Report on the study of the morphological composition of municipal waste in the Kherson municipality

Autumn season (October 2024)

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Introduction

The scientific and technical report on the study of the composition of municipal waste in the Kherson municipality was prepared in accordance with the Methodological Recommendations for Determining the Morphological Composition of Municipal Waste [1].

Kherson municipality is a municipality in Ukraine, in the Kherson region with the administrative centre in the city of Kherson. The territory covers 452,769 km². The municipality consists of 16 administrative units: the city of Kherson, urban-type settlements Antonivka, Zelenivka, Komyshany, Naddnipryanske, villages of Bohdanivka, Petrivka, Sadove, Stepanivka and villages of Blahovishchenske, Zymivnyk, Inzhenerne, Molodizhne, Prydniprovske, Pryozerne, Solnechne. The municipality has been severely affected and suffers from daily shelling by the Russian Federation. A large part of the municipality is located in the Dnipro River delta and therefore was severely affected by the explosion of the Kakhovka hydroelectric power station in June 2023.

The population of the municipality has decreased from 317.8 thousand people (January 2022, of which 279.1 thousand people lived in Kherson) to 90.9 thousand people (May 2024, of which 70.9 thousand people lived in Kherson). The population is unstable and highly dependent on the security situation. The statistics are not updated due to martial law.

The Kherson City Military Administration provided a table with information on the number of residents by administrative unit (Annex 1), but there is no data on the ratio of residents in multi-apartment and single-family housing, so we did not use the appropriate weighting factors to adjust the results. Therefore, the composition of municipal waste for the Kherson municipality was calculated as an arithmetic mean.

When conducting the study of the composition of municipal waste and preparing this report, the requirements of the Terms of Reference for the development of a report on the determination of the morphological composition of municipal waste in the territory of the Kherson municipality were taken into account in accordance with the Agreement No. 07 30/08/2024 between the NGO "Zero Waste Alliance Ukraine", EDRPOU code 42830021, represented by Sidorenko Sofia-Yulia Anatolievna, acting on the basis of the Charter - the "Customer", and the Individual entrepreneur Kovalenko Victoria Viktorovna, EDRPOU code 3283600308 - the "Contractor".

The aim of this study is to obtain baseline data on the morphological composition of municipal waste to improve the efficiency of its management in the Kherson municipality.

1. Description of the research methodology

In accordance with the Methodological Recommendations for Determining the Morphological Composition of municipal Waste [1], a special commission was established with representatives of the relevant structural units of local governments and/or their executive bodies, waste management service providers, business entities operating in the field of municipal waste management in the territory of the Kherson municipality to organise the study to determine the morphological composition of municipal waste (Annex 2).

The morphological composition of municipal waste was determined by three sources of its generation:

1) households - multi-apartment residential buildings;
2) households - single-family residential buildings;
3) other sources of municipal waste generation (enterprises, institutions and organisations).

According to the Terms of Reference, the morphological composition of municipal waste is planned to be determined during 4 seasons in 2024-2025.

The morphological composition of municipal waste is determined by classification (Annex 3).

The morphological composition of municipal waste was determined by:

1) Collection of municipal waste from containers on specially selected routes (Annex 4);
2) Collection and transportation of municipal waste by special-purpose vehicles for the collection and transportation of the respective type of municipal waste (hereinafter referred to as garbage trucks) without their forced compaction;
3) employees trained and instructed (Annex 5) to carry out the study to determine the morphological composition of municipal waste (hereinafter referred to as sorters);
4) the morphological composition of municipal waste was determined in accordance with Section II of the Methodological Recommendations for Determining the Morphological Composition of Municipal Waste [1], collected and transported by garbage trucks.

Since waste in the Kherson municipality is currently collected according to a certain schedule, the study was conducted:

1) on Route 1 "Multi-apartment residential buildings" - 4240 kg of municipal waste was collected for the period 21.10.24-23.10.2024 (3 days). The analysis was carried out on 24.10.2024;
2) on Route 2 "Single-family residential buildings" - 8610 kg of municipal waste was collected for the period 21.10.24-24.10.2024 (4 days). The analysis was carried out on 25.10.2024;
3) on Route 3 "Other sources of municipal waste generation: enterprises, institutions and organisations" - 1820 kg of municipal waste for the period 15.10.24-21.10.2024 (6 days). The analysis was carried out on 22.10.2024.

The survey was carried out by a team of 3 sorters with whom the company has concluded a contract for the provision of services.

The study was conducted in the following order:

1) Prior to the study, a briefing on labour protection and work under martial law was conducted for municipal waste sorters (Annex 5) directly on the territory of the municipal waste treatment facility - 120 Raketna St., Kherson, municipal landfill;

2) Before the study, each sorter was given plastic bags for separate collection of certain or several types (or their components) of municipal waste;

3) A separate site was allocated for research on the territory of the municipal waste treatment facility;

4) The garbage truck with municipal waste was checked for radioactive contamination and weighed on truck scales installed at the municipal waste treatment facility with a discreteness of up to 10 kg and a weighing error of no more than 0.5 ± 1%, and the weight was entered into Excel tables.

5) The garbage truck was unloaded at a designated site and the total amount of unloaded municipal waste was selected with shovels:

- 30 samples weighing 10 kg each for municipal waste from households - "multi-apartment residential buildings". The analysis was carried out on 24.10.2024.
- 30 samples weighing 10 kg each for municipal waste from households - "single-family residential buildings". The analysis was carried out on 25.10.2024.
- 15 samples of 10 kg each for municipal waste from other sources of municipal waste generation. The analysis was carried out on 22.10.2024.

Each sample was transferred to a sorting table for further separation into separate types (components thereof) of municipal waste, and the remaining municipal waste from the sample was removed from the site;

6) Each municipal waste sorter collected several types of municipal waste in containers of different sizes (plastic containers, bags, sacks or beggars). The containers were filled manually. After the selection of certain types (or components thereof) of municipal waste was completed, the residues that could not be sorted were loaded into bags.

7) The volume of the containers with the selected types of municipal waste and the remaining waste was weighed and measured in turn. The results of each measurement were entered into Excel spreadsheets. The selection of individual components of municipal waste and their measurement was accompanied by photographic documentation and attached to the report.

The morphological composition of municipal waste should be determined by weighing dry waste. However, in Ukraine, there is currently virtually no access to large-scale dewatering facilities. Therefore, untreated wet waste was used for the analysis.

Errors that need to be taken into account during the study

The morphological composition of waste on Monday will differ from that on other days of the week (weekend effect).

The morphological composition of waste will be different during school holidays and the morning after holidays. Accordingly, samples are not collected during school holidays (during the school year) or weeks with holidays.

But this is irrelevant to the current situation in Kherson.

1.1. Selection of routes for municipal waste collection

The routes were selected to cover: multi-apartment residential buildings - Route 1, single-family residential buildings - Route 2, and other sources of municipal waste generation (enterprises, institutions and organisations) - Route 3 (Annex 4).

1.2. Territory and premises for research

The study was conducted in a specially equipped room with safe working conditions and labour protection regulations. The premises at 120 Raketna St., Kherson, a

municipal waste landfill, are equipped with electricity for lighting, water for washing hands and containers, and heating.

It is very important to have good lighting conditions during sorting. The illumination on the table should be ≥300 lux (1 lux is 1 lm/m2). This means that if the sorting takes place with inadequate basic lighting, additional lighting must be provided: in our case, two LED lamps of 50 W each, 4000 ml each.

As the weather was warm and rain-free, part of the study was carried out outdoors on a strong film.

Military risks were taken into account:

- in case of shelling, the nearest shelter is located on the territory of the training ground;
- in case of a power outage, reports were printed out (Annex 3);
- the scales were charged, and a connection to a generator was provided.

1.3. Equipment and inventory

The equipment and supplies used for the transport, sorting, survey and processing of the results are presented in Annex 6. All equipment and supplies were procured prior to the start of the first phase and will be purchased as needed prior to each phase. Any equipment that can be reused will be reused to reduce waste generation and to comply with the principle of resource efficiency.

1.4. Training programme for sorters

Prior to the study, a safety briefing was conducted for municipal waste sorters (Annex 5) directly on the territory of the municipal waste treatment facility - 120 Raketna St., Kherson, municipal solid waste landfill (landfill).

Training was also provided on how to identify the type of waste in accordance with the sorting catalogue by type of municipal waste (Annex 7).

1.5. Sampling of municipal waste

In accordance with Section II of the Methodological Recommendations for Determining the Morphological Composition of Municipal Waste [1], the methodology for preparing a sample of mixed municipal waste for sampling for research:

- for multi-apartment residential buildings: for 3 days, it is recommended to collect 1000 kg (5-7 m3) daily from the garbage truck of the selected municipal waste collection route - or up to 6 containers of 1.1 m3, filled by at least 75%. Since the frequency of waste collection on the selected route is once every 3 days, we collected a total of 4,240 kg of municipal waste, which meets the requirements.

- for single-family residential buildings (manor type houses): within 3 days, it is recommended to collect 1000 kg (5-7 m3) daily from the garbage truck of the selected municipal waste collection route or up to 6 containers of 1.1 m3 filled by at least 75%. Since the frequency of waste collection on the selected route is once every 4 days, we collected a total of 8610 kg of municipal waste, which meets the requirements.

- for other sources of municipal waste generation: it is recommended to collect 500 kg (2.5-3.5 m3) or up to 3 containers of 1.1 m3 filled to at least 75% from the garbage truck of the selected municipal waste collection route within 3 days. Since the waste collection frequency on the selected route is once every 7 days, we collected a total of 1820 kg of municipal waste, which meets the requirements.

The sampling methodology for the study of the morphological composition of mixed municipal waste included:

- for multi-apartment residential buildings: from the appropriate sample of mixed municipal waste, take 30 shovelfuls of at least 10 kg each. A total of 300 kg of municipal waste;
- for single-family residential buildings (manor-type houses): from the appropriate sample of mixed municipal waste, select 30 samples weighing at least 10 kg each with shovels. The total sample is 300 kg of municipal waste;
- for other sources of municipal waste generation: from the appropriate sample of mixed municipal waste, take 15 shovelfuls of at least 10 kg each. A total of 150 kg of municipal waste.

The team analysed the samples using the following algorithm:

- the samples were moved to an open area, a strong film was spread and the samples were turned over;
- containers of different volumes, with appropriate labelling of the contents, placed around the film;
- check the cleanliness of the sorting table;
- spread the film on the table;
- checked the scales and their measurements;
- prepared a statement of accounts.

Electronic scales are installed and adjusted. We used scales with the following characteristics:

- Maximum weight: 1000 kg;
- Minimum weight: 10 kg;
- Two additional clean containers of 20 and 5 litres were used for packaging.

The waste was sorted and large items (larger than Ø 100 mm) were placed in the appropriate container (as is done on the sorting line). Smaller items were then sorted, especially hazardous waste.

Note: after the sorter identified the waste as medicine, it did not open the packaging, even if it was transparent.

When the container was full, it was weighed and the contents were poured into a garbage bag for later disposal. A suitable container was placed on the scales, the containers were then weighed and the results were entered into a report card.

The volumes of each type of waste were also measured and recorded in a report.

In the end, all the containers were emptied, the table was wiped down, and the room was cleaned.

The data from the reporting sheets were transferred to Excel spreadsheets.

We handed over photos and reports.

A photo report on the results of the morphological composition of municipal waste in Kherson municipality is presented in Annex 8.

2. Results of the study

The amount of municipal waste was analysed by the main parameters: weight (kg), volume (m3), and average density (kg/m^3).

The results of the study were processed in the following order:

- determining the weight of municipal waste for each garbage truck as the difference between the weight of the garbage truck filled with municipal waste and the weight of the empty garbage truck;
- the weight of each sorted type (or its component) of municipal waste was determined by summing up the relevant weighing data;
- the total weight of the sorted sample is determined by summing up all the data obtained during the weighing of the types (their components) of municipal waste and their residue;
- the mass of municipal waste that has been sorted is taken as 100% (by weight), the content (in percentage) of each type (its component in the composition) of municipal waste in a given sample is calculated;
- The volume of each sorted type (its component in the composition) of municipal waste was determined using containers of different sizes and scientific methods;
- the total volume of the sorted sample is determined by summing up all the data obtained during the measurement of the volume of types (their components) of municipal waste and their residue;
- the volume of municipal waste that has been sorted is taken as 100% (by volume), the content (in percentage) of each type (its component in the composition) of municipal waste in a given sample is calculated;
- The average density of municipal waste in garbage trucks by type of municipal and other sources of municipal waste generation was determined;
- summarises the results by type of municipal and other sources of municipal waste generation;
- The average morphological composition of municipal waste by weight and volume received by municipal waste management facilities in garbage trucks was determined.

Based on the results of the conducted research, the average arithmetic indicators of the morphological composition of mixed municipal waste generated in the Kherson municipality were calculated. Let's look at the results in more detail.

2.1. Research results: multi-apartment residential buildings

Route 1 "Multi-apartment residential buildings", 4240 kg were collected over the period 21.10.24-23.10.2024 (3 days), sample size 300 kg, sample volume 5.67 m3. The analysis was carried out on 24.10.2024. According to the calculations, the main fractions by weight are (Fig. 2.1, Table 2.1):

- bio-waste (43%), of which green waste (fallen leaves, branches) - 25.3% prevail over food waste (16.3%). In addition, during the morphological study, 3 cats were found (Annex 8) in a bag, which was not included in the results of this study. This indicates a major problem with the attitude towards animals in the municipality that needs to be addressed - programmes for chipping and sterilisation of pets and stray animals.

- residual waste that could not be separated by 28.8%.

- recycled materials account for 21.4%: glass - 7.7%, certain types of plastic - 8% (bottles labelled PET-1 - 4.5%, bottles labelled HDPE-2 - 0.5%, plastic packaging labelled LDPE-4 (film) - 3%), paper and cardboard - 2.8%, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of film) - 0.4%, ferrous metal packaging (cans) -

1.3%, non-ferrous metal packaging (aluminium food and drink cans) - 1.0%. This is a fairly high proportion of waste that can be recovered (recycled) if collected separately.

- waste that is not or very rarely subject to recovery (recycling) 6.7%: textiles 4.1%, plastic packaging with PP-5 labelling (yoghurt cups, other dairy products) - 0.5%, plastic packaging with PS-6 labelling (yoghurt cups, other dairy products) - 0.2%, other plastic packaging and unlabelled plastic (including children's toys) - 0.4%, other composite packaging (ketchup and mayonnaise pouches) - 1.0%, waste electrical and electronic equipment (WEEE) - 0.5%.

- hazardous waste 0.5%: battery and accumulator waste 0.02%, other (including medical) waste 0.47%. Although hazardous waste typically accounts for up to 1% of municipal waste, its separate collection is very important for protecting the environment and the health of municipality residents.

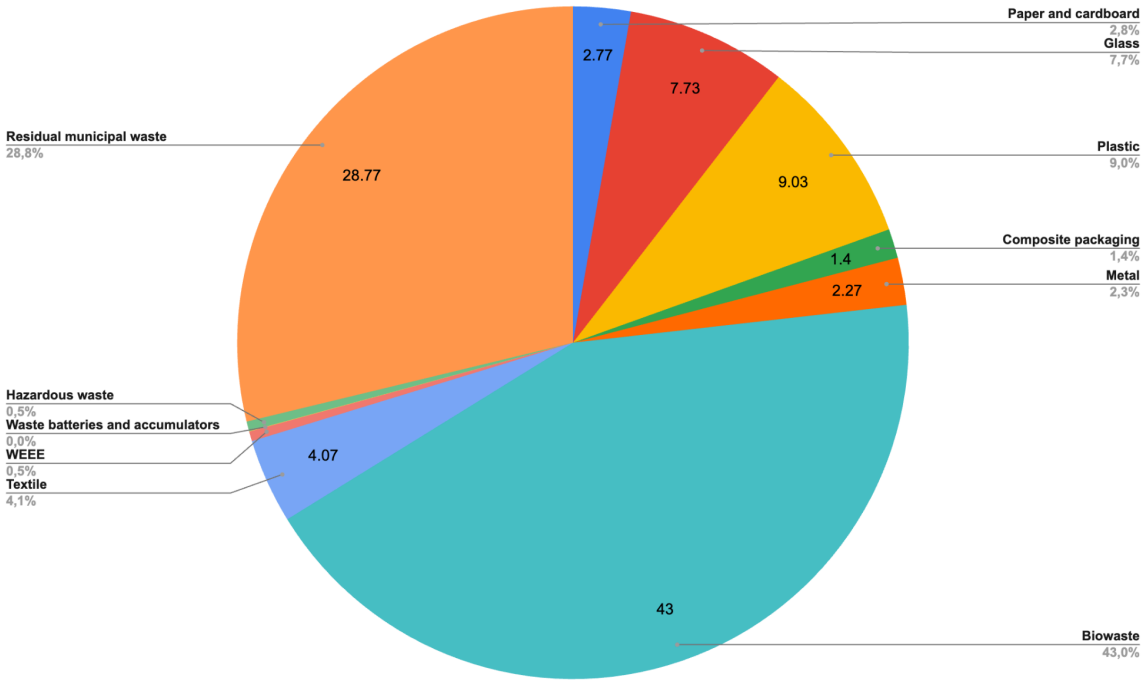

Fig. 2.1. Distribution of mixed municipal waste from multi-apartment residential buildings in Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are (Fig. 2.2, Table 2.1):

- plastic - 46.2%, with 37.8% being recoverable (recyclable) (PET-1 bottles - 29.3%, HDPE-2 bottles - 2.1%, LDPE-4 plastic packaging (film) - 6.4%). That is, bottles labelled PET-1 actually take up ⅓ of the bin. If they are collected separately, the municipality can significantly save on the transportation of municipal waste. And even if separate collection is organised, residents need to develop a culture of squeezing empty bottles to avoid transporting air. Plastic waste that cannot or very rarely can be recovered (recycled) 8.4%: plastic packaging with PP-5 labelling (yoghurt cups, other dairy products) - 2.1%, plastic packaging with PS-6 labelling (yoghurt cups, other dairy products) - 2.1%, other plastic packaging and unlabelled plastic (including children's toys) - 4.2%.

- bio-waste is 32.0%, of which green waste (fallen leaves, branches) - 29.3% prevails over food waste - 2.1%. Accordingly, another ⅓ of the bin is green waste, so, as noted above, organising its decentralised and centralised collection should be a priority.

- other recyclables accounted for 11.2%: paper and cardboard - 4.3%, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of film) - 0.9%, ferrous metal packaging (cans) - 2.1%, non-ferrous metal packaging (aluminium food and drink cans) - 2.1%, and glass - 1.8%.

- other waste that cannot or rarely can be recovered (recycled) 6.2%: textiles 4.2%, other composite packaging (ketchup and mayonnaise pouch) 1.6%, waste electrical and electronic equipment 0.4%.

- residual waste that could not be separated - 4.2%.

- hazardous waste - 0.2%: waste batteries and accumulators, other (including medical).

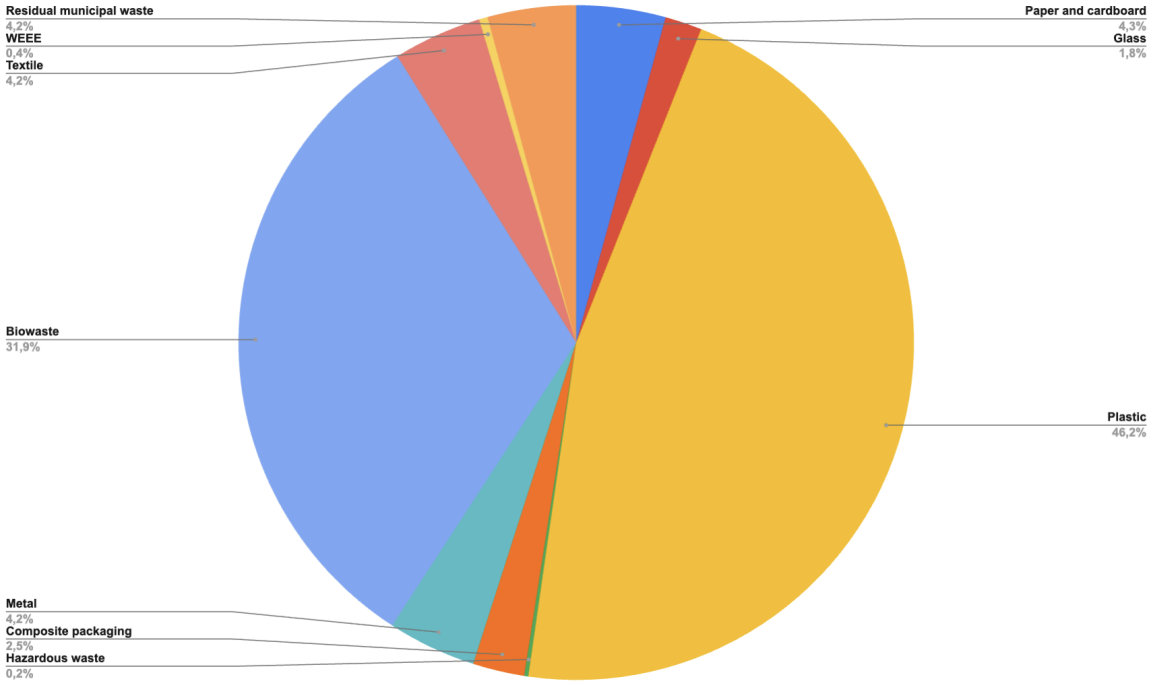

Fig. 2.2. Distribution of mixed municipal waste from multi-apartment residential buildings in Kherson municipality in % of the total sample volume

Table 2.1. The results of the study of the morphological composition of the municipal waste from multi-apartment residential buildings in the Kherson municipality, autumn season, 2024

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
1.	**Paper and cardboard**	**8,30**	**2,77**	**0,24**	**4,27**	**34,30**
1.1.	Paper packaging	0,00	**0,00**	0,00	0,00	
1.2.	Flat cardboard packaging	5,60	1,87	0,12	2,12	46,67
1.3.	Cardboard (corrugated)	2,30	0,77	0,12	2,12	19,17
1.4.	Office paper	0,00	0,00	0,00	0,00	
1.5.	Other paper	0,40	0,13	0,00	0,04	200,00
1.6.	Other cardboard	0,00	0,00	0,00	0,00	0,00
2.	**Glass**	**23,20**	**7,73**	**0,10**	**1,77**	**232,00**
2.1.	Transparent glass packaging	10,40	3,47	0,05	0,88	208,00
2.2.	Coloured glass packaging	12,80	4,27	0,05	0,88	256,00
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.4	Other glass	0,00	0,00	0,00	0,00	0,00
3.	**Plastic**	**27,10**	**9,03**	**2,62**	**46,24**	**10,34**
3.1.	Bottles with PET-1 labelling	13,40	4,47	1,66	29,30	8,07
3.2.	Plastic packaging with PET-1 marking	0,00	0,00	0,00	0,00	0,00
3.3.	Bottles marked with HDPE-2	1,40	0,47	0,12	2,12	11,67
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging marked LDPE-4	9,00	3,00	0,36	6,35	25,00
3.6.	Plastic packaging with PP-5 marking	1,40	0,47	0,12	2,12	11,67
3.7.	Plastic packaging marked PS-6	0,60	0,20	0,12	2,12	5,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
3.8.	Plastic with marking 7	0,00	0,00	0,00	0,00	0,00
3.9.	Other plastic packaging without labelling	0,70	0,23	0,12	2,12	5,83
3.10.	Other plastics	0,60	0,20	0,12	2,12	5,00
4.	**Composite packaging**	**4,20**	**1,40**	**0,14**	**2,47**	**30,00**
4.1.	Tetra pack type packaging	1,20	0,40	0,05	0,88	24,00
4.2.	Other composite packaging	3,00	1,00	0,09	1,59	33,33
5.	**Metals**	**6,80**	**2,27**	**0,24**	**4,24**	**28,33**
5.1.	Packaging (containers) made of ferrous metals	3,80	1,27	0,12	2,12	31,67
5.2.	Packaging (containers) made of aluminium	3,00	1,00	0,12	2,12	25,00
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	0,00	0,00	0,00	0,00	0,00
6.	**Biowaste**	**129,00**	**43,00**	**1,81**	**31,95**	**71,27**
6.1.	Food waste	48,80	16,27	0,12	2,12	406,67
6.2.	Waste from green spaces	75,90	25,30	1,66	29,30	45,72
6.3.	Other biodegradable waste	4,30	1,43	0,03	0,53	143,33
7.	**Wood**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
8.	**Textiles**	**12,20**	**4,07**	**0,24**	**4,24**	**50,83**
8.1.	Clothing and footwear	10,40	3,47	0,12	2,12	86,67
8.2.	Other textile materials	1,80	0,60	0,12	2,12	15,00
9.	**Waste electrical and electronic equipment**	**1,40**	**0,47**	**0,02**	**0,41**	**60,87**
9.1.	Small municipal appliances and parts	1,40	0,47	0,02	0,41	60,87
9.2.	Computer equipment	0,00	0,00	0,00	0,00	0,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
9.3.	Televisions and other devices containing a cathode ray tube	0,00	0,00	0,00	0,00	0,00
9.4.	Lamps with low energy consumption	0,00	0,00	0,00	0,00	0,00
10.	**Waste batteries and accumulators**	**0,07**	**0,02**	**0,00**	**0,00**	**4666,67**
11.	**Hazardous waste**	**1,40**	**0,47**	**0,01**	**0,19**	**130,84**
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00
11.2.	Unused medicines and their packaging	1,20	0,40	0,01	0,18	120,00
11.3.	Syringes	0,00	0,00	0,00	0,00	0,00
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	0,20	0,07	0,00	0,01	285,71
11.6.	Paint	0,00	0,00	0,00	0,00	0,00
11.7.	Other hazardous waste	0,00	0,00	0,00	0,00	0,00
12.	**Bulky municipal waste**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
13.	**Municipal C&D waste**	**0,00**	**0,00**	**0,00**	0,00	**0,00**
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Sawn timber	0,00	0,00	0,00	0,00	0,00
13.4.	Plasterboard	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	**Residual municipal waste**	**86,33**	**28,78**	**0,24**	**4,24**	**359,71**
15.	**Total**	**300,00**	**100,00**	**5,67**	**100,00**	**52,95**

2.2. Research results: single-family residential buildings

Route 2 "Single-family residential buildings", 8610 kg were collected over the period 21.10.24-24.10.2024 (4 days), sample size 300 kg, sample volume 3.77 m3. The analysis was carried out on 25.10.2024.

According to the calculations, the main fractions by weight are as follows (Fig. 2.3, Table 2.2):

- bio-waste 77.1%, of which green waste (fallen leaves, branches) 66.3% significantly prevail over food waste (4.3%). This means that private sector residents, who have all the conditions for composting, throw green waste into the garbage. In this case, systematic educational work with residents will not only help reduce the burden on utilities but will also allow residents to make their own fertilizer for their own gardens. Moreover, this practice is actively used not only abroad, but also in Ukraine - we are attaching the press release of the project "Best Practices for Biowaste Management in Small Municipalities in Ukraine" [2].

- recycled materials make up 14.5%: glass - 7.9%, certain types of plastic - 3.7% (bottles labelled PET-1 - 1.2%, bottles labelled HDPE-2 - 0.6%, plastic packaging labelled LDPE-4 (film) - 1.9%), paper and cardboard - 1%, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of film) - 0.3%, ferrous metal packaging (cans) - 1.5%, non-ferrous metal packaging (aluminium food and drink cans) - 0.1%. The amount of paper and cardboard is relatively small, which we believe is due to its use as fuel.

- waste that is not or very rarely can be recovered (recycled) 6.1%: textiles - 2.2 %, plastic packaging with PET-1 marking (trays) - 0.3 %, plastic packaging with PP-5 marking (cups for yoghurts and other dairy products) - 0.3 %, plastic with 7 marking - 0.1 %, other plastic packaging (including vacuum packaging) and unlabelled plastic (including children's toys) - 1.2%, other composite packaging (ketchup and mayonnaise pouches) - 1.5%, waste electrical and electronic equipment - 0.5%.

- residual waste that could not be separated - 1.1%.

- hazardous waste - 1.1%: waste batteries and accumulators, other (including medical).

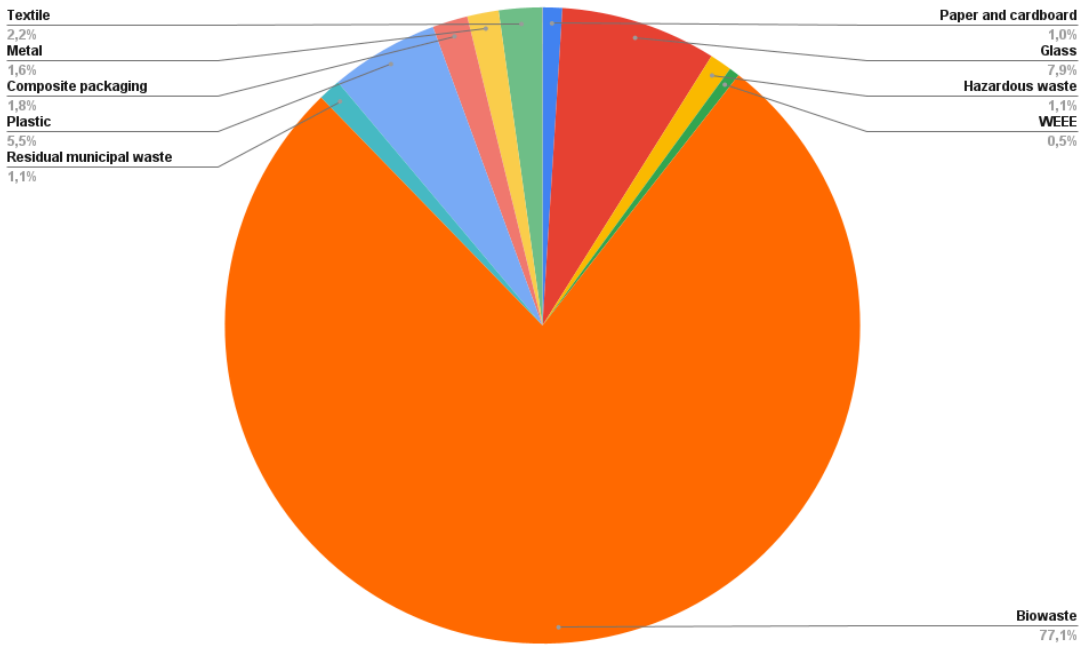

Fig. 2.3. Distribution of mixed municipal waste from single-family residential buildings in Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are (Fig. 2.4, Table 2.2):

- bio-waste is 50.5%, of which green waste (fallen leaves, branches) - 44.1% - significantly prevails over food waste - 3.2%. That is, ½ of the tank is biowaste.

- plastic - 27.9%, of which 14.9% is recoverable (recyclable) (PET-1 bottles - 3.2%, HDPE-2 bottles - 3.2%, LDPE-4 plastic packaging (film) - 8.5%). Plastic waste that cannot or rarely can be recovered (recycled) - 13.1%: plastic packaging with PET-1 marking (trays) - 3.2%, plastic packaging with PP-5 marking (yoghurt cups, other dairy products) - 3.2%, plastic packaging with OTHER 7 marking - 3.2%, other plastic packaging and unmarked plastic (including children's toys) - 3.5%.

- other recyclables accounted for 12.2%: paper and cardboard - 5.1%, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of film) - 0.4%, ferrous metal packaging (cans) - 3.2%, non-ferrous metal packaging (aluminium food and drink cans) - 0.8%, and glass - 2.7%.

- other waste that cannot or very rarely can be recovered (recycled) - 8.5%: textiles - 3.3%, other composite packaging (ketchup and mayonnaise pouches) - 5.1%, waste electrical and electronic equipment - 0.1%.

- hazardous waste - 0.5%: waste batteries and accumulators, other (including medical).

- residual waste that could not be separated - 0.4%.

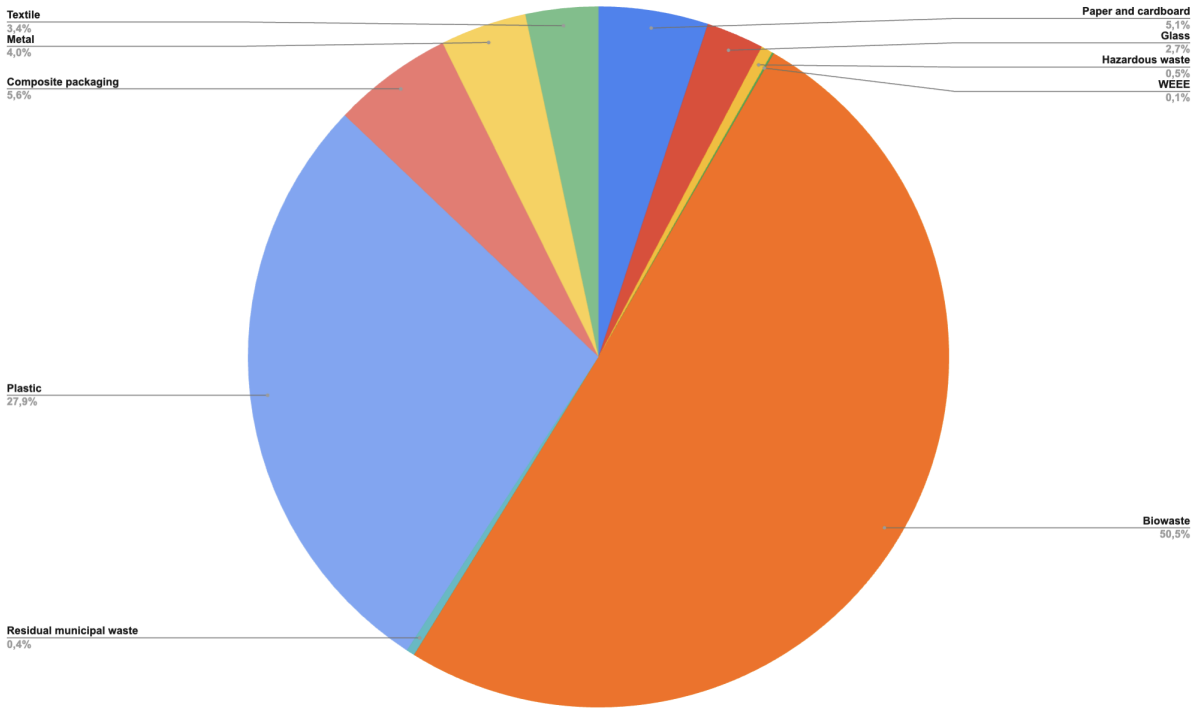

Fig. 2.4. Distribution of mixed municipal waste from single-family residential buildings in Kherson municipality in % of the total sample volume

Table 2.2. Results of the study of the morphological composition of the municipal waste from single-family residential buildings in Kherson municipality in autumn 2024

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
1.	**Paper and cardboard**	**3,00**	**1,00**	**0,19**	**4,98**	**15,79**
1.1.	Paper packaging	0,00	0,00	0,00	0,00	0,00
1.2.	Flat cardboard packaging	1,60	0,53	0,06	1,68	25,00
1.3.	Cardboard (corrugated)	0,00	0,00	0,00	0,00	0,00
1.4.	Office paper	0,60	0,20	0,01	0,13	120,00
1.5.	Other paper	0,20	0,07	0,00	0,03	200,00
1.6.	Other cardboard	0,60	0,20	0,12	3,14	5,00
2.	**Glass**	**23,80**	**7,93**	**0,10**	**2,62**	**238,00**
2.1.	Transparent glass packaging	12,40	4,13	0,05	1,31	248,00
2.2.	Coloured glass packaging	11,40	3,80	0,05	1,31	228,00
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.4	Other glass	0,00	0,00	0,00	0,00	0,00
3.	**Plastic**	**16,60**	**5,53**	**1,05**	**27,51**	**15,81**
3.1.	Bottles with PET-1 labelling	3,60	1,20	0,12	3,14	30,00
3.2.	Plastic packaging with PET-1 marking	1,00	0,33	0,12	3,14	8,33
3.3.	Bottles marked with HDPE-2	1,80	0,60	0,12	3,14	15,00
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging marked LDPE-4	5,60	1,87	0,32	8,38	17,50
3.6.	Plastic packaging with PP-5 marking	0,80	0,27	0,12	3,14	6,67
3.7.	Plastic packaging marked PS-6	0,00	0,00	0,00	0,00	0,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
3.8.	Plastic with marking 7	0,40	0,13	0,12	3,14	3,33
3.9.	Other plastic packaging without labelling	3,20	1,07	0,12	3,14	26,67
3.10.	Other plastics	0,20	0,07	0,01	0,26	20,00
4.	**Composite packaging**	**5,40**	**1,80**	**0,26**	**6,89**	**20,53**
4.1.	Tetra pack type packaging	1,00	0,33	0,07	1,83	14,29
4.2.	Other composite packaging	4,40	1,47	0,19	5,06	22,80
5.	**Metals**	**4,80**	**1,60**	**0,15**	**3,93**	**32,00**
5.1.	Packaging (containers) made of ferrous metals	4,60	1,53	0,12	3,14	38,33
5.2.	Packaging (containers) made of aluminium	0,20	0,07	0,03	0,79	6,67
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	0,00	0,00	0,00	0,00	0,00
6.	**Biowaste**	**231,40**	**77,13**	**1,90**	**49,77**	**121,79**
6.1.	Food waste	12,80	4,27	0,12	3,14	106,67
6.2.	Waste from green spaces	198,90	66,30	1,66	43,49	119,82
6.3.	Other biodegradable waste	19,70	6,57	0,12	3,14	164,17
7.	**Wood**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
8.	**Textiles**	**6,60**	**2,20**	**0,13**	**3,30**	**52,38**
8.1.	Clothing and footwear	5,20	1,73	0,12	3,14	43,33
8.2.	Other textile materials	1,40	0,47	0,01	0,16	233,33
9.	**Waste electrical and electronic equipment**	**1,60**	**0,53**	**0,00**	**0,08**	**533,33**
9.1.	Small municipal appliances and parts	1,60	0,53	0,00	0,08	533,33
9.2.	Computer equipment	0,00	0,00	0,00	0,00	0,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
9.3.	Televisions and other devices containing a cathode ray tube	0,00	0,00	0,00	0,00	0,00
9.4.	Lamps with low energy consumption	0,00	0,00	0,00	0,00	0,00
10.	**Waste batteries and accumulators**	**0,04**	**0,01**	**0,00**	**0,00**	**4400,00**
11.	**Hazardous waste**	**3,40**	**1,13**	**0,02**	**0,53**	**167,49**
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00
11.2.	Unused medicines and their packaging	1,80	0,60	0,01	0,26	180,00
11.3.	Syringes	0,00	0,00	0,00	0,00	0,00
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	1,20	0,40	0,01	0,26	120,00
11.6.	Paint	0,00	0,00	0,00	0,00	0,00
11.7.	Other hazardous waste	0,40	0,13	0,00	0,01	1333,33
12.	**Bulky municipal waste**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
13.	**Municipal C&D waste**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Sawn timber	0,00	0,00	0,00	0,00	0,00
13.4.	Plasterboard	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	**Residual municipal waste**	**3,36**	**1,12**	**0,02**	**0,39**	**223,73**
15.	**Total**	**300,00**	**100,00**	**3,82**	**100,00**	**78,59**

2.3. Research results: other sources of municipal waste generation

Route 3 "Other sources of municipal waste generation: enterprises, institutions and organisations", 1820 kg were collected for the period 15.10.24-21.10.2024 (7 days), so the sample is 150 kg, the sample volume is 2.92 m3. The analysis was carried out on 22.10.2024.

According to the calculations, the main fractions by weight are (Fig. 2.5, Table 2.3):

- recyclable materials make up 45.2 %: glass - 22 %, certain types of plastic - 9.7 % (bottles with PET-1 labelling - 5.3 %, bottles with HDPE-2 labelling - 0.4 %, plastic packaging with LDPE-4 labelling (film) - 4 %), paper and cardboard - 5.6 %, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of film) - 5.3%, non-ferrous metal packaging (aluminium food and drink cans) - 1.4%, other non-ferrous metals - 1.2%. The highest rate of recyclable materials among the 3 routes analysed, can be recovered (recycled) if collected separately.

- bio-waste - 38%, including food waste - 33%, green waste (fallen leaves, branches) - 5%

- waste that cannot or rarely can be recovered (recycled) - 11.7%: textiles - 2.6 %, plastic packaging with PET-1 marking - 0.6 %, plastic packaging with PP-5 marking (yoghurt cups, other dairy products) - 2 %, plastic packaging with PS-6 marking (yoghurt cups, other dairy products), and other dairy products) - 1.1%, other plastic packaging (including vacuum packaging) - 0.2%, other composite packaging (ketchup and mayonnaise pouches) - 2.8%, and waste electrical and electronic equipment - 2.4%.

- residual waste that could not be separated - 3.4%.

- hazardous waste 1.7%: waste batteries and accumulators, other (including medical). This route accounts for the largest share of hazardous waste among the 3 routes in terms of municipal waste.

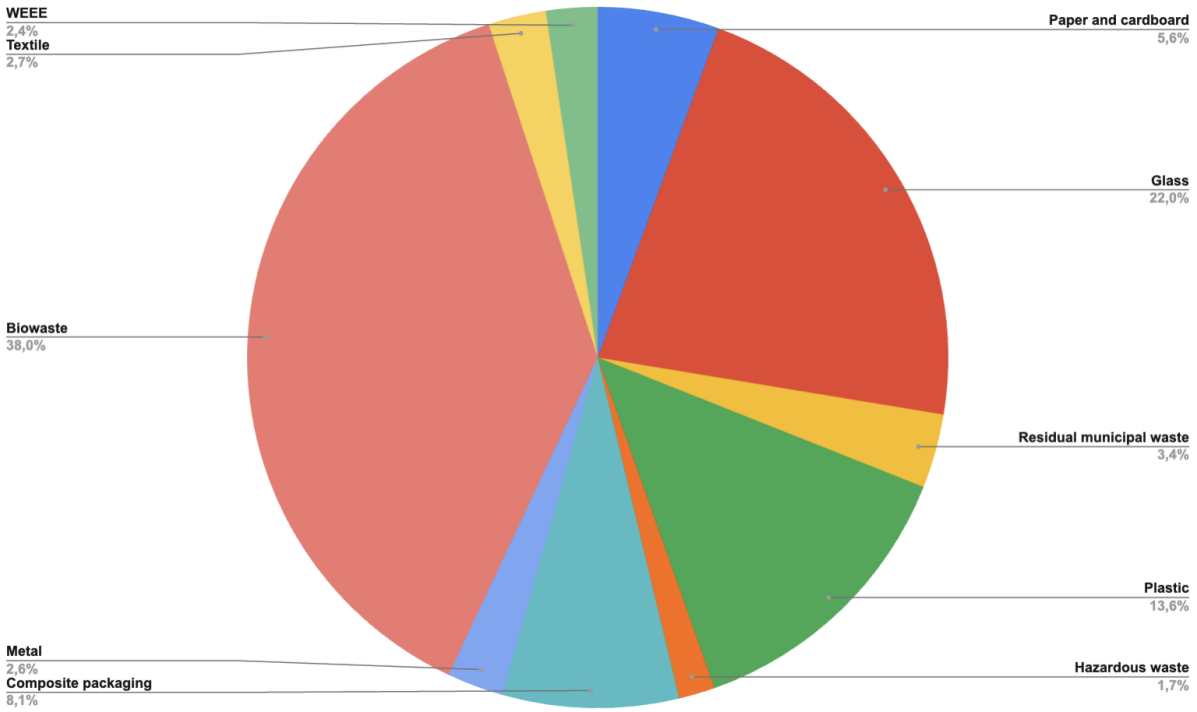

Fig. 2.5. Distribution of mixed municipal waste from the route "Other sources of municipal waste generation: enterprises, institutions and organisations" of Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are (Fig. 2.6, Table 2.3):

- plastic - 58.1%, with 45.8% being recoverable (recyclable) (PET-1 bottles - 33.5%, HDPE-2 bottles - 4.1%, LDPE-4 plastic packaging (film) - 8.2%). That is, bottles labelled PET-1 actually take up ⅓ of the bin. If they are collected separately, the municipality can significantly save on municipal waste transportation. And even if a separate collection is organised, residents need to develop a culture of squeezing empty bottles to avoid transporting air. Plastic waste that cannot or rarely can be recovered (recycled) - 12.4%: plastic packaging with PET-1 labelling (trays) - 4.1%, plastic packaging with PP-5 labelling (yoghurt cups, other dairy products) - 4.1%, plastic packaging with PS-6 labelling (yoghurt cups, other dairy products) - 2.1%, other plastic packaging - 2.1%.

- other recyclables accounted for 23.5%: paper and cardboard - 7.0%, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of film) - 8.2%, non-ferrous metal packaging (aluminium food and drink cans) - 2.1%, other non-ferrous metals - 2.1%, glass - 4.1%.

- other waste that cannot or very rarely can be recovered (recycled) - 9.2%: textiles - 4.1%, other composite packaging (ketchup and mayonnaise pouches) - 4.1%, waste electrical and electronic equipment - 1%.

- bio-waste - 8.2%, including green waste (fallen leaves, branches - 4.1%), food waste - 4.1%.

- residual waste that could not be separated 0.7%.

- hazardous waste - 0.4%: waste batteries and accumulators, other (including medical).

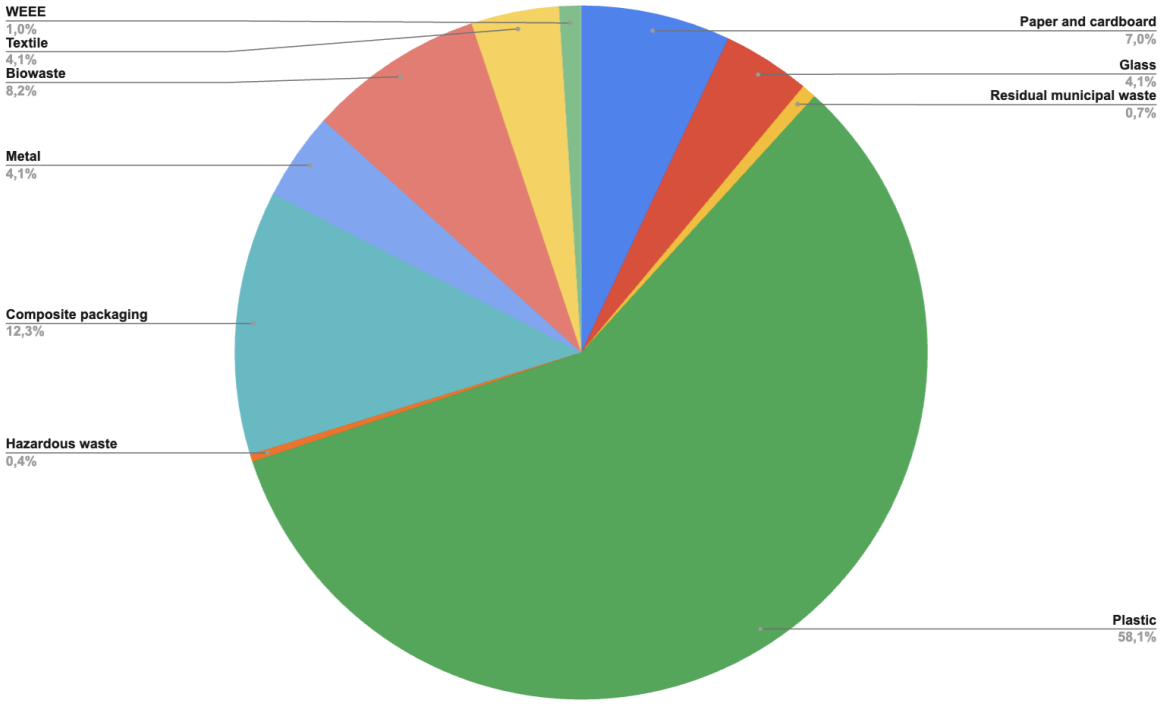

Fig. 2.6. Distribution of mixed municipal waste from the route "Other sources of municipal waste generation: enterprises, institutions and organisations" in Kherson municipality in % of the total sample volume

Table 2.3. The results of the study of the morphological composition of the municipal waste from other sources route in the Kherson municipality in autumn 2024

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
1.	**Paper and cardboard**	**8,40**	**5,60**	**0,20**	**6,98**	**41,18**
1.1.	Paper packaging	7,60	5,07	0,20	6,84	38,00
1.2.	Flat cardboard packaging	0,00	0,00	0,00	0,00	0,00
1.3.	Cardboard (corrugated)	0,00	0,00	0,00	0,00	0,00
1.4.	Office paper	0,00	0,00	0,00	0,00	0,00
1.5.	Other paper	0,80	0,53	0,00	0,14	200,00
1.6.	Other cardboard	0,00	0,00	0,00	0,00	0,00
2.	**Glass**	**33,00**	**22,00**	**0,12**	**4,10**	**275,00**
2.1.	Transparent glass packaging	17,00	11,33	0,07	2,39	242,86
2.2.	Coloured glass packaging	16,00	10,67	0,05	1,71	320,00
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.4	Other glass	0,00	0,00	0,00	0,00	0,00
3.	**Plastic**	**20,35**	**13,57**	**1,70**	**58,13**	**11,97**
3.1.	Bottles with PET-1 labelling	7,90	5,27	0,98	33,51	8,06
3.2.	Plastic packaging with PET-1 marking	0,90	0,60	0,12	4,10	7,50
3.3.	Bottles marked with HDPE-2	0,55	0,37	0,12	4,10	4,58
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging marked LDPE-4	6,00	4,00	0,24	8,21	25,00
3.6.	Plastic packaging with PP-5 marking	3,00	2,00	0,12	4,10	25,00
3.7.	Plastic packaging marked PS-6	1,70	1,13	0,06	2,05	28,33
3.8.	Plastic with marking 7	0,00	0,00	0,00	0,00	0,00
3.9.	Other plastic packaging without labelling	0,30	0,20	0,06	2,05	5,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
3.10.	Other plastics	0,00	0,00	0,00	0,00	0,00
4.	**Composite packaging**	**12,20**	**8,13**	**0,36**	**12,31**	**33,89**
4.1.	Tetra pack type packaging	8,00	5,33	0,24	8,21	33,33
4.2.	Other composite packaging	4,20	2,80	0,12	4,10	35,00
5.	**Metals**	**3,90**	**2,60**	**0,12**	**4,10**	**32,50**
5.1.	Packaging (containers) made of ferrous metals	0,00	0,00	0,00	0,00	0,00
5.2.	Packaging (containers) made of aluminium	2,10	1,40	0,06	2,05	35,00
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	1,80	1,20	0,06	2,05	30,00
6.	**Biowaste**	**56,95**	**37,97**	**0,24**	**8,21**	**237,29**
6.1.	Food waste	49,40	32,93	0,12	4,10	411,67
6.2.	Waste from green spaces	7,55	5,03	0,12	4,10	62,92
6.3.	Other biodegradable waste	0,00	0,00	0,00	0,00	0,00
7.	**Wood**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
8.	**Textiles**	**4,00**	**2,67**	**0,12**	**4,10**	**33,33**
8.1.	Clothing and footwear	2,40	1,60	0,06	2,05	40,00
8.2.	Other textile materials	1,60	1,07	0,06	2,05	26,67
9.	**Waste electrical and electronic equipment**	**3,55**	**2,37**	**0,03**	**1,03**	**117,55**
9.1.	Small municipal appliances and parts	3,50	2,33	0,03	1,03	116,67
9.2.	Computer equipment	0,00	0,00	0,00	0,00	0,00
9.3.	Televisions and other devices containing a cathode ray tube	0,00	0,00	0,00	0,00	0,00
9.4.	Lamps with low energy consumption	0,05	0,03	0,00	0,01	250,00
10.	**Waste batteries and accumulators**	**0,00**	**0,00**	**0,00**	0,00	**0,00**
11.	**Hazardous waste**	**2,51**	**1,67**	**0,01**	**0,35**	**242,64**
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
11.2.	Unused medicines and their packaging	0,80	0,53	0,01	0,17	160,00
11.3.	Syringes	0,02	0,01	0,00	0,00	625,00
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	0,09	0,06	0,00	0,01	300,00
11.6.	Paint	0,00	0,00	0,00	0,00	0,00
11.7.	Other hazardous waste	1,60	1,07	0,01	0,17	320,00
12.	**Bulky municipal waste**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
13.	**Municipal C&D waste**	**0,00**	0,00	**0,00**	**0,00**	**0,00**
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Sawn timber	0,00	0,00	0,00	0,00	0,00
13.4.	Plasterboard	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	**Residual municipal waste**	**5,15**	**3,43**	**0,02**	**0,68**	**257,25**
15.	**Total**	**150,00**	**100,00**	**2,92**	**100,00**	**51,29**

2.4. Average data of municipal waste composition for the autumn season

According to the calculations, the main fractions by weight are (Fig. 2.7, Table 2.4):

- bio-waste 55.6%, of which green waste (fallen leaves, branches) - 37.6% - prevails over food waste - 14.8%;

- recycled materials account for 23.3%: glass - 10.7 %, certain types of plastic - 6.6 % (PET-1 bottles - 3.3 %, HDPE-2 bottles - 0.5 %, plastic packaging with LDPE-4 (film) - 2.8 %), paper and cardboard - 2.6 %, Tetra Pak packaging (mainly disposable "paper" cups which actually contain a layer of film) - 1.4%, ferrous metal packaging (cans) - 1.1%, non-ferrous metal packaging (aluminium food and drink cans) - 0.7%, other non-ferrous metals - 0.2%. This is a fairly high proportion of waste that can be recovered (recycled) if collected separately.

- residual waste that could not be separated - 12.6%.

- waste that cannot or rarely can be recovered (recycled) - 7.5%: textiles - 3 %, plastic packaging with PET-1 marking (trays) - 0.3 %, plastic packaging with PP-5 marking (cups for yoghurts and other dairy products) - 0.7 %, plastic packaging with PS-6 marking (cups for yoghurts and other dairy products) - 0,3 %, plastic with marking 7 - 0.1 %, other plastic packaging (including vacuum packaging) and unmarked plastic (including children's toys) - 0.7 %, other composite packaging (ketchup and mayonnaise pouches) - 1.5 %, waste electrical and electronic equipment - 0.9 %.

- hazardous waste - 1%: waste batteries and accumulators, other (including medical). Although hazardous waste typically accounts for up to 1% of municipal waste, its separate collection is very important for protecting the environment and the health of municipality residents.

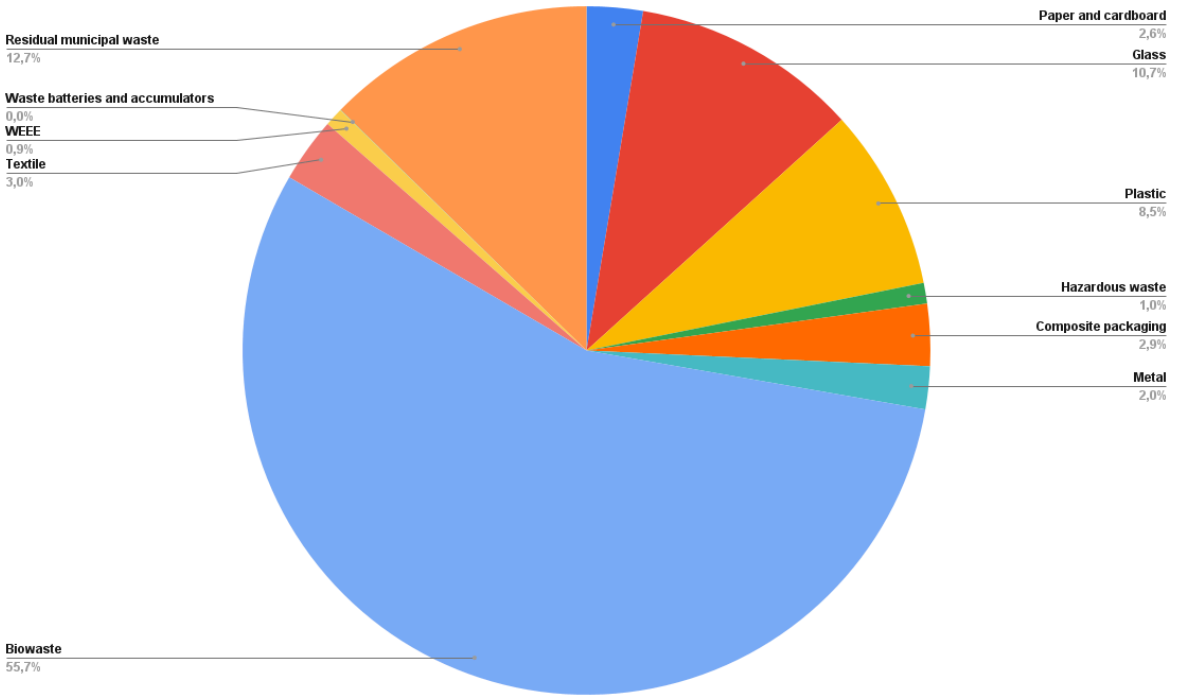

Fig. 2.7. Distribution of mixed municipal waste in Kherson municipality in % of the total weight of the sample

According to the calculations, the main fractions by volume are as follows (Fig. 2.8, Table 2.4):

- plastic - 43.5%, of which 32.6% is recoverable (recyclable) (PET-1 bottles - 22.3%, HDPE-2 bottles - 2.9%, LDPE-4 plastic packaging (film) - 7.4%). Plastic waste that cannot or rarely can be recovered (recycled) - 10.8%: PET-1 plastic packaging - 1.9%, PP-5 plastic packaging (yoghurt cups, other dairy products) - 2.9%, PS-6 plastic packaging (yoghurt cups, other dairy products) - 1.5%, plastic with a 7 marking - 1.0%, other plastic packaging and unmarked plastic (including children's toys) - 3.5%.

- bio-waste - 32.0%, of which green waste (fallen leaves, branches) - 27.8% prevails over food waste - 2.9%. Accordingly, almost ⅓ of the municipal waste by volume is green waste.

- other recyclables accounted for 14.3%: paper and cardboard - 5.1%, Tetra Pak packaging (mainly disposable "paper" cups that actually contain a layer of film) - 2.5%, ferrous metal packaging (cans) - 1.9%, non-ferrous metal packaging (aluminium food and drink cans) - 1.7%, other non-ferrous metals - 0.5%, and glass - 2.6%.

- other waste that cannot or very rarely can be recovered (recycled) - 7.7%: textiles - 3.9%, other composite packaging (ketchup and mayonnaise pouches) - 3.3%, waste electrical and electronic equipment - 0.5%.

- residual waste that could not be separated - 2.2%.

- hazardous waste - 0.3%: waste batteries and accumulators, other (including medical).

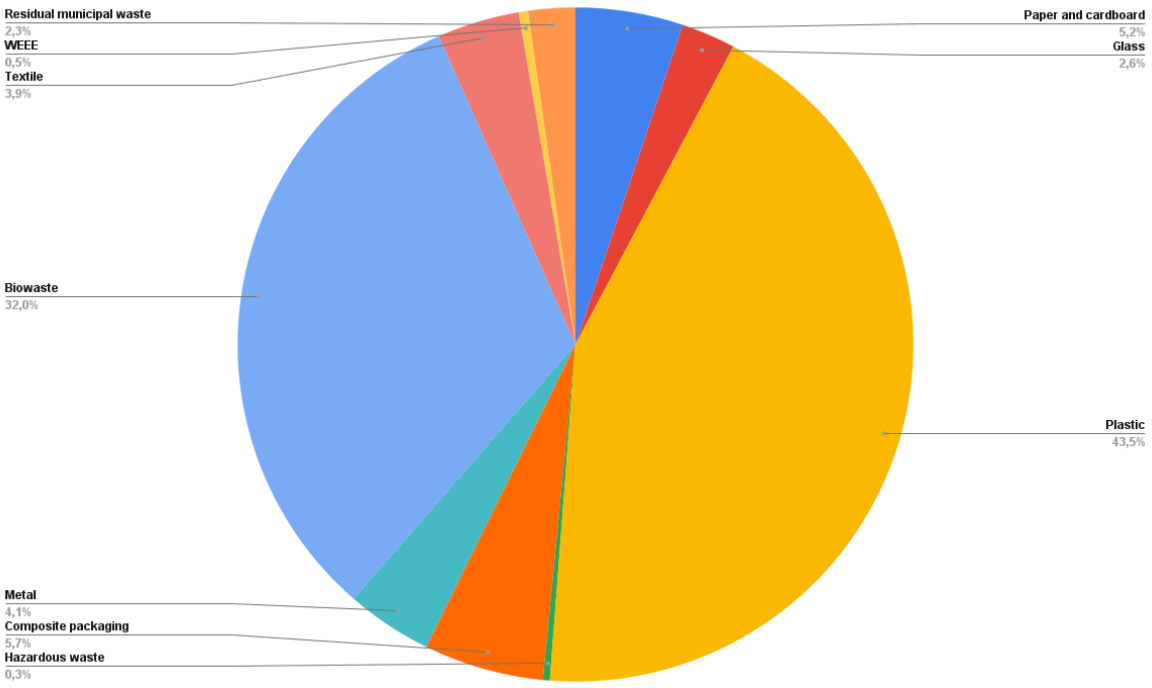

Fig. 2.8. Distribution of mixed municipal waste in Kherson municipality in % of the total sample volume

Table 2.4. The results of the study of the morphological composition of the municipal waste, average indicators for the Kherson municipality in autumn 2024

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
1.	**Paper and cardboard**	**6,60**	**2,64**	**0,21**	**5,15**	**16,76**
1.1.	Paper packaging	2,53	1,01	0,07	1,62	0,07
1.2.	Flat cardboard packaging	2,40	0,96	0,06	1,49	23,89
1.3.	Cardboard (corrugated)	0,77	0,31	0,04	0,97	6,39
1.4.	Office paper	0,20	0,08	0,00	0,04	40,00
1.5.	Other paper	0,47	0,19	0,00	0,06	133,33
1.6.	Other cardboard	0,20	0,08	0,04	0,97	1,67
2.	**Glass**	**26,67**	**10,67**	**0,11**	**2,59**	**156,71**
2.1.	Transparent glass packaging	13,27	5,31	0,06	1,38	152,02
2.2.	Coloured glass packaging	13,40	5,36	0,05	1,21	161,35
2.3.	Window glass	0,00	0,00	0,00	0,00	0,00
2.4.	Ceramics	0,00	0,00	0,00	0,00	0,00
2.4	Other glass	0,00	0,00	0,00	0,00	0,00
3.	**Plastic**	**21,35**	**8,54**	**1,79**	**43,47**	**9,28**
3.1.	Bottles with PET-1 labelling	8,30	3,32	0,92	22,34	13,02
3.2.	Plastic packaging with PET-1 marking	0,63	0,25	0,08	1,94	2,82
3.3.	Bottles marked with HDPE-2	1,25	0,50	0,12	2,91	8,93
3.4.	Plastic packaging with PVC-3 marking	0,00	0,00	0,00	0,00	0,00
3.5.	Plastic packaging marked LDPE-4	6,87	2,75	0,31	7,45	14,25
3.6.	Plastic packaging with PP-5 marking	1,73	0,69	0,12	2,91	6,15
3.7.	Plastic packaging marked PS-6	0,77	0,31	0,06	1,46	1,69

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
3.8.	Plastic with marking 7	0,13	0,05	0,04	0,97	1,11
3.9.	Other plastic packaging without labelling	1,40	0,56	0,10	2,43	10,85
3.10.	Other plastics	0,27	0,11	0,04	1,05	8,33
4.	**Composite packaging**	**7,27**	**2,91**	**0,24**	**5,74**	**18,73**
4.1.	Tetra-pack type packaging	3,40	1,36	0,10	2,48	28,91
4.2.	Other composite packaging	3,87	1,55	0,13	3,26	18,75
5.	**Metals**	**5,17**	**2,07**	**0,17**	**4,13**	**20,15**
5.1.	Packaging (containers) made of ferrous metals	2,80	1,12	0,08	1,94	23,33
5.2.	Packaging (containers) made of aluminium	1,77	0,71	0,07	1,70	10,58
5.3.	Other ferrous metals	0,00	0,00	0,00	0,00	0,00
5.4.	Other metals (non-ferrous)	0,60	0,24	0,02	0,49	0,02
6.	**Biowaste**	**139,12**	**55,65**	**1,32**	**31,97**	**64,43**
6.1.	Food waste	37,00	14,80	0,12	2,91	171,15
6.2.	Waste from green spaces	94,12	37,65	1,15	27,85	55,22
6.3.	Other biodegradable waste	8,00	3,20	0,05	1,21	102,50
7.	**Wood**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
8.	**Textiles**	**7,60**	**3,04**	**0,16**	**3,93**	**34,44**
8.1.	Clothing and footwear	6,00	2,40	0,10	2,43	43,35
8.2.	Other textile materials	1,60	0,64	0,06	1,51	82,80
9.	**Waste electrical and electronic equipment**	**2,18**	**0,87**	**0,02**	**0,45**	**198,08**
9.1.	Small municipal appliances and parts	2,17	0,87	0,02	0,45	198,08
9.2.	Computer equipment	0,00	0,00	0,00	0,00	0,00

No.	Name of the MW faction	Weight, kg	Waste composition by weight, %	Sample volume, m^3	Composition of waste by volume, %	Density kg/m^3
9.3.	Televisions and other devices containing a cathode ray tube	0,00	0,00	0,00	0,00	0,00
9.4.	Lamps with low energy consumption	0,02	0,01	0,00	0,00	0,00
10.	**Waste batteries and accumulators**	**0,04**	**0,02**	**0,00**	**0,00**	**3022,22**
11.	**Hazardous waste**	**2,44**	**0,97**	**0,01**	**0,33**	**99,45**
11.1.	Fluorescent lamps	0,00	0,00	0,00	0,00	0,00
11.2.	Unused medicines and their packaging	1,27	0,51	0,01	0,20	100,00
11.3.	Syringes	0,01	0,00	0,00	0,00	0,00
11.4.	Mineral oils (technical)	0,00	0,00	0,00	0,00	0,00
11.5.	Gas canisters	0,50	0,20	0,00	0,09	135,24
11.6.	Paint	0,00	0,00	0,00	0,00	0,00
11.7.	Other hazardous waste	0,67	0,27	0,00	0,04	444,45
12.	**Bulky municipal waste**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
13.	**Municipal C&D waste**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
13.1.	Concrete	0,00	0,00	0,00	0,00	0,00
13.2.	Asphalt	0,00	0,00	0,00	0,00	0,00
13.3.	Sawn timber	0,00	0,00	0,00	0,00	0,00
13.4.	Plasterboard	0,00	0,00	0,00	0,00	0,00
13.5.	Mixed construction waste	0,00	0,00	0,00	0,00	0,00
14.	**Residual municipal waste**	**31,61**	**12,64**	0,09	**2,23**	**194,49**
15.	**Total**	**250,00**	**100,00**	**4,12**	**100,00**	**45,20**

List of references

1. Order of the Ministry of Communities, Territories and Infrastructure of Ukraine No. 409 of 03.05.2024 "On Approval of Methodological Recommendations for Determining the Morphological Composition of municipal Waste". URL: https://rada.info/upload/users_files/04388478/9920006ccaf9d75a69cb5247b8a915a9.pdf
2. Press release of the project "Best practices of bio-waste management in small municipalities of Ukraine". URL: https://zerowaste.org.ua/2024/05/29/pres-reliz-proyektu-krashhi-praktyky-upravlinnya-biovidhodamy-v-malyh-gromadah-ukrayiny/