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TOXICITY EVALUATION USING BIOINDICATORS IN THE PERIMETER OF LANDFILL ŞOMÂRD, FROM TOWN MEDIAŞ

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ABSTRACT. Municipal landfill from Şomârd-Mediaş, the county of Sibiu zone induces a significant pollution, caused by inadequate waste disposal, with a negative environmental impact on soil and surface water. The study of this objective, were performed analysis on samples of water and of soil taken from the boundary landfill. The ecotoxicity and biomonitoring was tested with Lolium perenne, for the soil samples, and with Lemna minor for water samples.

This study sought to highlight the main source of pollution, the degree of pollution of the area and the importance of developing a technology for bioremediation of water from municipal landfill water storage pit Şomârd - Mediaş.

Key words: *biomonitoring, municipal landfill, technology for bioremediation*, *Lolium perenne*, *Lemna minor.*

INTRODUCTION

The landfill from Medias, Valley Şomârd is currently closed. Closing the landfill was not carried out as required by the legislation in force that provides ecological zone and returning it to the circuit in nature. The landfill was closed from Şomârd-Mediaş as decided by the government in 2005 on the landfill of waste, due to several irregularities like:

- Lack of drainage and leachate collection;
- Lack of landfill gas collection.
- The location near the stream Şomârd makes extremely difficult and expensive the implementation of such arrangements.

Analyses performed on the landfill showed high levels of pollution since 2006. When analyzing the soil samples were observed a concentration of lead which is above the alert threshold. The waters from storage pit have an acidic character and heavy pollution, organic compounds and heavy metals - Copper, lead, cadmium, etc. (CCPAIM, 2006a).

Following the analysis for soil and water samples taken from the site in 2011-12 is observed that:

- analyzes of soil samples indicates a negative effect on waste disposal activity in the immediate vicinity of the ramp, with a greater impact than in 2006;

- analyzes of water samples from the storage pit and the stream from the vicinity of landfill indicate a massive pollution (in particular the organic load) which imposes a ban on use of water from this source (CCPAIM, 2006b).

- So far, there have not been applied technologies or ecological rehabilitation of the area (Mihăiescu *et al.*, 2010).

MATERIALS AND METHODS

Water samples were taken from the water storage pit in landfill household, municipal and industrial waste Şomârd-Mediaş, county Sibiu. This water is being loaded with various pollutants: heavy metals, oxides, phosphates, etc. and having a slightly acid pH represented an important environmental issue for the area (Oprea *et al.*, 2010; Muntean, 2003).

There were determined the physical parameters of water that have been compared to standard drinking water from Romania and the European Union. With the help of the device RQ flex 10 Meck were determined the concentrations of the different heavy metals.

Table 1. *Heavy metals present in contaminated water from the water storage pit of municipal landfill from Şomârd (05.11.2011)*

Parameters analyzed	Measure unit	Obtained rezults water storage pit	Figures adm. Cf. Ord. 1146/2002 Class V-a quality water	Standard methods used
1. pH	Unit. de pH	**4.3**	6,5-8,5	SR ISO 10523
2. Lead	µg/l	**38**	>25	STAS 8637-79
3. Cadmium	µg/l	**9.4**	>5	STAS 6953/81
4. Zinc	µg/l	**472**	>200	STAS 7852-80

In table 1 are presented the results of analyzes made in the laboratory on polluted water from the water storage pit of landfill. It can be seen above the maximum permissible concentrations of heavy metals.

Biomonitoring and ecotoxicity study of pollutants in waters, was carried out in two variants (micro-tanks), with Lemna minor plant grown from fresh water (Variant 1 – blank sample) and in polluted water brought from the water storage pit of Şomârd (Version 2). In each variant were added one liter of water and 16 grams of plant Lemna minor to cover the entire surface of the water.

To apply eco-toxicity test, Lolium perenne was placed in two variants experimental, in three repetitions (containers) with 50 plants in each. Observations and the notary were performed over a period of two weeks.

RESULTS AND DISCUSSION

Using biomarkers to characterize pollution is based on biological responses of individuals, of biocenoses or populations and under different environmental pollution. The use of bioindicators has the justification that different pollutants act in a different manner on bodies (selective) and that is why various physiological functions will be affected differently. Some species are more sensitive and can be used as an indication of the existence or intensity (concentration) of pollutant (Oros, 2002; Malschi, 2011).

Through the environmental monitoring are determined and monitored pollutant concentrations in biota, namely water, air and soil. The biomonitoring cannot replace these monitoring systems, but it can complete. Activity of monitoring can be applied on the biotic environmental components. At the completion of environmental monitoring to correctly assess eco-toxicological effects on the biotic component are studying fingerprints traces of pollutants (Oros, 2002; Malschi, 2009a; 2011).

In applying ecotoxicity and biomonitoring tests of soil samples were used the species *Lolium perenne* and for contaminated water was used species *Lemna minor*. This has been accomplished by the test method the biotechnology laboratory of the Faculty of Science and Environmental Engineering using bioindicator plant pollution (Malschi, 2009, 2011; Rachel *et al.*, 2011).

After the study is has been observed 100% mortality in variant 2 (Fig. 2), which indicates a significant pollution of the soil surrounding the landfill compared with blank sample (Fig. 1). Demonstration of soil toxicity requires quick actions to stop the pollution source and application of the bioremediation technologies and ecological reconstruction of the area Şomârd.

In Figure 3 it is observed that Lemna minor plant from the blank sample - V1 developed normally, has green colour, and the mortality is reduced (Fig. 6 and 8). For the variant V2 (Fig. 4) it can be noticed that Lemna minor plant has a high mortality (Fig. 7 and 9), which indicates a significant pollution of the water. The plant has a dark color compared to the blank sample.

Fig. 1. *Biomonitoring conducted with Lolium perenne plant in unpolluted soil which is blank sample.*

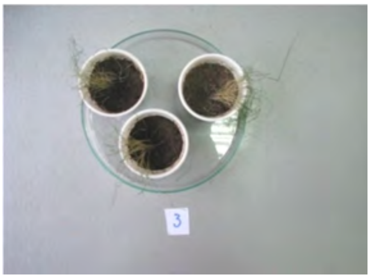


Fig. 2. *Biomonitoring conducted with Lolium perenne plant in polluted soil from landfill Şomârd-Medias.*

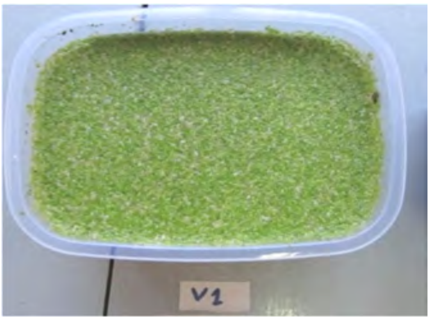


Fig. 3. *Biomonitoring with Lemna minor plant, in fresh water - after two weeks.*

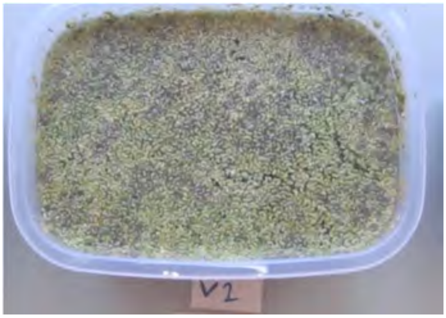
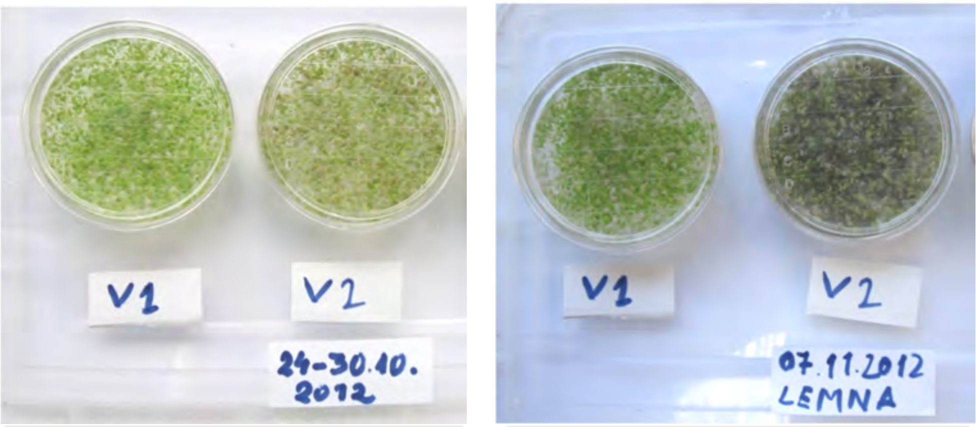


Fig. 4. *Biomonitoring with Lemna minor plant, in the water from bund, after two weeks.*

Table 2. *Biomonitoring mortality plant Lemna minor (%) in the water samples from the water storage pit Şomârd, Mediaş (23.10. – 7.11.2012)*

Variants	23-30.10.2012	30-07.11.2012
V1 = blank sample	11.6 %	12.7 %
V2 = water from storage pit from Şomârd	25.7 %	53.3 %



Biomonitoring with *Lemna inor*/ 30.10.2012

Biomonitoring with *Lemna minor*/ 7.11.2012

Fig. 5. *Biomonitoring of water samples taken in 2012 from the landfill Şomârd, in experiments with Lemna minor. Variants: 1.= fresh water, 2=water from bund Şomârd*

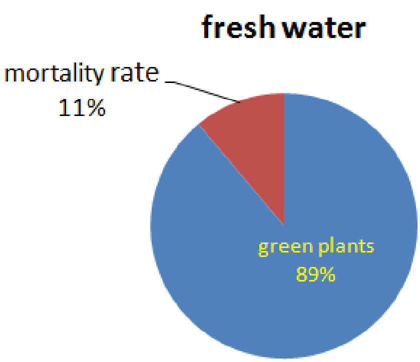


Fig. 6. *Mortality plant Lemna minor after a week in the blank sampler (V1)*

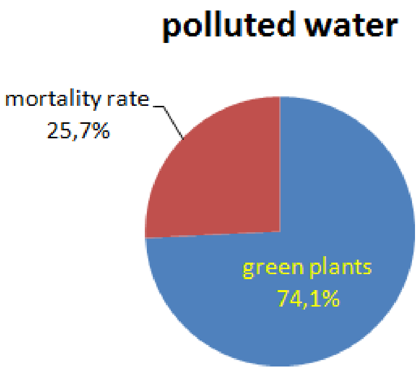


Fig. 7. *Mortality plant Lemna minor after a week in contaminated water sample (V2)*

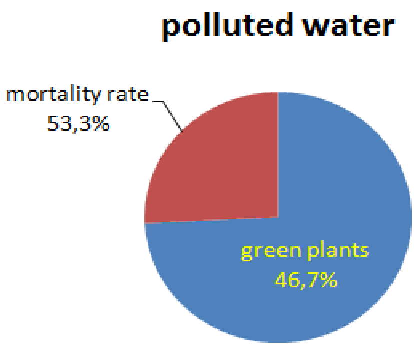


Fig. 8. *Mortality plant Lemna minor after two weeks in the blank sample (V1)*

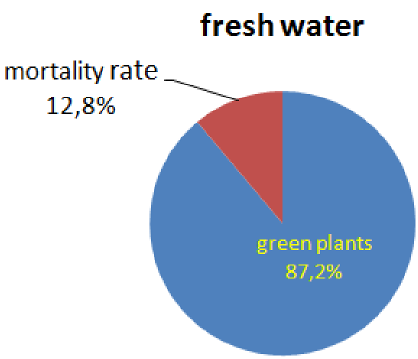


Fig. 9. *Mortality plant Lemna minor after two weeks in contaminated water sample (V2)*

After completing field observations and laboratory results we can say that the main source of pollution is the bund from the landfill. Pollution of the soil around the landfill is determined by the existence of some infiltrations into the soil surrounding the landfill. According to the studies presented above obviously, it can be seen that the water from the bund has a low quality and it cannot be used for watering animals and in the agriculture. To stop this major source is necessary to be applied the bioremediation technologies to the bund.

Using biocenosis built as artificial flooding area (constructed wetland) decontamination can be achieved by bioremediation of polluted waters.

Experiments have shown the effect of phytoremediation and bioaccumulation by aquatic plants on the various contaminants (organic compounds and heavy metals). This model of bioremediation is one of the cheapest technology remediating contaminated water from storage pits and ponds (Malschi, 2011; Malschi et al., 2012; Vymazal, 2005; Vymazal, 2010). The efficiency of these species is influenced by the temperature that can vary from 100% to 60% (Masi *et al.* 2002) and 76% in the case of an experimental study (Sim *et al.*, 2007).

All natural and constructed wetlands have a common characteristic: presence of surface water or near the surface at regular intervals time (USEPA, 1999). Wetland hydrology is represented by streams of water in slow motion and shallow waters, or those with saturated substrates. Slow the water flow and depth superficial allow sediment particles as the water passes over the surface of the wetland, allowing prolonged contact between water and areas of the wetlands (Vymazal and Kropfelova, 2011). The complex mass of organic and inorganic, as well as the opportunity to exchange the gas / liquid favors the development of a large number of micro-organisms that break down and/or transform a variety of toxic compounds (Vymazal, 2010).

CONCLUSIONS

The bioindicators could help determine the degree of pollution of the area and can build a complex picture of the polluted perimeter. Using Lemna minor species could detect the main source of pollution. After this laboratory study could study a bioremediation technology to the pollution source and the entire perimeter.

Construction of wetlands - pools with plant associations for the greening in bioremediation and phytoextraction plan of polluted waters from Şomârd bund may be an adequate technology for biological remediation.

Using the constructed wetland ecosystems zones, composed of aquatic plants with high biological treatment, bioaccumulation of pollutants (bulrush, reeds, rushes, lentils, etc.) as well as using of green algae, the cyanobacteria, various species of water microbiota to remove heavy metals and other pollutants is an important method of biological pollution.

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