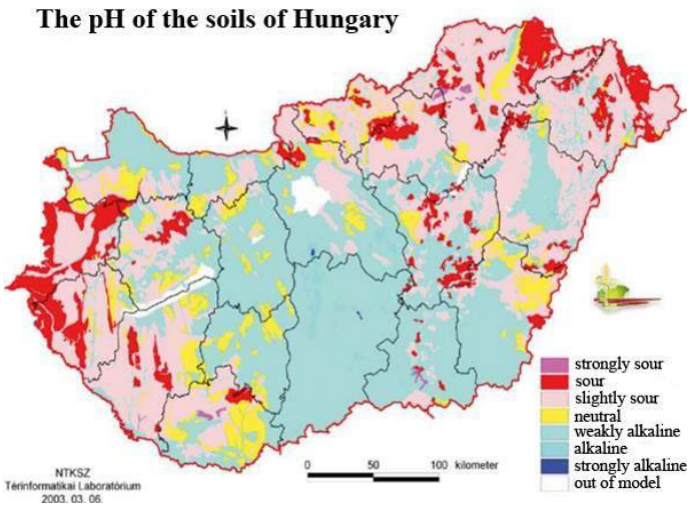

Figure 1. The pH of the soils of Hungary

In terms of its physical properties, it can be said to have a mechanical composition, a constraint, a structure, and its own water and air management.

Soil contamination

The following can be considered as the definition of soil pollution, the entry of foreign substances into the soil that reduce the fertility and quality of the soil, either directly or through air or water. Also, the combined effect of soil degradation caused by secondary contaminants formed during the transformation of the input materials causes the deterioration of soil quality and fertility, which can also be caused by human activity and natural processes. These processes usually have some physical, biological negative effect. Changes in the balance of physical and biological soils are accompanied by changes in soil ecology:

1. direct pollution → anthropogenic + local
2. with air / water → regional or global
3. lithosphere pollution (deeper)
4. contamination under the humus layer (in the case of lateral movement)

Using a different definition, it can be said that it is a process related to human activity, during which the physical, chemical and biological properties of the soil developed under natural conditions change significantly and in an unfavorable direction. Soil pollution impairs ecological soil functions (biomass production, filtering, balancing, transformation and storage role, habitat and genetic reserve).

Types of waste, production and consumption waste

One of the main problems with waste is that products with a minimum lifespan are produced from too many materials and by investing large amounts of energy. Due to the organization of the consumer society, rapidly consuming energy sources are available, in contrast, an increasing amount of waste is generated in developing and developed countries. Therefore, a more modern approach and assessment of waste will be given great emphasis in the coming period.

Today, human society is producing ever-increasing waste heaps. This entails pollution, but it is also a huge problem for today's social order. The biggest fact about waste that we have to declare is that the best waste is what we don't even produce. With this in mind, we need to take stock of the types of waste, at the level of production and use, as well as the technologies, ideologies associated with waste management, fashion trends today, and the effects of waste on the environment.

Groupings and quantities of waste

In terms of legal regulations, the definition used in Hungary today, but also internationally accepted, was formulated and applied in accordance with the amended European Community Directive 75/442 / EEC on Waste, which reads as follows: "the intention of all holders of waste and interest based on it". In addition, Section 3 (a) of the Waste Management Act provides the domestic definition, which includes the following: An object or substance falling within one of the categories set out in Annex I which the holder discards or intends or is required to discard. [3]

The production / use of waste and its disposal pathway must consider the chemical / physical / biological effects of the waste and, in this context, require legal and social measures covering a coordinated set of activities covering the whole life cycle of the waste. This includes the prevention of waste generation, the minimization or reduction of the amount of waste generated, and the application of one final solution, storage and disposal. In accordance with this, Act XLIII of 2000, which has a broad legal background applicable in Hungary, was born. Act on Waste Management. [4]

According to a 2016 figure, the amount of waste generated in the European Union is estimated at 2 and a half billion tons. A significant part of this comes from mining (~ 25.3%) and construction (~ 36.4%), but a huge amount is generated from household waste (~ 8.5%). [5]

MEASUREMENT RESULTS AND CONCLUSION

The results in the table above, which were considered to be above the limit value, were determined according to the points of the relevant annex of Joint Decree 6/2009 (IV. 14.) KvVm-EüM-FVM. [6]

Original sample identifier in the first soil sample: District X 1/1; simple name 1/1 sample exceeds the soil limits in several points. A III. These are marked with an asterisk in Annex. Among the general chemical

parameters tested, the following metals exceeded the pollution limit values set out in the relevant Annex 1 points of Joint Decree 6/2009 (IV. 14.) KvVm-EüM-FVM [7].

Barium (Ba)

Barium is a naturally occurring element that can have the following physiological effects: high barium content is usually a toxic element measured in air and soil (which is the 14th most common in soil) from which it can be extracted by skin or by growing vegetation in the area toxic effects, which can lead to paralysis and, in severe cases, death. In general, the toxic element in areas containing hazardous waste is barium, which is miscible in water, so the compounds formed from it can leach from the soil into deeper water layers, which can further pollute the ecosystem as well as groundwater. [8]

$$Ba + 2H_2O \rightarrow Ba\,(OH)_2 + H_2$$

Exceeding the limit value of almost 10% can be measured in the examined soil sample. The limit value is 6/2009. (IV.14.) KvVM-EüM-FVM, in which Annex 1 deals with the pollution limit value by groups of substances, of which Annex 1 contains metals and semi-metals. The limit is given in mg / kg dry matter. The measured result is 273 mg / kg dry matter. The value of barium exceeding the limit value measured in the soil is probably due to the fact that the examined area (District X 1/1 sample - 0.15 m) of the illegally dumped waste had been ignited earlier. An area of 2 to 1-2 centimeters high ash covered the area, covering an area of almost 10-15 m2. During sampling, this ash portion did not come into contact with the soil sample as they were taken at a depth of 15–30 cm. It can therefore be concluded that barium, which belongs to the group of alkaline earth metals in the soil, is derived from illegally deposited waste incinerated there. Because barium is water-soluble, it could have been washed into the soil with the help of rainwater, causing pollution. From the results measured so far, it can be seen that it has entered and washed into the top layer of the soil.

Cadmium (Cd)

From a physiological point of view, in connection with the measured results, it can be said that it is an important moment during the research and exploration of contaminated soil. Cadmium can be said to be dangerous in several ways, as it can be enriched much more easily in the upper layers of the soil than other heavy metals. This is because it cannot leach out of the soil and makes it much easier to get into the food chain. It is important to mention that they are easily absorbed from the soil in plants, even without visible poisoning. [8] By incorporating essential zinc into the human body, it can have harmful effects that can damage the liver and the lungs when inhaled but can also lead to many cardiovascular problems.

One of the factors influencing cadmium uptake is pH, which in larger acidic soils other than the general pH 7 allows higher amounts to enter living organisms. [9] This is fully met in our case, as it is clear that at each sampling point, although the pH point falls within the "normal" pH range, the other points in the study area are strongly acidic pH areas. As the contaminated source is not entirely a point source, possible leaching is possible to the entire area covered by illegal waste. Like barium, cadmium pollution above the limit value can pose a serious threat to wildlife. Aware of these, it can be said that it can be concluded that cadmium, which belongs to the group of transition metals in the soil, comes from illegally deposited wasteincinerated there. Because cadmium is soluble in water, it could leach into the soil with the help of rainwater, causing contamination in the topsoil.

Zinc (Zn)

The average amount of zinc in the lithosphere is 80 mg kg-1 on average, while in Hungary it is 25-100 mg kg-1 [10]. In general, it can be found in the form of Zn2 +. The material balance of the soil in the case of zinc shows that more zinc enters the soil every year than the soil-dwelling vegetation can absorb or utilize. It can get into the soil mostly in connection with mining, metallurgy and the burning of fossil fuels, the latter burning the sheep into the soil by settling out of the float. Because zinc is an essential trace element,
it is easily absorbed by wildlife, but in parallel it is one of the most dangerous heavy metals. The high value measured at the first soil sampling point is extremely important for soil remediation.

Copper (Cu)

Copper plays a particularly important role in plant nutrition and plant growth. As an essential element essential for proper life processes to take place, it is an activator of the respiratory chain, an activator and creator of many enzymes. The average total copper content of the soils is approx. 20 mg / kg, but this is the average of very different extremes. The mineral content of soil-forming rocks primarily determines the total copper content of soils, as in the case of Zn and Mg. depending on the rock type, the copper content varies, the highest amount is found in basic rocks (140 mg / kg), sedimentary rocks already contain less copper (57 mg / kg) and the smallest amount (30 mg / kg) in acidic rocks such as e.g. occurs in granite. The amount of microelements that can be taken up by plants is regulated primarily by the reaction state and pH of the soil, so any effect that directly or indirectly affects the pH of the soil also affects the uptake of microelements. The resulting deficiencies and the possible toxic effects are also strongly influenced by the microbiological processes that change with the effect of pH, the microbiological activity modifies the solubility and oxidation state of the microelements Mn, Zn, Cu, Al and Mo.

Lead (Pb)

Of the toxic heavy metals, lead is one of the oldest known occupational toxicants. It is used in many areas of the economy as a metal or in the form of its compounds. During exposure, it tends to accumulate in the human body and cause damage to health. The damage to health can be temporary or permanent, so it is important to control exposure

The average amount of lead (Pb) in the earth's crust is 15 mg kg^{-1}. The lead content of surface soils varies in the range of 3-189 mg kg^{-1}, the lead content of unpolluted agricultural soils is 10-67 mg kg^{-1}, with an average of 32 mg kg^{-1}. 80% of domestic soils have a lead content of less than 25 mg kg^{-1}, the same as the domestic background value [12]

CONCLUSIONS

However, the adverse effects of metals are significantly more complex in environmental compartments, as toxicity is determined by solubility, ionic strength, pH, and redox conditions. As a result, with changes in temperature, solubility, pH, and redox conditions, the metal compounds present can be transformed, and the most toxic form can appear at any time.

In biological systems, the concentration of metals can vary by several orders of magnitude relative to each other. Their presence in a certain concentration is necessary for healthy functioning. The so-calledessential metals below a certain concentration cause developmental disorders, which are Zn, Cr, Co, Mn, Mo, Sn, Cu and Fe.

In the case of soil contamination, the most important feature is remediation, and this is determined by the remediation target value. The value is defined as the remediation target value, which gives the maximum concentration of the pollutant in the environmental medium after remediation. This value must not only be achieved during remediation but must also be maintained in the long term. In addition to professional and technical issues, ethical and social aspects of the environment must be taken into account when determining concentration.

One of the most frequently used methods of cleaning up a polluted environmental element is boundary system remediation. The system is based on a table of specific pollutant concentration values, which prescribes limit values based on a uniform environmental policy for all environmental elements. During system-based remediation, the limit values in force in the contaminated area apply with binding effect to the target condition to be achieved.

Soil pollution can be caused by any anthropogenic, liquid, dissolved, or soluble foreign matter that enters the soil surface or directly into the soil. These contaminants move in the soil according to the laws of physical chemistry and also affect the ecosystem. The speed of movement is determined by several parameters. The most important of these are the chemical properties of the contaminant, persistence, solubility, gravity, pressure conditions, specific gravity differences, soil porosity / capillarity, soil sorption / retention capacity, redox conditions and soil solution pH. In addition to the parameters that determine the transport process, taking into account the effects of pollutants on soil and water, pollution prevention and

remediation offer a wide range of solutions in the field of environmental technology. The applied technological solutions may be unique, but the operational elements of the technology are similar.
Suggested solutions:
As the sampling shows the measured values over a given period, it is in any case necessary to re-examine the given soil samples at a later date. It is considered possible that III. The amount of impurities exceeding the limit values indicated in Annex I will also appear in deeper layers in spring, as the sampling took place in the early autumn after summer. In the case of higher precipitation, which could be said to be true for the last few days (until 2021.10.01-2021.11.05), the fact may arise that the pollution has entered the deeper layers. It cannot be ruled out that it will sooner or later reach the aquifers. Therefore, a soil damage in the area is suggested in this way.
The high PAH content measured in the contaminated soil area is partly due to the fact that it was taken next to an access road. It has been reported in several literature that the optimal air-fuel mass ratiorequired for perfect fuel combustion is 14.5 [11]. In the case of a different ratio, we can speak of imperfectcombustion, during which polyaromatic hydrocarbons, also known as combustion, can be formed.
A soil remediation procedure is recommended in the area, as the area is approximately 20 square meters and only the top 15cm in height was measurable, so soil replacement is recommended in the area. However, PAH pollution exceeding the limit value needs further investigation, as the amount of illegally disposed waste found in the area does not justify the pollution exceeding the limit value.

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