

## A Contribution to the Waste Analysis and Management in the Prizren Municipality, Republic of Kosovo

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### ABSTRACT

The municipal waste composition in three localities in southern Kosovo was analyzed in 2004 and 2017. The results show that most of the municipal waste is composed by biodegradable components and at a lesser degree by cardboard, glass, plastic, metals etc. The presence and increase of hazardous waste in municipal containers was observed in all investigated localities. This study showed that there was no significant change in the municipal waste composition in 2017 compared to 2004. This investigation through a case study in the Prizren Municipality is a contribution to the municipal waste management in Kosovo. It highlights the importance of including the registration of individual and organized cardboard, metal and plastic operators into the municipal waste management system, in order to know the exact amount of waste produced per capita. It also emphasizes the importance of organizing separate containers for hazardous waste due to the possible significant environmental and health problems.

**Keywords:** residual waste, hazardous waste, waste management.

### INTRODUCTION

The modern way of life continuously increases the amount of produced waste, both in rural and urban areas throughout the globe [e.g. Ziadat and Mott, 2005]. Large amounts of food waste, construction and industrial waste, electronics, clothes and furniture waste end up in the environment, thus causing disturbances in the functioning of different ecosystems [Abdel-Shafy and Mansour, 2018]. However, the legislation at the European level has tightened up during the past two decades, thus causing a significant increase of awareness in terms of environmentally sustainable management of waste. The most important document in this regard, The Waste Framework Directive (WFD) sets up the priorities in the process of management by encouraging prevention of waste generation, as well as reuse and

recycling and environmentally friendly way of waste disposal. The usage of waste as a resource is also one of the priorities of WFD. WFD along with other EU directives includes targets in terms of reduction of municipal waste: recycling of half of the municipal waste, increase of batteries collection, recycling of a significant amount of non-hazardous construction and demolition waste.

The sustainable management of waste beside legal prerequisites, human and financial resources, also requires the precise knowledge and analysis of produced waste in order to be able to plan its disposal, processing and potential further usage in generating financial incomes [e.g. Cheng and Hu, 2010].

The legislation related to waste management in Kosovo is still in progress, including its transposition with the EU legislation. Law on Waste (No. 2012/04-L-060) has several main goals such

as: i) prevention and reduction of the generation of waste as much as possible, ii) reuse of used components from waste, iii) sustainable development through protection and preservation of human resources, iv) prevention of negative effects of waste in the environment and in human health, and v) final storage of waste in an acceptable environmental method [MESP, 2018]. There are several bylaws and administrative instructions dealing with different aspects of waste disposal, as well as treatment and management.

The goal of this paper is to analyze the structure, percentage, density, volume as well as the waste mass in the Prizren area in the southern part of the Republic of Kosovo, in order to contribute to the enforcement of the above mentioned priorities of WFD.

## MATERIAL AND METHODS

This investigation was carried out in three localities in the Municipality of Prizren in 2004 and 2017. Prizren is a municipality located in the southern part of the Republic of Kosovo, which according to the 2011 census has 177,781 inhabitants. Two of the investigated localities are found in the urban area of the Prizren town (Ortakoll and Kurilla), while the third locality is located in the rural area nearby Prizren (Korishë). Three containers were analyzed in Ortakoll, two in Kurilla and one container in Korishë. The

results are presented as average per locality. For the process of waste analysis, the following items were used: weight scale, plastic bags, gloves, working suit and a calculator.

In the investigated localities, three containers with the volume of 1100 liters were selected in each locality. The contents of containers were then emptied and separated into the following waste categories: organic waste, paper, cardboard, glass, Fe – Metal, nonmetal waste, plastic waste, PET, foil, textiles, inert material and hazardous waste.

## RESULTS AND DISCUSSION

Tables 1–2 and Figure 1 present the results of waste analysis expressed in kg and percentage, as well as the comparison of the average values for three localities in the Prizren municipality. The biodegradable waste varied in 2004 from 59 to 65%, while in 2017 – from 56 to 66%. The percentage of paper in 2004 but also in 2017 varied between the investigated sites from 2% to 5%. The cardboard contribution into the overall percentage of waste analyzed in 2004 was from 4% to 5% amongst different sites, while in 2017, it was from 3 to 6%. The percentage of glass in 2004, but also in 2017 varied from 2% to 6%. The Fe-metal percentage in the garbage in 2004 was from 1 to 5% while in 2017 it was from 2% to 6%. The lowest value of non-metal waste in 2004 was 4% and the highest similarly 4%, while in 2017

**Table 1.** Results of waste analysis in three localities in the Prizren Municipality, Republic of Kosovo, expressed in kg

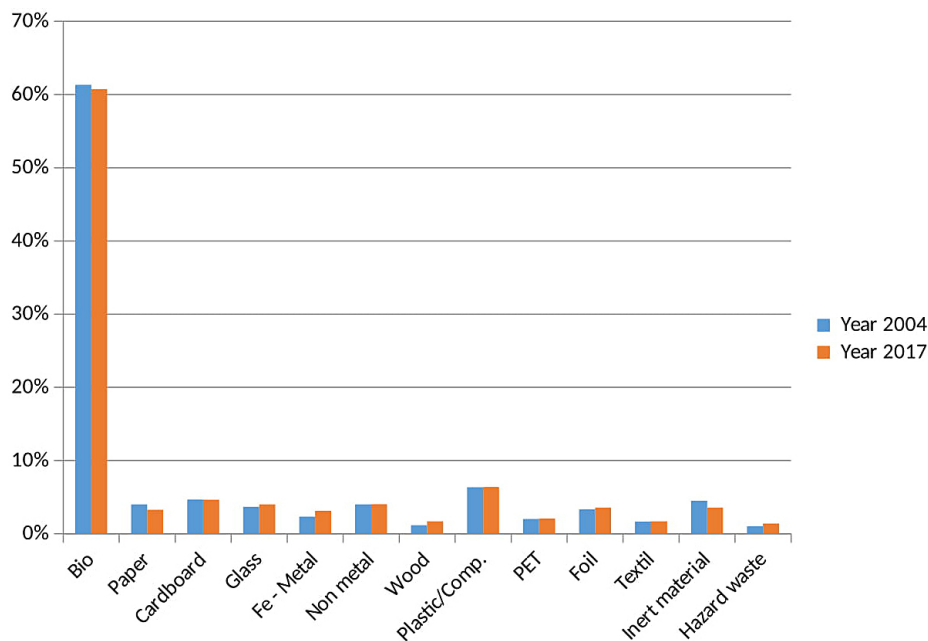
System	in [kg]						Calculations									
	2004	2017	2004	2017	2004	2017	2004	2017	2004	2017	Diference 2004	Diference 2017				
Zone	Ortakoll	Ortakoll	Kurilla	Kurilla	Korishë	Korishë	Scale	Scale	Average	Average	(-)	(+)	(-)	(+)		
Bio	64.5	72.3	85.1	82.8	39.1	40.5	39.1	85.1	40.5	82.8	62.89	65.18	23.79	22.16	24.68	17.57
Paper	5.1	3.5	7.0	5.7	1.6	1.5	1.55	6.95	1.5	5.7	4.53	3.57	2.98	2.42	2.07	2.13
Cardboard	4.8	3.2	6.8	6.9	3.6	4.1	3.6	6.75	3.16	6.9	5.06	4.72	1.46	1.69	1.56	2.18
Glass	5.9	7.1	3.5	3.1	2.3	2.6	2.25	5.9	2.6	7.06	3.87	4.24	1.62	2.03	1.64	2.82
Fe - Metal	5.5	9.0	0.7	2.3	1.2	1.1	0.65	5.47	1.1	8.96	2.44	4.10	1.79	3.03	3.00	4.86
Non metal	4.3	4.1	4.7	4.3	3.0	4.0	3	4.7	4	4.25	3.99	4.12	0.99	0.71	0.12	0.13
Wood	1.2	2.7	0.3	1.8	1.1	0.0	0.3	1.23	0	2.66	0.86	1.49	0.56	0.37	1.49	1.17
Plastic/Comp.	7.8	6.0	6.7	7.0	4.1	6.1	4.05	7.8	6.03	7	6.18	6.38	2.13	1.62	0.35	0.62
PET	2.7	2.2	1.3	1.7	1.6	2.0	1.3	2.67	1.7	2.2	1.84	1.97	0.54	0.83	0.27	0.23
Foil	3.9	4.2	3.8	4.0	2.0	2.5	1.95	3.9	2.5	4.2	3.20	3.57	1.25	0.70	1.07	0.63
Textil	1.5	2.0	0.7	1.9	2.1	1.5	0.65	2.05	1.5	2.03	1.39	1.79	0.74	0.66	0.29	0.24
Inert material	1.0	0.8	7.9	2.5	4.4	5.0	1	7.85	0.83	5	4.40	2.78	3.40	3.45	1.95	2.22
Hazard waste	1.3	1.5	1.4	1.8	1.2	1.2	1.15	1.4	1.2	1.75	1.29	1.49	0.14	0.11	0.29	0.26
Total	109.5	118.6	129.5	125.5	66.9	72.1										

**Table 2.** Results of waste analysis in three localities in the Prizren Municipality, Republic of Kosovo, expressed in percentage

System	in %						Calculations									
	Year	2004	2017	2004	2017	2004	2017	2004	2017	2004	2017	Diference 2004		Diference 2017		
Zone	Ortakoll	Ortakoll	Kurilla	Kurilla	Korishë	Korishë	Scale		Scale		Average	Average	(-)	(+)	(-)	(+)
Bio	59.0%	60.0%	65%	66.0%	60.0%	56.2%	59%	65%	56%	66%	61%	61%	2%	4%	5%	5%
Paper	5.0%	3.2%	5.0%	4.5%	2.0%	2.1%	2%	5%	2%	5%	4%	3%	2%	1%	1%	1%
Cardboard	4.0%	2.8%	5.0%	5.4%	5.0%	5.7%	4%	5%	3%	6%	5%	5%	1%	0%	2%	1%
Glass	6.0%	6.0%	2.0%	2.4%	3.0%	3.6%	2%	6%	2%	6%	4%	4%	2%	2%	2%	2%
Fe - Metal	5.0%	6.0%	1.0%	1.9%	1.0%	1.5%	1%	5%	2%	6%	2%	3%	1%	3%	2%	3%
Non metal	4.0%	3.0%	4.0%	3.6%	4.0%	5.5%	4%	4%	3%	6%	4%	4%	0%	0%	1%	1%
Wood	1.0%	3.6%	0.5%	1.5%	2.0%	0.0%	1%	2%	0%	4%	1%	2%	1%	1%	2%	2%
Plastic/Comp.	7.0%	5.0%	5.0%	5.6%	7.0%	8.5%	5%	7%	5%	9%	6%	6%	1%	1%	1%	2%
PET	2.0%	2.0%	1.0%	1.4%	3.0%	2.8%	1%	3%	1%	3%	2%	2%	1%	1%	1%	1%
Foil	4.0%	4.0%	3.0%	3.2%	3.0%	3.5%	3%	4%	3%	4%	3%	4%	0%	1%	0%	0%
Textil	1.0%	1.4%	1.0%	1.6%	3.0%	2.1%	1%	3%	1%	2%	2%	2%	1%	1%	0%	0%
Inert material	1.0%	2.0%	6.5%	1.8%	6.0%	6.9%	1%	7%	2%	7%	5%	4%	4%	2%	2%	3%
Hazard waste	1.0%	1.0%	1.0%	1.5%	1.0%	1.7%	1%	1%	1%	2%	1%	1%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%										

the lowest value was 3 and the highest 6%. The wood contribution into the overall percentage of the waste analyzed varied between sites from 1 to 2% in 2004, while in the 2017 analysis it was from 0 to 4%. The lowest and highest values for plastic waste in 2004 were 5 and 7% accordingly, while in 2007 these values were 5 and 9%. The lowest and highest values for PET percentage in

2004 and 2017 were similar, 1 and 3% accordingly. Similarly, the lowest and highest values for foil into the overall contribution of waste percentage were similar in 2004 and 2017, 3 and 4%, respectively. The textile contribution into the overall waste percentage was from 1% to 3% in 2004 and from 1 to 2% in 2017. The inert material percentage varied from 1 to 7% in 2004 and from



**Fig. 1.** Comparison of the percentage of different waste categories between 2004 and 2017 in three localities in the Prizren Municipality, Republic of Kosovo, expressed as an average value for three localities

2 to 7% in 2017. The contribution of hazard waste into the overall percentage of waste in 2004 was 1%, while in 2017 it varied from 1 to 2%.

On the basis of the overall results from 2004 and 2017, it can be concluded that the highest percentage in the waste composition belongs to the bio-degradable waste which was 61% in both years. All other categories of waste in both years were below 10%. High values were registered for plastic waste which was 6% in both years and cardboard waste which was 5% in both years and inert material waste which was 5% in 2004 and 4% in 2017. All other categories of waste were registered in less than 5% in both years of investigation.

Most of the results from 2004 and 2017 are similar and the difference in percentage contribution was registered for the following categories: paper, Fe-metal, wood, foil and inert material waste but the difference between two investigation years for any category of waste does not exceed 1%. All other categories of waste were registered in the same percentage in both years.

It is visible that the amount of metal, plastic and cardboard waste percentage is not high in the analyzed waste at the investigated localities. However, this does not say much about the produced waste belonging to these categories due to the fact that large scale collectors of these waste categories in Kosovo have been organized for many years. Many more individual collectors collect this type of waste from waste containers. It is difficult to make comparison of our results with other countries due to the difficulties arising from different management practices and levels. For example in Austria [European Commission, 2013], similarly to our results most of the produced municipal waste also belongs to bio waste (approximately 40%). Such large quantities of biodegradable waste produced in Kosovo makes initiation of sustainable management practices for this type of waste inevitable. Currently, it is left to degrade by itself in landfills. It is known that this decomposing produces methane as greenhouse gas, which is 25 times more harmful compared to carbon dioxide [Sanchez et al., 2015]. The level of glass produced in municipal waste is also similar (5.2% in Austria and 4% in our study case). The share of plastic in municipal waste composition is 9.8% in Austria and 8% in Kosovo. The most visible difference between the two countries is in the percentage of cardboard waste which is more than three times greater in Austria than in Kosovo. One of the reasons for

this huge difference is probably the fact that cardboard waste collection is not registered in Kosovo apart from public containers. The share of metal waste in both countries is also similar based on our results and the official results from Austria. The inert and hazardous waste is missing in Austrian municipal waste due to the fact that it is collected via separate system and not mixed with other municipal waste, as is the case in Kosovo.

The level of hazard waste has slightly increased during the 2017 survey compared to 2004, for about 1% in total. Even though the increase is not high, considering the health and environmental risk from this type of waste, this is of considerable concern. In Europe as well, there is a continuous trend of rapid increase in volume and types of hazardous waste as a result of continuous economic growth, urbanization and industrialization [Anthouli et al., 2013]. Household hazardous waste is defined as a type of waste which contains corrosive, explosive, flammable, toxic, ignitable, or reactive ingredients and is difficult to dispose of or which put human health and the environment at risk because of its bio-chemical nature [Slack et al., 2005]. According to the Law on Waste, municipal waste landfills must have their designated areas for hazardous waste. However, this is mostly related to the large amounts of hazardous waste produced mainly by industries and companies. Even in that case, Kosovo still does not have proper storage sites for this type of waste. This issue has been tackled in the Strategy on Waste Management 2013-2022 but so far no tangible result has been produced in practice. Finding a site for hazardous waste has been a matter of political and social discussion and dispute during the past two years as the municipality of Fushe Kosove rejected the governmental plan for designation of a site in this municipality. During the investigation, it was noted that domestic hazardous waste of small quantities is not separated at its collecting point and it usually ends up together with other types of waste, thus causing considerable environmental and health concerns. Another important issue raising up from this type of waste is the health problem under which are exposed individual waste pickers from containers and landfills. The risk factors, hazards, and vulnerabilities under which waste pickers are exposed during this collection is addressed as an important issue worldwide, especially in low and middle income countries [Gutberlet and Nazim-Uddin, 2017] and needs to be properly included in waste legislation in Kosovo as well.

From the results of this investigation it is obvious that there is no significant difference in residual waste composition between an urban and rural area, or at least in the rural areas where there is municipal waste management system. During the past decades the socio-economic barrier between the rural areas and urban areas in Kosovo is rapidly decreasing, causing in this regard similar life habits, in terms of production of waste as well.

## CONCLUSIONS

This investigation is a contribution to the municipal waste management in Kosovo. It highlights the importance of including the registration of individual and organized cardboard, metal and plastic operators into the municipal waste management system. It also emphasizes the importance of organizing separate containers for hazardous waste since this type of waste was present in public containers and if not properly managed, it can cause significant environmental and health problems. The results of this investigation are comparable in terms of percentage contribution of different waste type in the overall municipal waste produced.

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