



## Waste management in the industrial bakery Inpek in Podgorica

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### Abstract:

"Inpek" A.D. Podgorica is a company with a tradition of 75 years. Its main activity is the production and sale of bakery and confectionery products on the Montenegrin market. It has well-equipped facilities that are divided into:

- part for the production of basic and special types of bread and pastries with two large lines with a capacity of 3400 pieces / hour of 600g bread, as well as three lines for the production of special types of bread and pastries with a capacity of 800 pieces / hour.
- part for the production of frozen bakery products equipped with shock chambers and storage chambers as well as a temporary line for the production of frozen pastries,
- part for confectionery production equipped with the most modern equipment for the production of cakes and other confectionery products.

The Inpek range includes over 200 different products. Production is organized according to modern technical and technological requirements. The confirmation of quality is only the trust of consumers who have been using Inpek's products in their daily diet for many years, both in Podgorica and in other parts of Montenegro to which Inpek delivers its products. Since 2006, Inpek has implemented the Integrated Quality Management System, and now compliance with the requirements of the Food Safety System Certification 22000 FSSC 22000, version 5 has been achieved, which includes the following elements: ISO 22000: 2018, ISO / TS 22002-1: 2009. Thanks to this, Inpek has become one of the modernly designed plants for the production of bakery and confectionery products.

In this paper, we wanted to point out all the special aspects of waste management in the production process in Inpek, which are in line with procedures that guarantee compliance with all environmental principles. The presented experiences in this field can serve similar production and / or service organizations during the construction and improvement of their own waste management system in accordance with internationally recognized standards.

**Keywords:** bakery production, waste management, ecological principles

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### I. Introduction

"Inpek" Podgorica is an industrial plant for the production of a wide range of bread, pastries, frozen bakery products and confectionery. The total capacity of the factory is 5800 pieces / hour, calculated on a classic 600g bread. The plant has been operating continuously for 75 years and has great trust from customers in Podgorica and other parts of Montenegro because it markets its products daily through the distribution network of large retail chains as well as through its own distribution and retail network. It is important to say that all Inpek products meet all quality standards prescribed by applicable legislation. Since 2006, Inpek has implemented the Integrated Quality Management System, and now compliance with the requirements of the Food Safety System Certification 22000 FSSC 22000, version 5 has been achieved, which includes the following elements: ISO 22000: 2018, ISO / TS 22002-1: 2009. It is this fact that places Inpek among the modern and modernly designed factories for food production. The fact that it follows modern trends and harmonizes its production with new requirements enables this factory to be maintained on the market for more than half a century, despite the problems it encounters, especially those caused by unfair competition.

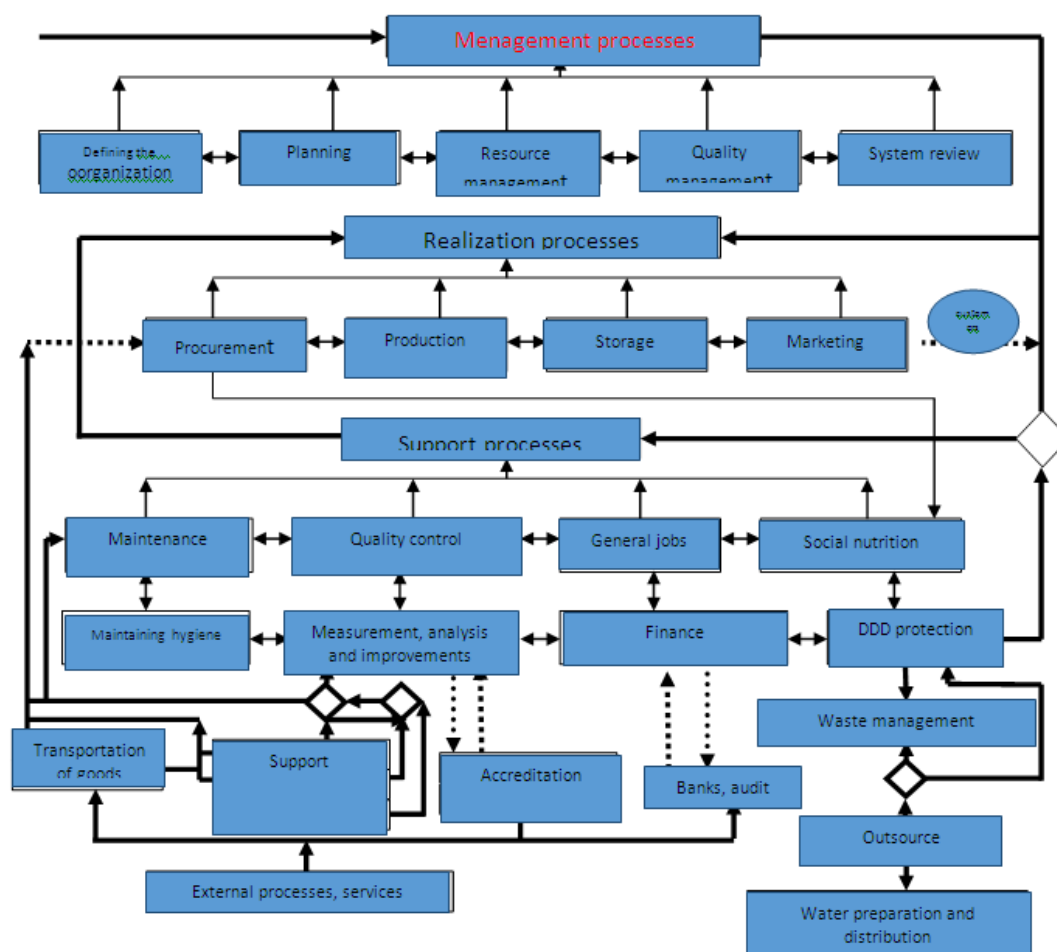
The structure of the equipment owned by this factory is as follows:

1. Two automatic lines for the production of various types of bread with a total capacity of 3400 pieces / hour converted into classic bread of 600g,
2. Three lines for the production of special types of bread and pastries with a total capacity of 2400 pieces / hour
3. Part of the plant for the production of frozen bread and pastries with modern automatic lines with a capacity of 240 kg / hour of pastries with associated shock chambers for deep freezing (at -40 degrees C) and lager chambers for storing frozen products (at -20 degrees C). the storage chamber is 80 tons of frozen goods.
4. Plant for the production of confectionery products with modern equipment, which includes, among other things, baking ovens and modern storage chambers for storing products (at a temperature of -4 to +10 degrees C).
5. Part of the raw material warehouse with four silos with a total capacity of 200 tons of flour with associated equipment for pneumatic transport and supply of flour to the plant and floor storage with a capacity of 600 tons.
6. Boiler plant for production of technological steam for the needs of the bakery part of the plant where there are 2 boilers that are supplied with combined burners of the plant on liquefied petroleum gas or light fuel oil.
7. The boiler room includes a device for preparation and softening of water for the needs of boilers.
8. Electrical machine workshop for the needs of maintenance of the plant and equipment in the plant.
9. Chemical and microbiological laboratory in which analyzes of raw materials and finished products for own needs are performed, which are supplied with modern equipment. The laboratory is part of the quality control service.

## II. Production process

The technological process of production in Inpek is based on several individual technological processes that take place independently or are interconnected in their individual phases. Also, in the part of procurement, storage, sales, hygiene maintenance, DDD protection, quality control, there are points of contact for all processes.

The production process itself and other activities related to it are presented in the following figure:



Picture 1. The process model in the company Inpek A.D. Podgorica

1. Storage of raw materials takes place in the main warehouse of INPEK, where the internal laboratory performs sampling of raw materials for analysis and verification of their quality. This process takes place in accordance with the provisions of the Ordinance, the manufacturer's recommendations (declarations) and the Instructions on storage and preservation of food and packaging.
2. The production of bread and pastries is a process that includes the preparation of raw materials, the production process itself and the process and final control of finished products by INPEK's laboratory.
3. The production of frozen products includes the preparation of raw materials and auxiliary materials for production, quality control of raw materials, process parameters and quality control of finished products, and the production process itself with all its phases.
4. Confectionery production includes preparation and control of raw materials for cake production, production process, process control by phases, control of finished products.
5. The energy sector includes the preparation of technological water and technological steam for the needs of the plant.
6. Maintenance service includes maintenance of equipment, electrical and other installations and means of transport.
7. Quality control includes a modernly equipped laboratory that enables quality control of raw materials, process control and control of final products.
8. Distribution includes a fleet of 30 specialized vehicles for the transport of bakery products as well as two dedicated refrigerators for the transport of frozen products and cakes.
9. The administration is a part of the joint affairs services in the plant building where all administrative activities are performed.
10. Storage of waste materials implies sorting and disposal of waste in designated places. Atmospheric wastewater is collected in two absorption wells.

### **III. Mission and vision of the factory "Inpek" AD**

The mission of "Inpek" or the purpose of existence is defined by the founding act and the Statute of the company, which is the daily supply and meeting the needs of the people of Podgorica and Montenegro with quality and safe food products and bakery and confectionery products. number of customers and expanding its own product range. Also, by monitoring new scientific knowledge and achievements in the field of their activity, Inpek experts introduce innovations into technological processes and create new products. The goal of all these activities is for this company to maintain its leading position. In addition, another important goal, which is planned after the end of the current Covid pandemic<sup>19</sup>, will be realized in terms of exports of Inpek products and their placement on foreign markets. In order to achieve the set goals, we constantly improve the quality and health safety of our products and continuous safety supervision at all stages of the production process. In this way, customer loyalty and gaining new ones is achieved. Continuous improvements in all work processes create the preconditions for successful economic and commercial operations.

### **IV. Quality system**

As a socially responsible company, Inpek, within the framework of environmental protection policy, acts responsibly and continuously works on all issues that may have a negative impact on the environment. Thus, within the production work, the aim is to reduce waste from all production processes and prevent significant emissions of combustion gases into the atmosphere, soil and water. We are also working on reducing energy consumption, so in 2006 the consumption of liquefied petroleum gas was introduced as an energy source instead of light fuel oil, which is a significant contribution to economical but also cleaner and more environmentally friendly production. Thus, economic savings of 25% were achieved. Waste that can be recycled is treated, and that that cannot be adequately disposed of, as required by regulations and in accordance with the Environmental Protection Policy. Inpek has contracts with relevant companies from the environment that deal with the purchase and disposal of various types of waste in order to protect the environment from possible negative consequences. We are continuously working on improving the effects in quality and environmental protection, in accordance with legal regulations and European standards, and all employees of Inpek participate in it, each in the field of their workplace and their responsibilities. The Executive Director with top management is authorized and responsible to ensure the proper and consistent implementation of the Environmental Policy. Since quality means the level to which a set of inherent characteristics meets the requirements (including those related to the environmental management system and product safety management system), INPEK AD has decided to develop and implement a management system that will meet the requirements of ISO standards 14001: 2004 and ISO 22000: 2005, which refer to the management system, when we talk about quality, we also mean the requirements related to the environmental management system and the food safety management system.

In INPEK, within the ISO 14001: 2004 system, there are applicable procedures and instructions:

1. DDD protection procedure Q2.32.
2. Instructions for protection and maintenance of equipment, raw materials and packaging within DDD procedures Q3.30.
3. Instructions for storage and dispensing of cleaning and sanitation products Q3.39
4. Waste Management Guide Q3.21.
5. Instructions on handling in case of spillage of cleaning and sanitation products Q3.18.
6. Instructions for use of cleaning agents and accessories Q3.15.
7. Instructions for sanitation and hygiene of equipment and space Q3.08.
8. Manual for handling glass and hard plastics Q3.16.
9. Instructions for receiving and managing spent products Q3.13.

Product health safety in INPEK is ensured by applying the HACCP system. The control of parameters is performed in our own laboratory every day for both input raw materials and final products. Comfort, modernity, safety and security in the offer of its products is ensured by an increasing number of specially equipped production and sales facilities, dedicated vehicles, introduction of quality systems, introduction of independent sources of necessary energy sources, quality equipment maintenance, quality human resources and continuous education and training. .

In order to raise the management of product quality and safety to an even higher level, Inpek A.D. went a step further in 2017 and expanded its activities to the implementation of an even more complex standard and achieved compliance with the requirements of Food Safety System Certification 22000 FSSC 22000, version 5 where the following elements are included: ISO 22000: 2018, ISO / TS 22002- 1: 2009.

## V. Waste management

The Waste Management Guide is a document that should ensure proper handling and management of all forms and types of waste generated in the production process in Inpek in order to combat the possibility of secondary contamination of raw materials, products, working environment and the environment. This Instruction prescribes how waste should be handled where recycling is envisaged and how it directly affects the protection of the environment. The instruction is applied in all phases of production and trade in INPEK. Responsibility according to the provisions of this Instruction is borne by all executors who participate in the process where various wastes occur. The method of waste classification and the basic characteristics of handling certain types of waste are presented below:

**Table 1. Types of waste and ways of dealing with it**

Type of waste	Manner of action
Flour and dough	Flour and dough as waste are generated in the production plant. Here, as part of the production process, waste flour and dough are collected from the floor with brushes and spatulas, and flour is separated by sowing, which is then placed in paper bags and forwarded to the warehouse as livestock flour. This is done during and after each shift and the workers at their workplaces in production are responsible. Waste flour is temporarily stored in the raw material warehouse at a designated place, and the dough in a garbage container. Garbage collection is done every day at the city landfill, and the workers responsible for controlling this process are the sanitary controller and the shift technologist.
Paper and cardboard	Paper and cardboard as waste are generated in the production plant and raw material warehouse. All waste paper and cardboard is disposed of at a paper press. The flour-working worker presses the paper and binds the press after each shift. After that, the presses are stored in a paper storage warehouse with a forklift. Responsible for this process is the raw material warehouseman and the head of the commercial sector for the sale and removal of presses from the factory.
PVC packaging	PVC packaging as waste is generated in the production plant and raw material warehouse. This waste is collected and disposed of at the time of generation in garbage bags and then in a container. Responsible worker in the workplace hygienist.
Worn plastic crates	Worn plastic crates as waste are created in the warehouse of finished products where they are used as packaging. After the triage, the broken crates are disposed of in a certain area around the factory and then taken for purchase to the plastic packaging factory. The responsible workers are the warehouseman and the manager of the commercial sector
Metal scrap	Metal waste is generated as waste from production (Al tins and pans) and from the workshop for maintenance of equipment and cars. This type of waste is disposed of in a designated place and then sold for recycling.
Waste edible oil	Waste edible oil is generated in the production plant. After changing the oil from the fryer, it is stored in a metal barrel and deposited in a designated place. When enough waste oil is collected, it is sold to an authorized recycling company. The responsible worker is the direct executor and

	the head of the commercial service.
Mineral oils	Mineral oils are generated as waste in an EM maintenance workshop. These are replaced motor and gear oils that are collected immediately upon generation and disposed of in barrels that are closed and periodically taken to a recycling plant. A random worker and a commercial manager are responsible.
Wastewater	Wastewater is generated in production, maintenance and trade. This waste is discharged into the central city collector. Responsible officer for sanitary control and head of the Organizational Unit.

The following table shows the waste materials generated in the production processes:

**Table 1. Data on waste materials**

No.	Origin of waste	Activity description	Type of waste	System of collecting the critical waste
1.	Production	Production of bread, pastries, cakes and frozen doughs	OV, PO, OO, PA, PU, KO, DG, VP,	Collector for waste water, container, metal barrels
2.	Plant for thermal energy production	Production of steam	DG, VP, OV, OM	Collector for waste water, atmosphere
3.	Preparation of water	Water softening	OV, R-NaCl,	Collector for waste water
4.	Workshops for maintenance of machines and motor vehicles	Maintenance of machines and motor vehicles	MU, MoU, ZKP, MO, PO, PA, OV, KO,	Collector for waste water, container, metal barrels, purchase of waste
5.	Laboratory	Quality control, chemical and microbiological analyses	KO, PO, SO, OV, OO,	Collector for waste water, container
6.	Administrative building	Management, Sale, Procurement, Finance	KO, PO, OV,	Collector for waste water, container

**Legend:** OV–waste waters, NaCl–a solution of kitchen salt, PO–paper waste, MU–machine oil, OO–organic waste (flour, dough, yeast, etc.), MoU–motor oil, PA–plastic packaging, ZKP–oily rags, protective footwear, PU–fried oil, MO–metal waste, KO–municipal waste, OM–sewage sludge, DG–fume gases, SO–glass waste, VP–water steam

**Table 2. Overview of waste control companies: "INPEK" AD. Podgorica**

No.	A factory part	Activity description	Type of waste	Systems of collecting the hazardous waste
1.	Auto-repair shop	Repair of cars	Oils for motor and gear, accumulators	Storing in proper barrels, arranging on the concrete floor in the protected space
2.	Locksmith shop	Repair of machines and devices	Gear and hydrophilic oil, lubricating grease	Storing in proper barrels
3.	Production facilities	Production of bread, pastries and cakes	Paper packaging, plastic packaging, palm oil, plastic crates, Al brasses	Sorting, pressing of paper and putting in "bales", storing in proper barrels, sending to be recycled
4.	Storeroom of raw materials	Storing raw materials for production	Paper packaging, plastic packaging	Sorting, pressing of paper and putting in "bales", sending to be recycled

**Table 3. Description of relevant waste of companies: "INPEK" AD. Podgorica - Non-hazardous waste**

Type of waste	Number	Code of waste No.	Quantity of waste / year [kg]	Companies in charge of collecting	Collection period	Costs of disposal [.../year]	Remaind waste [.../year]
Oils for motor, gear and hydraulic oils			800 l	"Hemosan" Bar	Annually	150 €	No
Accumulators			8 pcs	J. Komunalno Pg	Annually	No	No
User car tires			40 pcs	J. Komunalno Pg	Annually	No	No

Table 5. Possibilities for waste recycling technologies companies: "INPEK" A.D. Podgorica

Waste/ Emission / Problem. A possible technology for waste treatment	Paper and cardboard	Plastic	Glass	Colored metals	Motor oils	Car tyres	Batteries	Electronic waste	Edible oil	Wastewater	Atmospheric waters
Biogas											
Closed technology for water										x	x
Membranes											
Evaporation											
Ion exchanger											
Paper and cardboard recycling	x										
Composting											
Metal recycling				x		x					
Plastic recycling		x									
Waste used for energy					x	x			x		
Glass recycling			x								
Special procedures					x		x	x			

Table 6. List of companies engaged in waste collection

Type of waste	Collection company
Paper packaging and confection	"Kališ" Podgorica
PVC packaging	Deponija-gradska čistoća
Cardboard packaging	"Kališ" Podgorica
Glass packaging	Deponija- gradska čistoća
Metal packaging	Deponija- gradska čistoća
Palm oil	"Hemosan" Bar
Processed machine oils and fats	"Zlatar plast" Nova Varoš
Plastic crates	Javno komunalno Podgorica
AL - tins	Javno komunalno Podgorica
Wastewater	Gradski kolektor



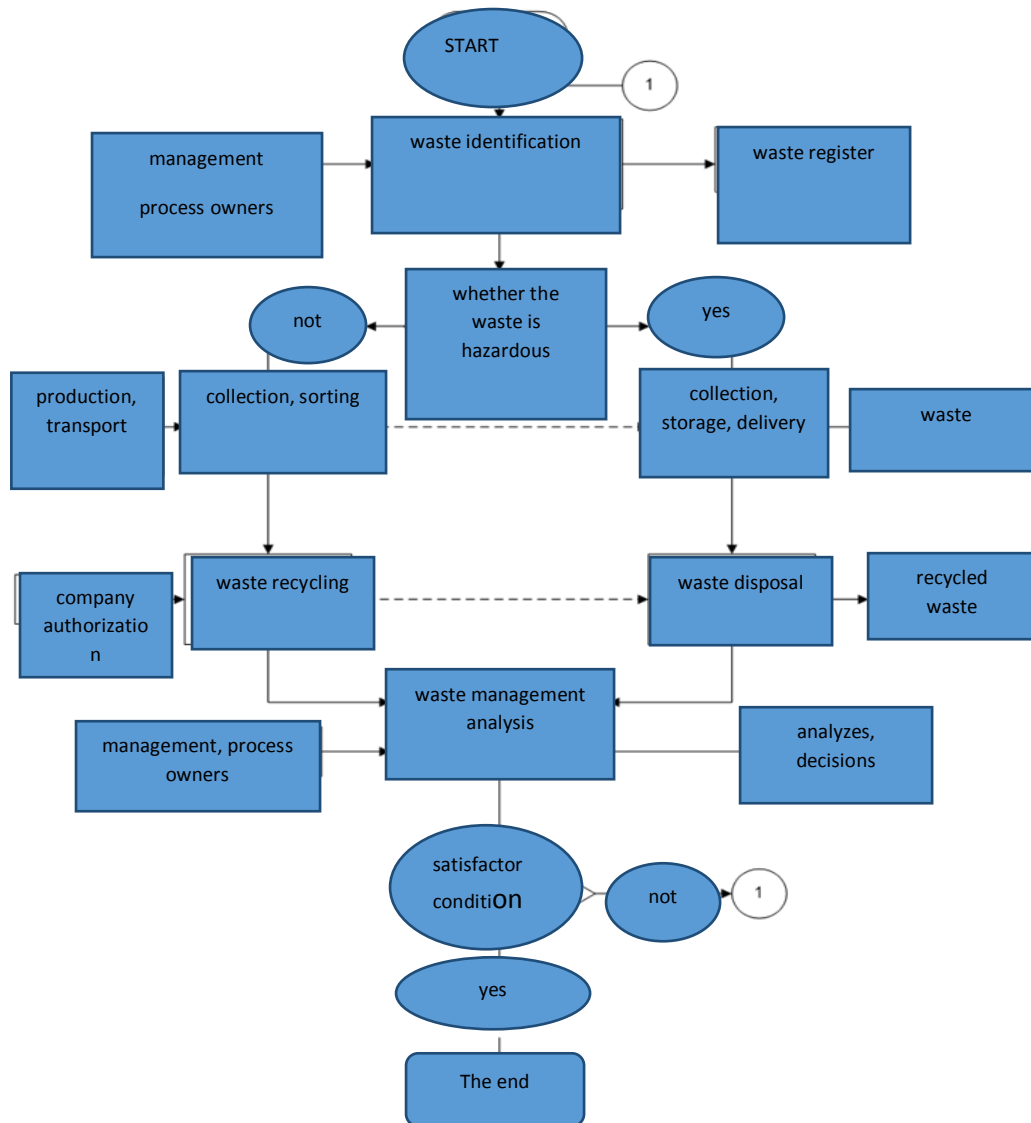


Figure 2. Schematic of waste management in the company Inpek A.D.

## VI. Conclusion

As can be seen from the above data in this paper, it can be concluded that this industrial company with its Quality Policy is fully committed to achieving its main goals and that is to maintain its leading position in the region by investing in the quality of its products, expand product range, increase the number of its consumers and soon start exporting goods to foreign markets. This will be achieved by producing high-quality and health-safe products, conducting permanent control at all stages of the production process, then fully understanding and meeting consumer requirements at the lowest possible cost.

We continue to constantly work on reducing the consumption of energy, raw materials and intermediate goods in all spheres of work, reducing waste from all production processes and reducing emissions of combustion gases into the environment (air, land, water). These factories are properly and safely disposed of properly and in accordance with the prescribed methods, depending on the type of waste handed over to the competent companies that have certificates for its processing. All types of waste that can be recycled are sorted and prepared for recycling. The waste that cannot be processed is removed from the process in accordance with the regulations and stored in a designated place when the company that picks it up comes and takes it for further processing because it is authorized to do so. All this is done according to environmental regulations. It can be stated on the basis of the above data that Inpek fully complies with all procedures related to the Environmental Policy.

Employees of Inpek A.D. have chosen quality, environmental protection and food safety as a working category that represents philosophy and practice at the same time as manifested by the application of "clean technologies" This commitment brings them changes in approach, habits and daily work resulting in improved

production and quality It should be said that the company Inpek was the first in Montenegro to receive the "Cleaner Production" certificate within the UNIDO project. Establishing a system of mutually harmonized and interconnected processes and performing tasks in a quality and safe manner for the first and each time in accordance with customer requirements, legal regulations, standards, regulations and specifications is the task of every employee.

In the end, it can be concluded that this paper shows how a socially responsible company should behave in waste management processes. the production processes themselves. Yet this example given in the paper can serve as a guide to other factories engaged in a similar or the same activity as Inpek A.D. from Podgorica

#### **Literature:**

- [1]. Management of Inpek AD, Rules of Procedure on food quality and health safety, (2011), Podgorica
- [2]. Monograph "INPEK" AD Podgorica, 2006, Podgorica
- [3]. Law on Environment, Official Gazette of Montenegro ", No. 052/16 of 09.08.2016, 073/19 of 27.12.2019, 073/19 of 27.12.2019)
- [4]. Law on Waste Management, "Official Gazette of Montenegro", no. 064/11 from 29.12.2011, 039/16 from 29.06.2016)
- [5]. Ordinance on waste classification and waste catalog, ("Official Gazette of Montenegro", No. 059/13 of 26.12.2013, 083/16 of 31.12.2016)
- [6]. Milijana Đorđević, Air, Water and Soil Pollution, (2011), University of Belgrade, Faculty of Philology
- [7]. Đorđević, M. : Introduction to Ecology, Faculty of Philology, (2011), Belgrade,
- [8]. S.Stanić, I.Buzov, (2009), Recikliranje i zbrinjavanje otpada