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Research of Heavy Metals and Physical and Chemical Analysis of Drainage Waters in the Peja Landfill

Dobroshi Florent[1,] , Mazrreku Armela[2*], Behrami Aziz[1], Malollari Ilirjan[3], Lorina Liçi[4]

[1*]University of Mitrovica "Isa Boletini, Mitrovica-Kosovo;

[2]University "Aleksander Xhuvani", Elbasan, Albania;

[3] Department of Industrial Chemistry, University of Tirana, Albania;

[4] Faculty of Geosciences, Polytechnic University of Tirana, Albania

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Abstract: Waste collection is one of the most serious problems of civilization both from the municipal as well as the commercial, sanitary - epidemiological, construction, hydrological and technological aspects. In this paper, four samples of drainage water from the Peja Depot were collected and divided: two in June and two in September. The purpose of the paper is based on the use of 3 different methods, which are compared between them with results based on the presence of heavy metal values and the physical and chemical analysis of the drainage water at the Peja landfill. Sampling was done after a lagoon survey and sampling, so sampling evidence was kept in order to enable conclusions to be made more accurate, where standard sampling tools and containers were used.The waste piles of the open-air environment posed danger and produced pollution and other hazardous substances, as well as drainage waters of such landfills which have a high level of pollution have been and are potential pollutants of surface and underground waters. Taking into account all these very damaging elements for the environment, this paper deals with the

research of drainage content and the problem of waste disposal at the regional landfill of Peja according to EU standards.

The methodology that will be used during this paper and study will be oriented to:

- Collection of literature and data about the study area.
- Collection of samples from collected water at the Peja dump.
- Analysis of collected samples.
- Presentation of data using statistics, graphics, maps etc.

The main purpose is to ensure minimal environmental impact

Keywords: landfill, waste, pollution, drainage, analysis.

INTRODUCTION

Lack of recyclable capacities made all waste generated both from households as well as from idustrials (white technology, various metal waste, different batteries with Pb content, Hg, Cd etc) to be deposited at landfill. One such example is the Peja landfill, which is overcrowded by debris, and almost all sides of the landfill derive acidic waters with high polluting concentrations[1].

Groundwater and land are particularly threatened in industrial sites and in many inadequate waste dumps.

The waste sector is also a source for greenhouse gas emissions and contributed emissions to the country by approximately 4 %, ie by 380 tons CO_2 in 2012 (Environment Status Report, AMMK, 2015).

The current municipal waste management system in Kosovo is environmentally unsustainable.

Collecting, transporting and disposing of MKs is not available for everyone, so uncollected waste is thrown or burned and this negatively affects human health, water, air, soil and biodiversity [2,3].

Such angles will contain highly polluting pathogens, highly toxic chemicals harmful to man and the ecosystem in general, then for a certain period of time we will also have the processes of biodegradation of organic matter and as a result we will have the appearance of ammonia (NH_3), Methane (CH_4) and other pollutants[4,5].

Throughout history, the development of civilization and human progress has often been linked to the development and advancement of regular waste management. The man has always insisted that the remnants produced leave them away from where they lived, adjusting and covering them.

Waste collection and inadequate care has become a global human problem, with the increasing tendency to endanger the surrounding environment [6].

For the last four decades, the European regulations described intensively follow the development of the concept of waste management, with the tendency of reducing the amount of waste both created and deposited.

Waste management is one of the most priority questions at the most diverse levels, both European and world-wide. The EU-approved rules show that among the initial relevant environmental acts that are defined

in the common chapters on environmental protection from harmful human actions and impacts, it is mainly related to waste problems and inadequate care [7,8].

In 2008, the so-called Waste Directive (2008/98 EU)[9,10], which has supplemended and amended several earlier directives where the waste definition is considered under the law on waste management: *any substance or object that the holder throws, aims or is obliged to cast.*

Waste is divided into groups, subgroups and types of waste according to the properties and place of their creation. Solid wastes represent a very complex and heterogeneous material, which under normal conditions are solid and are created as a result of the lifestyle and activity of the man in the household, the workplace, the public surfaces etc. According to European standards EN 13 965-1, solid waste is defined as "waste that is mainly composed of solid materials" [11].

Of course, by their properties, the waste is divided into: (hazardous, non-hazardous and inert waste) According to the site of creation we classify the waste into: (communal, industrial and hazardous). Remnants are numerous and classified according to the directives of the European Union and we distinguish: waste of paper, rubber, plastics, mining waste, automotive waste, construction waste, waste from used oils, waste from sewage, etc.

MATERIALS AND METHODS

Municipal waste generation in Kosovo by region is presented in **Tables 1 and 2** showing that the largest amount of waste during 2009 was deposited at Pristina landfill (84,660.59 tons), while the smallest amount was collected at the landfill Sharr (4807.00 tons).

If we compare the data for waste deposited in sanitary landfills for 2009, until 2013 it is noticed that in all the regional and municipal landfills there were larger quantities of waste disposal, while the waste collection data by region for the time period 2009-2013 are presented in **Figure 1 and 2.** The other data we have presented as in the tables below.

Table 1: *Quantity of waste deposited in landfills in Kosovo, 2009-2013*

Year	2009	2010	2011	2012	2013
Tons	247,206.65	255,546.27	270,788.07	264,309.08	285,209.59

Table 2: Tonnes per month waste in Kosovo

Type of material	Tonnes - months
Metals	3018.9
Paper	940
Plastics	128
Organic waste	52.5
Tire	4

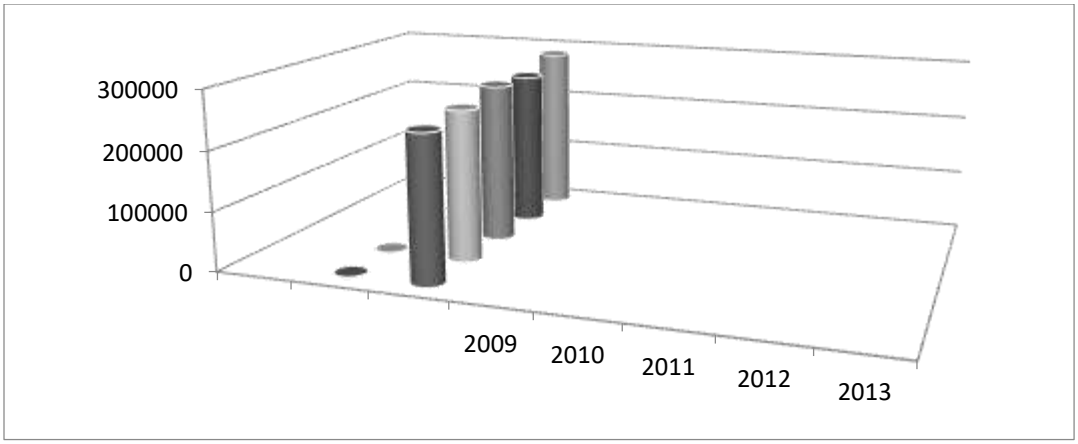

Figure 1: Quantity of waste deposited in sanitary landfills 2009-2013

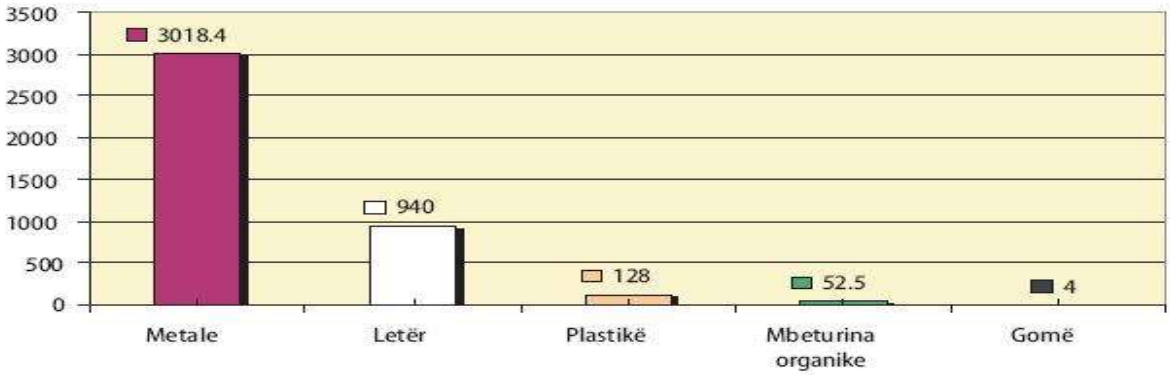

Figure 2: Graphic presentation of waste in Kosovo

There are very few natural and ideal sites for landfills, which sites have a suitable soil structure for discharged waste. The penetration of rainwater and surface waters into a landfill is associated with the causing of streams or locks.

RESULTS AND DISCUSSION

The experimental part of this paper was conducted in the laboratory of the Agricultural Institute in Peja. We have received 4 samples in total, and we have analyzed them. During the physicochemical analysis and the research of heavy metals in the wastewater in the waste landfill in Peja, we used different chemicals needed to determine the many parameters.

For the realization of this paper we have used contemporary methods of parameter setting, such as: direct dilution method, combustion method (MP-AES) and microwave method (ICP), and in very rare cases classical standard methods of analysis where sampling was done after a lagoon survey and site surveys.

Sampling evidence was kept in order to enable conclusions to be made more accurate, so standard sampling tools and containers were used.

For the determination of the parameters of the wastewater landfill samples in Peja we have used these devices and instruments:

- Measurement of Oxygen Oxygen Metered Meter.
- Conductivity measurement, Conductometry,
- pH measurement is done with pH meter,
- Measurements of heavy metals concentrations are made with three types of methods.

The toxicity of heavy metals depends on the type of metal, the compound, the amount arriving at the body and the duration of the metal action. In this metal group, they are part of: Hg, Pb, Cd, Cr, Cu, Ni, As, Zn.

Research of metals through MP-AES apparatus

Work performance: In the pre-ground porcelain cup at 200 ° C (30 min) and cooled to room temperature, weigh in the analytical scale the empty cup (A0), add 10-20 ml (A1) water sample, the sample flask is first heated to 200 ° C and placed in the oven at low temperature (200-300) ° C which gradually rises up to 560 ° C, at this temperature the sample stands for 4 hours. The hot sample is placed in a desiccator and after cooling, add 20 ml of HCl (1.4) and place in the normal container 100 (ml) and level with distilled water to the mark and measured in MP-AES.

Table 3: Burning Method (MP-AES) samples of the month of June

ppm	Ca	K	Mg	Zn	Fe	Pb	Mn	Cu
Sample 1	109,10	1975,21	73,18	4,93	2.03	0.16	0.8	0.41
Sample 2	98.70	1950.08	68,50	4,50	1,97	0,17	0.75	0.39

Table 4: Combustion Methods (MP-AES) samples of September

ppm	Ca	K	Mg	Zn	Fe	Pb	Mn	Cu
Sample 1	196.96	2100.1	133.8	072	43.43	n.d	1.23	1.89
Sample 2	147.59	2050.89	108.5	0.55	31.79	n.d	085	1.18

Table 5: Definition of macro elements

ppm	K	Ca	Mg	Na
Sample 1	2069.27	9250	7631	1577.97
Sample 2	2126.67	7350	6744	1561.21

Metals Research Method (ICP-OES): ICP-OES equipment is one of the most important elementary analysis methods, due to the advantages that are low detector boundaries for many elements as well as high precision.

Work performance : Filtration from the filtrate we get 45ml of teashed add 5ml of HNO_3 + 1ml of HCl into the microwave which has five steps:

- The first step is carried out at the temp. 145 ° C, 30 bar pressure and 5 min.
- The second step is carried out at the temp. 170 ° C, p = 30 bar and time 10 min.
- The third step is carried out at the temp. 190 ° C, p = 30 bar and time 15 min.
- The fourth step is carried out at the temp. 100 ° C, p = 0 bar and time 10 min.
- The fifth step is performed under the same conditions as the fourth step.

Table 6: ICP Method (Microwave)

ppm	Ca	K	Mg	Zn	Fe	Pb	Mn	Cu
Sample 1	111.70	2052.7	72.90	5.0	2.15	0.25	0.88	0.44
Sample 2	100.10	1978.40	67.85	4.48	2.0	0.19	0.73	0.40

Another method is the direct dilution method where we get 1 ml and put it in 100 ml container and leveled with distilled water *up to the mark* and measured directly in MP-AES.

T**able 7:** Results by direct lining method June

ppm	Zn	Cd	Fe	Cu	Pb	Mn
Sample 1	Nd	Nd	1.76	Nd	0.18	0.10
Sample 2	Nd	Nd	2.01	Nd	0.19	0.09

Table 8: Results by direct dilution method September

ppm	Ca	K	Mg	Zn	Fe	Pb	Mn	Cu
Sample 3	111.70	2052.7	72.90	5.0	2.15	0.25	0.88	0.44
Sample 4	100.10	1978.40	67.85	4.48	2.0	0.19	0.73	0.40

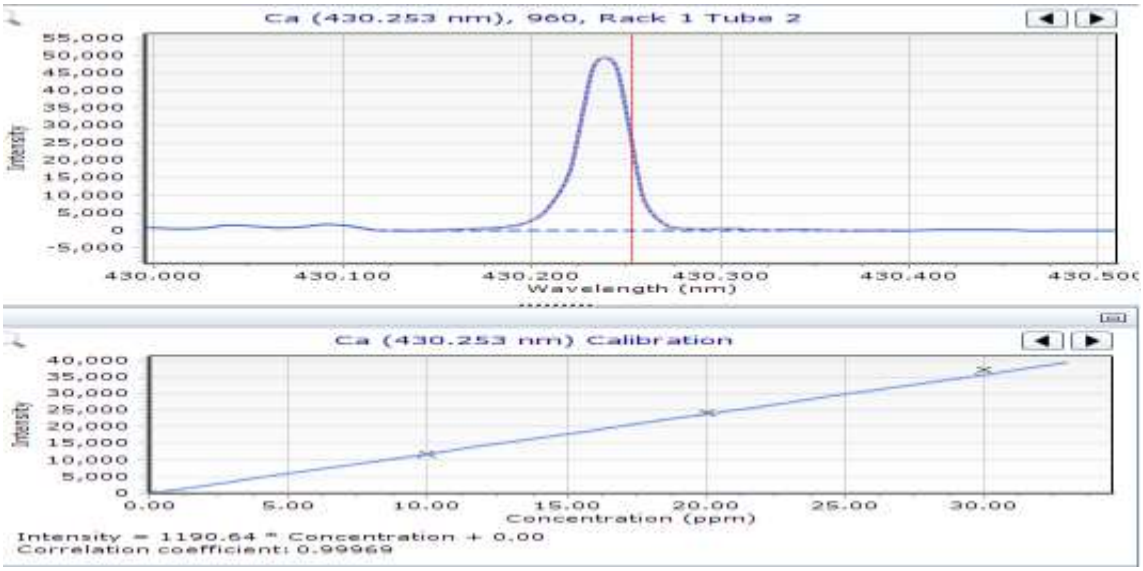

Figure 3: Ca graphical presentation in the first sample - September

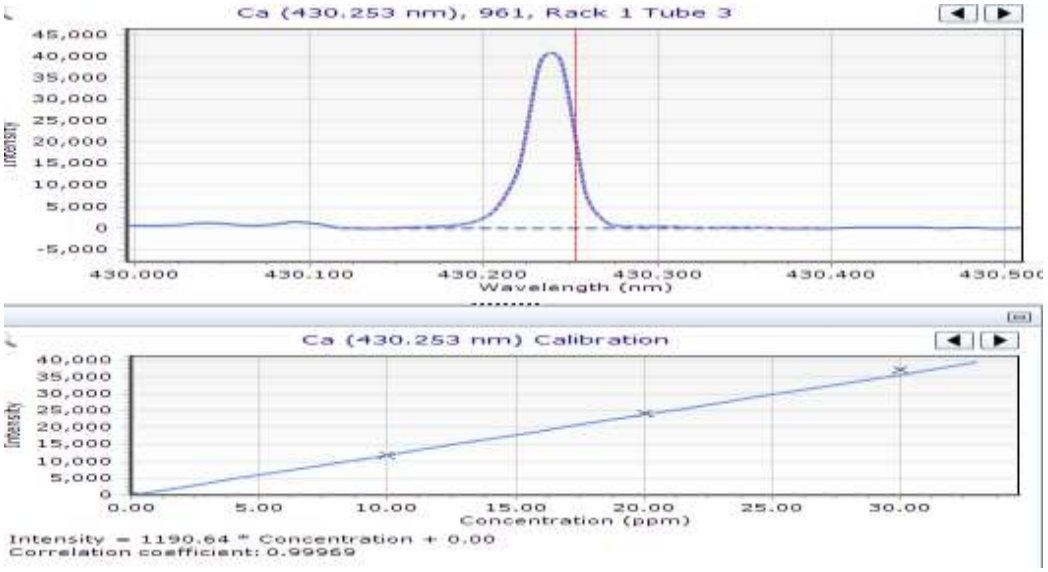

Figure 4: Graphic presentation of Ca in the second sample – September

DISCUSSION OF RESULTS

This paper includes the research of the waste dump metals in Peja. Four samples were taken directly to the well of the running waters of the Peja landfill.

Physical parameters before precipitation were determined on 26.06.2018 June and 15.09.2018 September in IBK and we have obtained the following data:

Time: Sampling is done at 15:00 in June and at 13:00 in September.

Weather: The weather can be sunny, cloudy, dry, and so on. The moment we took the water sample in the lagoon of waste landfill in Peja has been hot weather in June and sunny in September.

Temperature: The temperature measurement is done with a suitable and precise scale thermometer at 0.1 ° C. The ambient temperature is set where on 26.06.2018, the ambient temperature was 26 ° C in June and 30 ° C in September and then the water temperature that in our case is 14.05 ° C (June), and 17.0 ° C (September).

Flavor: We have defined the aroma as a physical parameter by sniffing. During the sampling of water at two intervals June, September in the lagoon of the waste dump in Peja, it was found that this water had a smelly flavor.

Color: Water in the lagoon of the waste dump in Peja is yellow in black and remains almost unchanged

pH: The pH difference is this. June 8.85 September 8.29. where the difference is not large but sensitive.

Electrical conductivity: The electrical conductivity in the lagoon of the waste dump in Peja is (17.19-18.53) μS/cm in June, while (24.5-19.2) μS/cm in September.

Determination of heavy metals : was done on 27.06.2018 Data on heavy metals are determined by the MP-AES, ICP-MS and direct dilution methods. From tables 3, 4 and 5 we understand that in the elements (K, Fe, Pb) we had value changes depending on the method used. In the elements (Mn, Ca, Na, Mg) there was a decrease of the values in the samples 1 and 2 and a significant difference also in the samples 3 and 4 of September.

If we take and make some comparisons between the samples June - September then we point these variations of values in the drainage water at the landfill of Peja, for example during the analyzes were used in the first 3 samples, while in the second samples 2 methods (slimming, microwave, and burning). The results achieved and the difference within the three month period, knowing that summer with its temperature influences to have higher metals values.

Slimming method: June samples (1 - 2) and in September samples (3 - 4)

Fe (2.15-2.01) ppm; Mn (0.88-0.73) ppm; Ca (109.10-298.70) ppm

Fe (1.76-2.10) ppm; Mn (0.10-0.73) ppm; Ca (1196.06=2147.59) ppm

CONCLUSION

During the work was mentioned the creation of acidic waters arising from the already filled landfills and from the landfills that have long been operating, the composition of the acidic waters and the methods of treatment. Each method of treatment has its own advantages but also on the other hand, each of them has their own shortcomings. Which processing method will be applied depends on the degree of purity that can be accomplished by such method, or can be used as a combination if a higher level of purification of these acidic waters is required. The negative effects that can be caused as a result of soil, surface water and subsoil water pollution and direct contact with the population justify the cost of treatment.

I consider that Peja's landfill should urgently review the continuation of its operation as a result of the lack of basic elements for operation, such as the removal and treatment of waste water and landfill gases since it is now in the phase of the generation of its gases and the cost of ecological disaster prevention will later be higher and the damages will be greater. Groundwater sample analyzes for wells near well-drained and accumulated landfills should be done continuously according to predetermined time standards.

Professional and managerial skills of landfill staff as well as the development and implementation of public awareness programs for the population near and around the landfill sites. Centralized treatment of drained waters with a treatment plant only for landfills. Finally, when constructing waste landfills, landfills should be deeply standard, so that these waters cannot be accessed in an open but flow into special treatment facilities, and from there flow as clean. To have a research and operational continuity within the landfill in the future in longer periods of time as a study point for younger generation scientists.

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*** Corresponding author: Mazrreku Armela;**

University "Aleksander Xhuvani", Elbasan, Albania;

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