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Qstock

Qstock waste report

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Background

A waste composition study was carried out by Haurun Jäteauto Oy at the annual Qstock music festival in Oulu Kuusisaari. As part of the study, waste composition analysis of different waste fractions has been carried out. It has been carried out in order to determine the types of waste that end up in the waste stream, and at the same time to see whether separate collection works as a recycling solution at the festival. The study has calculated the carbon footprint of waste management for the whole festival and analysed the fill levels of waste containers during the festival. The analysis and measurement of fill levels was carried out using Jaete sensors.

The study utilized the waste accumulation data of the entire Qstock festival, with waste collected in bins on the festival site. The sample consisted of bins used by guests and staff in the festival area, randomly selected for sorting study from different parts of the festival area. On the customer side of the festival area, there were mixed waste, plastic pint and cardboard collection containers. In the bar and restaurant area, staff also used biowaste bins, plastic bags and Snaps glass containers (plastic collection). On each stage there were also containers for zip ties (plastic), glass bins and roller cages for cardboard. However, the last two were not examined in this study.

Kuva: Teija Soini

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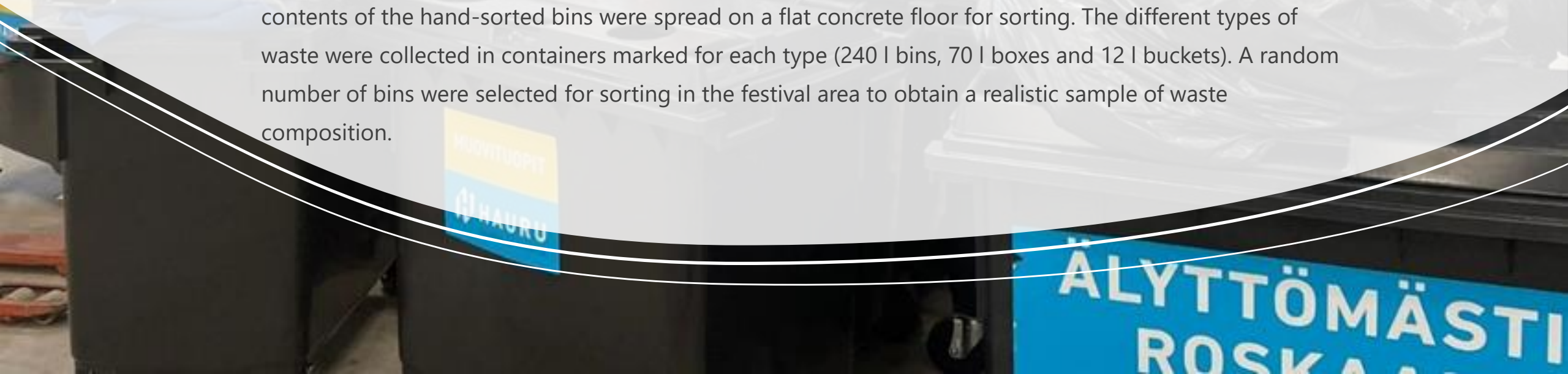
Waste collection & sorting

Waste fraction	Container size	Amount	Location
Mixed waste	660 l	90	Around festival area
Mixed waste	660 l	45	Around festival area
Plastic pints	240 l	10	Alcohol consumption areas
Paper cups & other cardboard	240 l	5	Near the cafés
Plastic film	120 l, plastic sack rack	10	For bar staff
Bio-waste	240 l	10	Restaurateurs
Snaps glasses	240 l	5	Customers & staff
Zip ties	240 l	6	Near the stages
Roller cages for cardboard		10	For bar staff
Glass	240 l	5	For bar staff

The waste collected for sorting was collected throughout the festival weekend from 30 August to 31 August 2021. However, the combustible waste bins were emptied in the morning of 31 August 2021, so the waste that ended up for sorting originated from Saturday (31 August).

There were no large items of waste that would have affected the distribution of waste quantities. The contents of the hand-sorted bins were spread on a flat concrete floor for sorting. The different types of waste were collected in containers marked for each type (240 l bins, 70 l boxes and 12 l buckets). A random number of bins were selected for sorting in the festival area to obtain a realistic sample of waste composition.



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Sorting category

The sorting has been carried out in accordance with KIVO Finland's guidelines. The bulk volumes of the waste fractions were also estimated.

The sorting categories in which the fractions were found were:

1.	Bio-waste
2.	Paper
3.	Cardboard
5.	Plastic
5.2.1	Other type of rigid plastics (Deposit-return plastic bottles)
6.1	Glass package
6.2	Other type of glass (Deposit-return glass bottles)
7.1	Metal package
7.2	Other type of metal (Deposit-return aluminium cans)
11.3.1	Other combustible waste

Plastics were also sorted into their own recycled plastic types:

PET <1>	PE-HD <2>
PVC <3>	PE-LD <4>
PP <5>	PS <6>
PLA <7>	Other types and mixed plastic<7>

Fill levels of waste containers

The data sent by the surface measurement sensors enabled the monitoring of the fill levels of the bins for combustible and plastic containers. Fill levels for combustible containers on Friday and Saturday are analyzed in the table below.

By analyzing the filling rates, it can be seen that most waste was generated at various transit points, such as the entrances to the licensed areas and the restaurant area in the centre of the festival area. Less waste was generated at locations where the distance to the bar and restaurant areas is greater (bins 1 and 3). The average fill rate for incineration containers is 63% on Friday and 62% on Saturday.

Container	Fill level Fri (%)	Fill level Sat (%)	Location
1	0	5	Alcohol consumption area of the main stage
2	72	10	Alcohol consumption area of the main stage, entrance
3	0	47	Alcohol consumption area of the main stage, koomalava
4	71	100	Restaurant area near Info desk
5	100	100	Restaurant area near Oulu stage
6	100	100	Alcohol consumption area of Rytmiranta, entrance
7	100	72	Alcohol consumption area of the Circus tent, entrance
Average	**63,3**	**62**	

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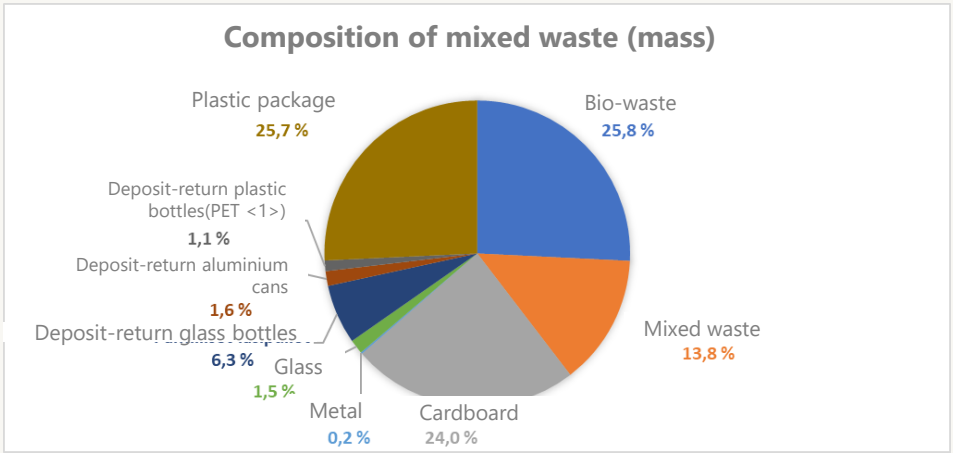
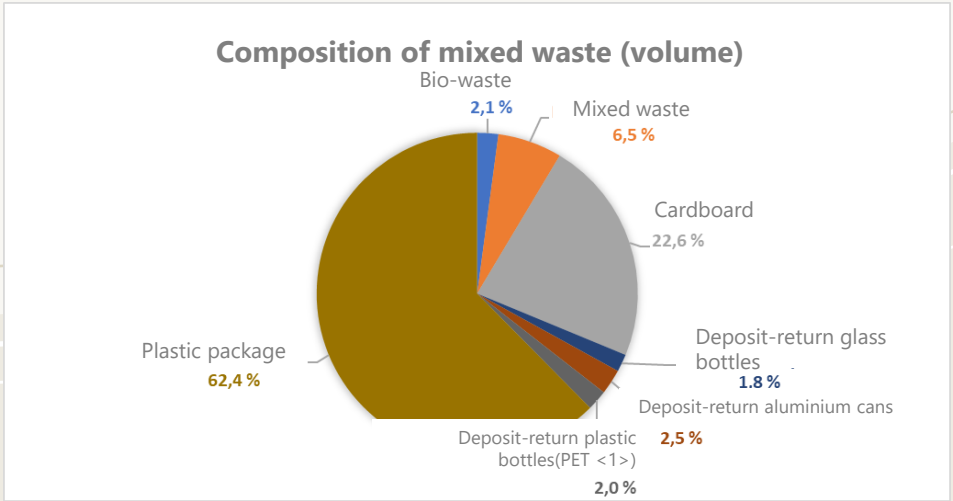
Results & analysis of the sorting study: Mixed waste

Three containers of combustible / mixed waste were sorted. The containers were 660 liters in size. The samples were had a total mass of 23.09 kg. The containers of combustible waste were emptied on Saturday morning (waste from Friday), so the sorted waste originates from Friday. The percentage composition and volume distribution of the waste are shown in the graphs. Plastics were sorted separately into recycled plastic types.

Waste fraction	Mass (kg)	Percentage
Bio-waste	5,95	25,8 %
Mixed / combustible waste	3,19	13,1 %
Cardboard	5,55	24,0 %
Metal	0,04	0,2 %
Glass	0,35	1,5 %
Deposit-return glass bottles	1,45	6,3 %
Deposit-return aluminium cans	0,36	1,6 %
Deposit-return plastic bottles (PET <1>)	0,26	1,1 %
Plastic packages	5,94	25,7 %
Total	**23,09**	





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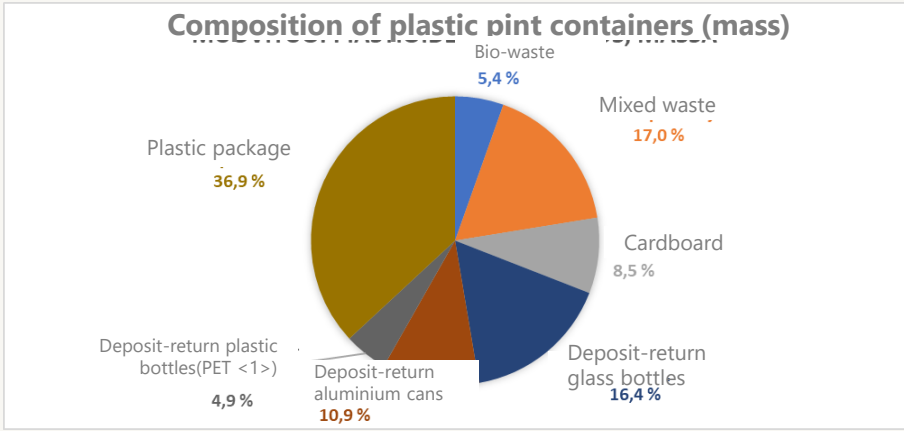
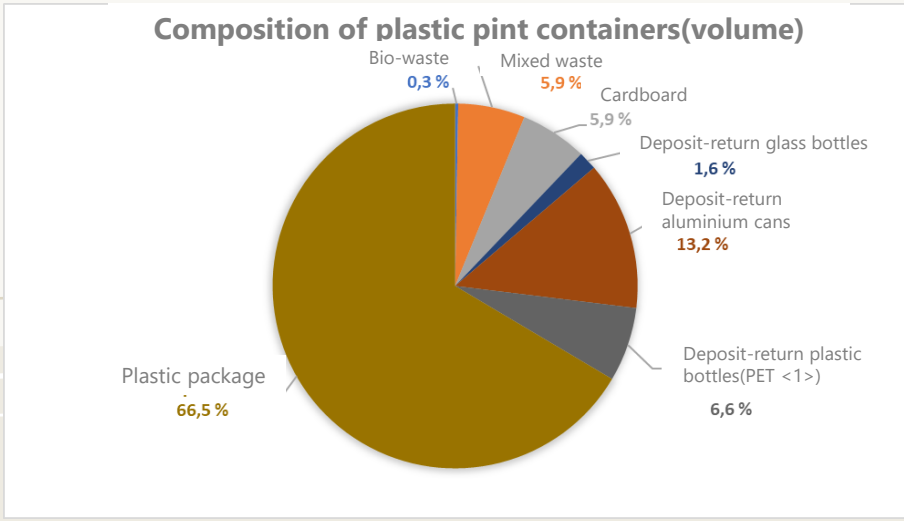
Results & analysis of the sorting study: Plastic pint containers

The content of each of the ten plastic pint containers in the festival area were sorted. The bins were 660 liters in size and the fill levels are listed in the table below. Some containers were fitted with Jaete sensors measuring the fill level. The total mass of the plastic containers was 61,26 kg. The percentage compositional distributions of the waste and the volume distribution are shown in the graphs. Plastics were sorted separately into plastic types.

Container	Fill level (%)
1	27
2	56
3	29
4	6
5	16
6	17
7	39
8	41
9	20
10	28
Average	**28**

Waste fraction	Mass (kg)	Percentage
Bio-waste	3,33	5,4 %
Mixed / combustible waste	10,42	17 %
Cardboard	5,19	8,5 %
Deposit-return glass bottles	10,06	16,4 %
Deposit-return aluminium cans	6,67	10,9 %
Deposit-return plastic bottles (PET <1>)	2,99	4,9 %
Plastic package	22,6	36,9 %
Total	**61,26**	





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Results & analysis of the sorting study:

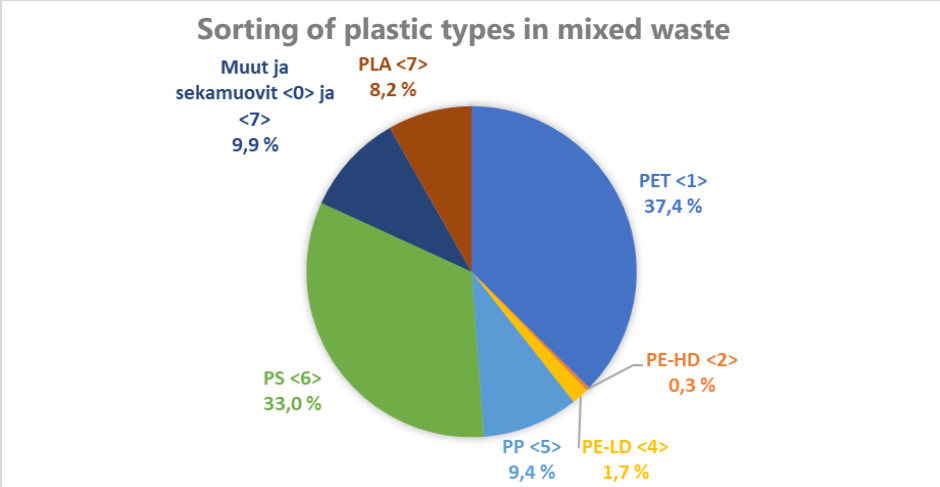
Recycled plastic types

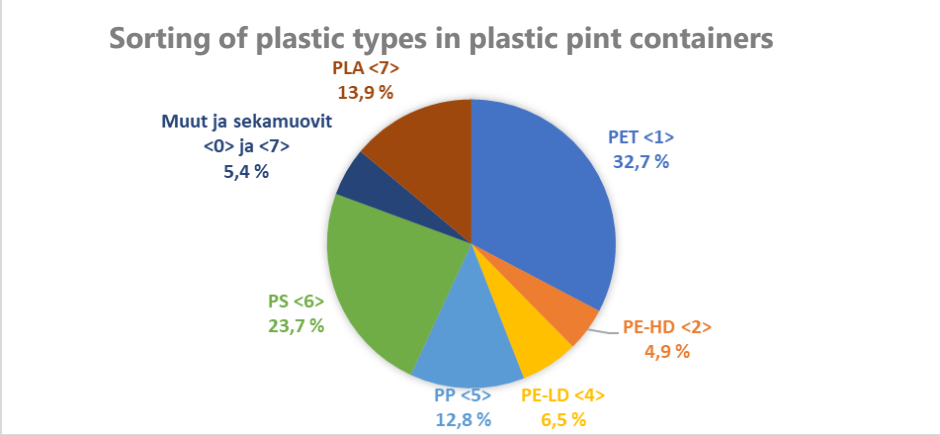
The plastics separated from the combustible waste containers and plastic pint containers were further sorted into recycled plastic types. The weight of the separated plastics was 5.94 kg in combustible waste containers and 22.6 kg for ten plastic pint containers. The amount of plastic is shown in the table below and the percentage distribution in the graphs. The bio-based and biodegradable plastic PLA <7> is sorted as a separate type due to its high volume and because it interferes with the recycling of other plastics due to its properties.

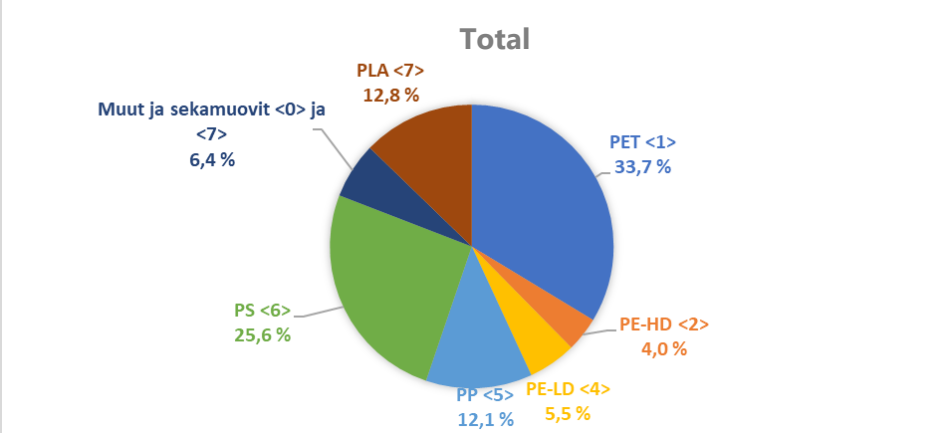
In percentage terms, the distribution of plastics contained in both containers across the different types of recycled plastics was very similar, indicating similar plastic waste.

The majority of the plastic waste was single-use plastic glasses and pints. Several different types of plastic glasses from several different plastic grades were used at the festivals. The bio-based and biodegradable plastic PLA <7> (polylactic acid) was sorted separately because of its quantity and because it poses problems for the recycling of other types of plastic due to its properties. It should also be noted that there were many different types of plastic glasses of the same size and appearance, and even of different types of plastic.

Plastic	Plastics in mixed waste (kg)	Plastics in plastic pint containers (kg)	Total plastic mass (kg)
PET <1>	2,22	7,39	9,61
PE-HD <2>	0,02	1,11	1,13
PE-LD <4>	0,1	1,46	1,56
PP <5>	0,56	2,9	3,46
PS <6>	1,96	5,36	7,32
Other types and mixed plastic <7> and <0>	0,59	1,23	1,82
PLA <7>	0,49	3,15	3,64
Total	**5,94**	**22,6**	**28,54**



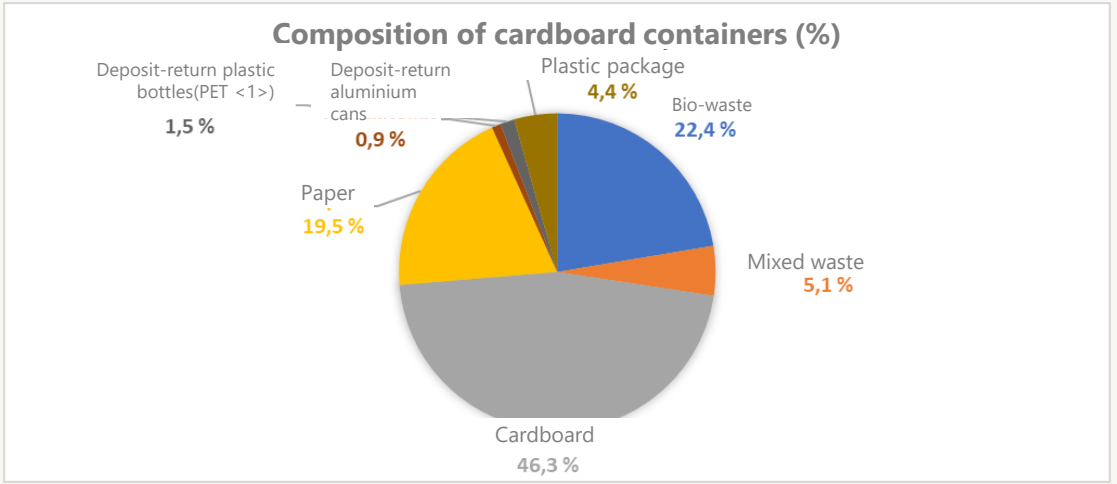


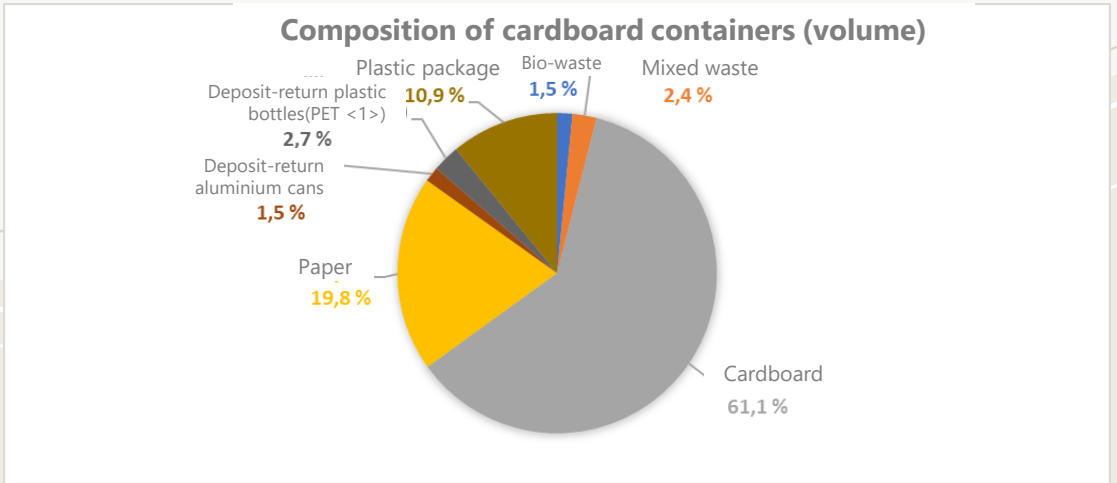


Results & analysis of the sorting study: Cardboard

Two cardboard containers were sorted. The containers had a capacity of 240 liters and fill levels of 90 % and 70 %. The samples had a combined mass of 16.42 kg. The percentage composition and volume distribution of the waste are shown in the graphs. The masses are shown in the table below. However, the cardboard in the cardboard containers was dirty and could not be recycled as cardboard but as energy waste which could possibly be composted and used in biogas production (as biowaste).

Waste fraction	Mass (kg)	Percentage
Biowaste	3,67	22,4 %
Mixed / combustible waste	0,83	5,1 %
Cardboard	7,6	46,3 %
Paper	3,21	19,5 %
Deposit-return aluminium cans	0,15	1,5 %
Deposit-return plastic bottles (PET <1>)	0,24	0,9 %
Plastic packages	0,72	4,4 %
Yhteensä	**16,42**	





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Results & analysis of the sorting study: Plastic sack rack

All 39 separately collected plastic bags were collected and weighed. The total combined weight of the plastic bags was 151.79 kg. The plastic sacks contained film plastic (PE-LD <4>), almost all of which was packaging material from aluminium cans. Due to its very high purity, the collected packaging waste is easily recyclable. The plastic sack racks were placed at the disposal of the bar staff and a total of 10 of them were in use.

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Results & analysis of the sorting study: Bio-waste

10 bio-waste bins were placed at the disposal of restaurateurs. The average fill level was 7.5% per day. The composition of the biowaste bins was very largely made up of leftover food and raw materials from restaurants. The bio-waste bins accumulated around 290 kg of waste during the festival. However, a large part of the bio-waste generated during the festival was food waste, which ended up in combustible waste and plastic waste.

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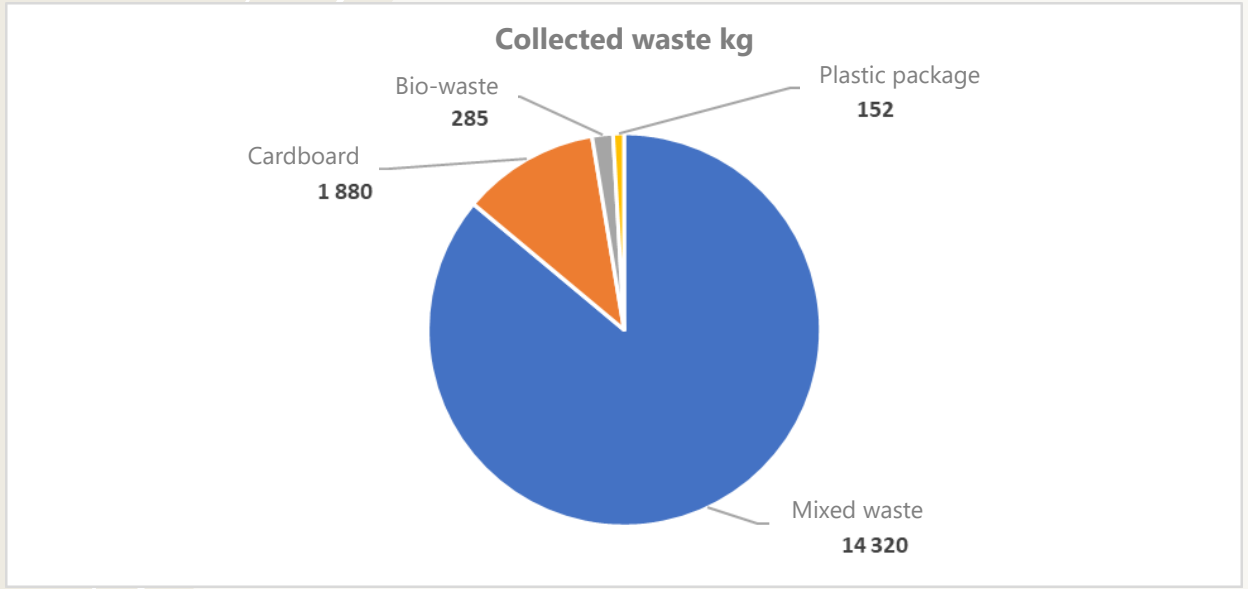
Results & analysis of the sorting study: Containers for snaps glasses and zip ties

Two snaps glass containers were sorted, with fill levels of 100% and 85%. The first container was located on the staff side and contained various mixed plastic waste. The second container was located on the customer side and was similar in content to the mixed combustible waste containers. The main purpose of the snaps containers was to test the recycling of a specific type of plastic (PS <6>). The bar staff had no other plastic collection container available, so the container still contained all types of single-use plastic glasses.

There were six containers for zip ties, one at each bar. The aim was to monitor the amount of zip ties created during unloading of goods. However, a large proportion of these containers were empty, or comparable in content to combustible mixed waste containers.

Results & analysis of the sorting study: Accumulated waste

During the two-day festival, approximately 14 320 kg of combustible waste (mixed waste + pint containers), 1 880 kg of cardboard, 285 kg of biowaste and 152 kg of packaging plastic were generated. **The total amount of waste was about 16 637 kg**. Sanitary waste (waste from Mobile toilets) was not included in the survey. Also, deposit-return bottles and cans collected from restaurants and cafeterias were not included in the amount of waste, as they were delivered to the PALPA bottle deposit system. However, some deposit-return bottles and cans were included in the customer's incinerable waste.



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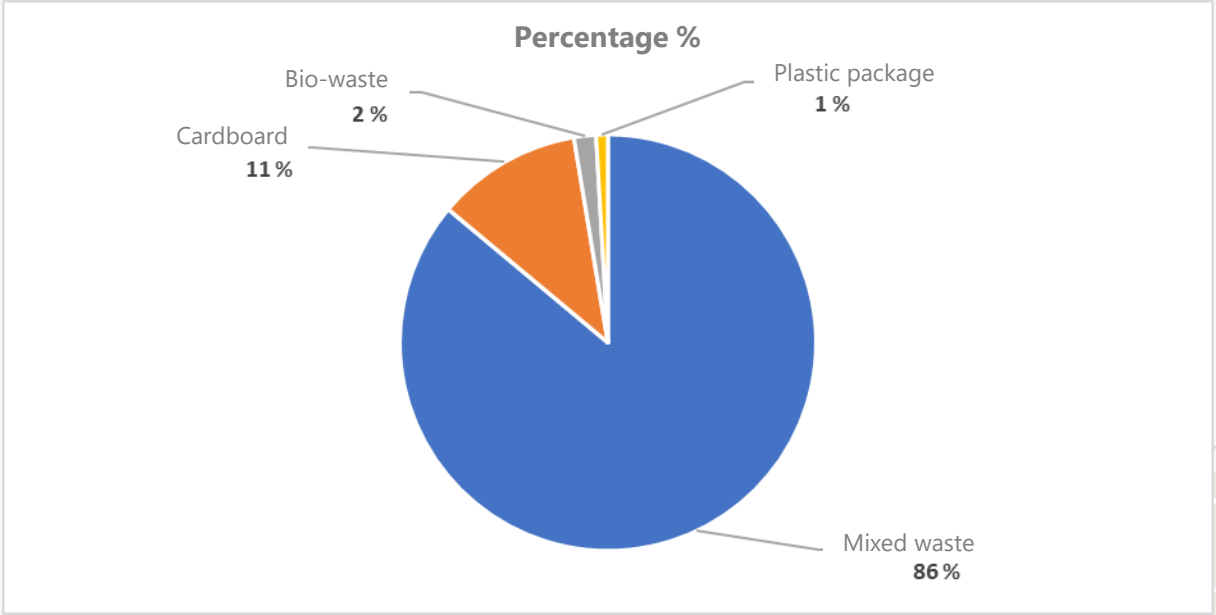
Results & analysis: Carbon footprint

If all collected waste is incinerated as energy waste (including biowaste), the carbon footprint of the waste would be about 6 654.8 kg CO2 eq. The emission from the incineration of combustible waste is 0.4 kg CO2 eq/kg (Fuel Classification 2021, Statistics Finland). Waste transport over two days would account for emissions of about 104.1 kg CO2 eq. (Lipasto 2017, VTT). The total carbon footprint would therefore be about 6759 kg CO2 eq. if everything is delivered as energy waste. If we separate out the recycled materials and recycle them as separate fractions, the result changes slightly. Mixed waste generates 14 320 kg and has a carbon footprint of 5 728 kg CO2 eq. because it is incinerated. Mixed waste contained a large amount of sortable plastic, which could be collected for separate recycling, thus improving the recovery of waste and further reducing the carbon footprint. The carbon footprint of recyclable cardboard can be calculated as 0 kg CO2 eq. as it can be reused as a recycled raw material. Similarly, PE-LD plastics from the beverage containers of the food and café outlets in the festival area were collected in their own containers. This plastic can also be calculated to have a carbon footprint of 0 kg CO2 eq. (ecoinvent 3.6, ecoinvent), as it can be used as a recycled raw material. Biowaste was collected from restaurant and café operations. Its recovery for biogas production results in emissions of 0.075 kg CO2 eq/kg (ecoinvent 3.6, ecoinvent). In other words, the separately collected biowaste had a carbon footprint of 21 kg CO2 eq. Combining the recycled materials and the combustible waste and their transport, the carbon footprint is about 5857 kg CO2 eq, i.e. recycling can reduce the carbon footprint by about 902 kg CO2 eq. And if further reductions in the carbon footprint are desired, the easiest way to achieve this would be through the separate collection of plastic containers, which would also probably require a reduction of the plastic grades to mainly one plastic material.

	Amount of waste kg	Emission factor kg CO2 ekv. /kg	CO2 emissions kg CO2 ekv.	Waste transport kg CO2 ekv.	Emissions total kg CO2 ekv.
All waste to incineration	16 637	0,4	6654,8	104,1	6 758,9
Energy waste	14 320	0,4	5728	89,6	5 817,6
Cardboard to recycling	1880	0	0	12,5	12,5
Plastic to recycling	152	0	0	4,2	4,2
Biowaste to recycling (biogas)	285	0,075	21,4	1,8	23,2
				Recycling of sorted material total:	5 857 kg CO2 ekv.

Results & analysis: Recycling rate

All waste collected at festivals can be recycled. Of the separately collected waste, cardboard could be collected from the restaurants and cafés. The cardboard from food containers and paper cups at the customer side was not recyclable due to its dirtiness. Bottles and cans were not counted as waste. However, some of them were found in mixed waste. Clean cardboard and plastic waste (PE-LD) was collected from packaging waste at restaurants and cafés. Similarly, biowaste was collected from these points, which can be used in a biogas plant. The remaining mixed waste is suitable for energy production. However, the recycling rate at the festivals was low. The percentage of recycled waste was around 14% of the total waste.



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Recommendations

Plastic waste

Plastic waste accounts for a very high proportion of the volume of incinerable waste: about 26% of the waste mass and about 62% by volume. There were several types and qualities of single-use plastic glasses. One of the plastic grades was the bioplastic PLA (<7>). It poses problems for plastics recycling due to its properties if it gets into the recycled plastic as an impurity. PLA accounted for about 8% of the plastic waste from incinerable waste and about 14% of the plastic waste from plastic containers. The question is whether it makes sense to use bioplastics as a material for plastic glasses when they are not recyclable with other plastics.There were numerous plastic glasses of similar size and appearance in use, and of different grades of plastic. This time the question must be asked whether there should be several different types and grades of plastic glasses of the same size, or whether it would be possible to reduce the number. Given the high proportion of plastic waste in combustible waste and the fact that it is largely made up of recyclable hard plastic, recycling is recommended. The average fill rate of the ten plastic containers after the two-day festival was 28%, of which 37% by mass and 67% by volume was plastic. One way to improve recycling and filling rates is to place the plastic containers close to the incineration bins, which makes it easier to sort them into different waste fractions. Proper sorting guidance can also improve the recycling rate. The design of the plastic bin can also influence the quality of the plastic collected. This will require new ideas from the bin design team, such as new options for hatches and designing feeders for different materials according to the collection needs.

Biowaste and tissue paper

Bio-waste accounts for a high proportion of the incinerable waste mass (about 26%), but it was not possible to recycle bio-waste on the festival's customer side. However, biowaste accounted for only a small proportion of the volume of incinerable waste (around 2%). The biowaste came from food waste, so placing biowaste bins near restaurants for use by customers would reduce the amount of mixed waste going to incineration and its carbon footprint. When sorting the incineration bins, paper was classified as incinerable waste due to its dirt and moisture content. A very large proportion of the paper was tissue paper, which can also be sorted as bio-waste. This reduces the amount of combustible waste, thus reducing the carbon footprint.It is recommended that in the future, separate bio-bins are also set aside for bio-waste from the customer side. Innovative design of bio-waste containers should encourage people to sort bio-waste into their own containers instead of mixed waste. The location of the containers and instructions on how to use them also play an important role.

Containers for zip ties

A large proportion of containers for zip ties were empty or had a waste content comparable to combustible mixed waste. The low proportion of zip ties may be result of a lack of guidance. But it is also worth considering whether it makes sense to collect zip ties as a separate fraction. Due to the assumed low amount, zip ties can be sorted into combustible mixed or basic plastic waste bins.

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Recommendations

Cardboard

Cardboard accounted for a large proportion of the waste in cardboard containers (about 46% of the waste mass and about 61% of the volume). The cardboard bins were placed near the cafeterias in the festival area to collect cardboard and cardboard waste from their maintenance, as well as disposable cardboard cups. However, some of the cardboard that ended up in the bins was dirty disposable cardboard from the restaurant area, which was not recyclable.

One of the cardboard containers was located at a separate café point further away from the restaurant area, so there was not as much dirty non-recyclable cardboard and organic waste. The use of cardboard containers is a viable solution if the location of the containers is taken into account.

One way to improve the recycling rate of cardboard and paperboard is to place the bins near the cafeterias and also near the food outlets, making it easier to sort the waste into different fractions. Proper sorting guidance can also further improve the recycling rate.

The planning of cardboard collection can also influence the quality of the cardboard material collected. This will require new ideas from the waste container design team, such as new flap options and designing feed openings for different materials according to collection needs.

Plastic sack racks

The total weight of the separately collected plastic bags was 151.79 kg. The plastic sacks contained film plastic (PE-LD <4>) from the packaging waste of cans and were recyclable due to their high degree of purity. Plastic sack racks are a viable system for collecting such plastic material. If the amount of plastic waste generated is to be significantly reduced, cans could in future be packaged in cardboard instead of plastic.

Snaps glass containers

The snaps glass containers used by bar staff contained mixed plastic waste, a very large proportion of which was single-use plastic glasses. It is not considered advisable to separate the collection of a single type of plastic (PS <6>) from snaps unless there are also recycling bins for other plastic waste. With the high volume of plastic waste, it would therefore be simpler to reduce the number of different types of plastic than to invest in separate sorting. The placement of plastic collection bins for use by bar staff is a viable solution to the high volume of plastic waste.

The snaps glass container on the customer side had become a mixed waste container in use. If a particular type of waste is to be collected, then the bin should be designed so that it cannot be opened by customers, and fitted with, for example, feed slots to feed in specific types of waste, and the instructions should be very clear. In practice, the plastic collected at the restaurant is only suitable for chemical plastic recycling, as there were several types of plastic.