Project SAMRS/2023/GE/1/4

Support for the introduction of the separate waste collection system in Georgia

Activity 1.

Strategy for the separate collection of plastic waste through the support of local government in the field of waste management

Sub-activity 1.4.

Manual for separate collection of waste for municipalities (practical guideline with manual for successful introduction and operation of separate collection of municipal waste with the use of Slovak experience)

Slovak Environment Agency, Basel Convention Regional Centre in Bratislava

April, 2024

Content

1. Introduction

This report was created within the project SAMRS/2023/GE/1/4 Support for the introduction of the separate waste collection system in Georgia, activity 1 for the separate collection of plastic waste through the support of local government in the field of waste management, sub-activity 1.4. Manual for separate collection of waste for municipalities (practical guideline with manual for successful introduction and operation of separate collection of municipal waste with the use of Slovak experience)

Its goal is to provide the municipality with the information necessary for the introduction and successful operation of the separate collection of municipal waste based on experience from Slovakia.

2. What is separate collection of municipal wastes?

In municipalities several wastes are produced, most of them as a result of household life, some wastes are produced by small business entities as small shops or administrative companies and some waste is produced by the municipality during works provided for the municipality (e.g. care of public greenery, care of infrastructure).

Municipal wastes usually end in the dump or landfill, although they are a valuable source of secondary raw materials. With the aim to use valuable components from waste the separate collection of specified waste streams is introduced.

Separate collection of municipal wastes is collection of specified waste streams into separate bins with the aim to get valuable materials suitable for recycling.

Wastes from separate collection can be sold for recycling, but the price of the material depends on its quality. It is therefore important to ensure the best possible degree of separation and the greatest possible purity of the material. This will be achieved by introducing an appropriate municipal waste collection system, including mixed municipal waste. If the municipality has not a suitable mixed municipal waste collection system in place, then citizens throw mixed municipal waste into containers for separate collection.

From a well-established separate collection system, the municipality can benefit financially from the sale of secondary raw materials and at the same time reduce the costs of landfilling mixed municipal waste.

Separate collection can be ensured in different ways. The most used is separation directly in households into different containers. Mainly in areas with apartment buildings, collection into common containers is used, usually color-coded for different waste streams, large-volume semi-underground or underground containers can also be used. In smaller villages, it is possible to use collection in common containers located in strategic places in the village (for example, at a crossroads, near a shop, near a bus stop, etc.). Municipalities use collection yards (fenced places where several containers are placed for the needs of the residents of the municipality).

After waste separation, secondary raw materials are obtained, which serve as raw materials for further production. Some wastes are of such quality after separation that no further operations are necessary before their processing (for example, metals or paper), others need to be further sorted (plastics), rid of unwanted metal parts (caps on glass bottles must be separated with a magnetic separator, vignettes on PET bottles are washed away by water etc.).

3. Which municipal waste streams can be separately collected and why?

Many interesting and necessary products can be made from waste, which we often don't even know are made from waste. This is the main goal of separate collection as well as increased environment protection and people´s health protection.

From the point of view of efficiency and the possibility of obtaining secondary raw materials, it is advisable to collect the following streams of municipal waste separately:

- Paper/cardboard, which become mostly from packaging wastes,
- Plastics, which become mostly from packaging wastes,
- Glass, which become mostly from packaging wastes,
- Metals,
- Multilayer combined materials, which become mostly from packaging wastes,
- Biodegradable (mainly green) wastes from households, cemeteries, parks and gardens,
- Construction and demolition wastes,
- Electrical and electronic wastes,
- End-of-life vehicles,
- Waste batteries and accumulators,
- Textile wastes.

From the point of protection of human health and environment the separate collection of hazardous waste is advisable.

3.1. Paper and cardboard wastes

Paper is nearly 100 % recyclable. The exceptions are only greasy papers, polluted papers (with rests of food), tissue papers, wax papers, carbon papers.

Paper and cardboard are recycled in paper mills by the common paper producing technologies in paper machines[1]. The condition is a sufficiently long cellulose fibre in the recycled paper, therefore, for example, tissue papers are not suitable for recycling because fibres that are too short end up in waste water in the paper recycling process and it is necessary to clean this water.

Most of paper mills producing tissue paper prefer recycled paper than virgin material because of operational costs.

[1] E.g. https://voith.com/corp-en/components-papermaking/xcelline.html, https://www.valmet.com/board-and-paper/board-and-paper-machines/ , https://www.scanmachineries.com/paper-technology/complete-paper-machine/

Picture 1: What is made from waste paper?

Sanitary napkins 	Napkins 	Hand paper 
Toilet paper 	Recycled paper 	Wrapping paper 
Kitchen towels 	Paper packaging 	Sucked cardboard 

3.2. Plastic wastes

Plastic waste represents a mixture of different plastics with different chemical composition and different physical properties. Not all types of plastic can be recycled, so waste pre-sorting is necessary before recycling.

Wastes from polyethylene (foils, bags), polypropylene (food packaging), PET (usually beverage bottles) and polystyrene (both packaging and construction) are most often recycled.

Very often, different products than the original ones are made from recycled plastics. For example, only a small percentage of PET bottles can be used for the production of new bottles, but the material is suitable for other products (e.g. binding tapes, brooms, etc.)

Plastics can be processed mechanically - thermally (production of granules, flakes, remelting) or chemically (production of chemically pure plastics).

Packaging from milk products (yogurt, milky cream, butter…) are not recyclable, but can be used as a alternative fuel due to its high energy value. Alternative fuel is usually a mixture of crushed wastes from paper, plastics, wood, textile and other materials with high energy value.

Picture 2: What is made from plastic wastes?

New plastic materials 	Textile fibres 	New products 
Recycled polystyrene 	Insulation materials 	Heating oil 
Alternative fuel for cement kilns or heating plants 	Plastic granulate that is mixed with primary plastic 	Construction materials 

3.3. Glass wastes

Glass is a unique material because it can be endlessly recycled. Since recycling takes place in a glass furnace[2] at high temperatures, there is no need to treat or clean the glass before recycling. It is necessary only to remove metal parts, and in the case that glass factories producing packaging for food from recycled glass, it is necessary to meet the hygienic requirements for the composition of the glass (content of heavy metals).

Since in the EU glass factories are involved in the system of trading emission quotas, it is more profitable for them to produce products from recycled glass, because the remelting of shards does not require such a high temperature as the production of glass from glass sand. Therefore, in general, recycled glass is an easily tradable commodity.

Ordinary packaging glasses are easily recycled, special glasses are problematic, for example front windscreens from cars, glass from TV screens, etc. These types of glass need special recycling technology, but can be used in construction industry.

Safety issues are associated with the separate collection of glass waste. It is necessary to introduce the collection of glass waste in order to avoid the possibility of cutting workers, so plastic bags for separate collection of glass wastes are not recommended.

Picture 3: What is made from glass wastes?

Glass bottles 	Jam jars 	Plate glass 
Glass vessels 	Fluorescent glass 	Artistic products 

[2] E.g. https://pyrometrcz.cz/reseni/prumyslovy-material/sklo/sklarska-tavici-pec/ , https://www.bvd.cz/sklo?gad_source=1

3.4. Metal wastes

Similar to glass wastes metal wastes are endlessly recycled, while the quality of the material is at the same level as the quality of virgin material. Metal waste is recycled by thermal processes in ironworks.

Before recycling itself, it is necessary to separate individual metal materials (steel, iron, aluminium, copper, tin...). In most cases, such sorting can be ensured mechanically, or manually.

Picture 4: What is made from metal wastes?

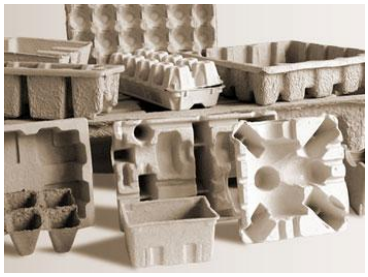
New metal materials	New metal products
	

3.5. Wastes from multilayer combined materials

Multilayer combined materials are packaging materials formed of a layer of cardboard (usually over 70 % of weight), polyethylene and aluminium foils. Most often they are used as a beverage packaging (e.g. Tetra Pak).

Recycling consists either in the separation of individual layers or in the production of a new material using all three components (the waste is crushed and glued together with expanded polyethylene under high pressure to create high-quality building materials replacing plasterboard or other traditional construction materials).

Picture 5: What is made from multilayer combined wastes?

Construction materials	Sucked cardboard
	

3.6. Biodegradable wastes

Biodegradable wastes form about 50 % of the total weight of produced municipal waste. The inappropriate handling of these wastes causes various environmental damages. When it is burned, it creates air pollution (usually in the inner city of the village), when it is improperly stored, leachates are formed that pollute water recipients.

Biodegradable waste has been used since time immemorial as a source of nutrients for agriculture. During their aerobic processing by composting, a high-quality fertilizer is produced that can be used in fields and gardens. Compost unlike industrial fertilizers contains a high amount of organic material, which improves soil fertility and ensures its sustainability.

Composting can take place in industrial large-capacity composting plants, or in domestic conditions in the form of home composting in a composter. In addition to other advantages, home-made compost also has a positive impact on the municipal budget, because the municipality does not bear financial responsibility for the waste processed in this way.

Biodegradable waste can also be processed industrially in a biogas station. Under anaerobic conditions, biogas is produced, which is a mixture of gases with a high proportion (more than 90%) of methane. Biogas can be used directly for the production of electric power and heat, or can be cleaned and supplied o the natural gas network.

Picture 6: What is made from biodegradable wastes?

Compost / fertilizer	Energy
	

3.7. Construction and demolition wastes

Construction and demolition wastes are a mixture of various materials not suitable for recycling. If these wastes should be used for recycling, it is necessary to separate hazardous wastes from non-hazardous wastes. Hazardous wastes are mainly asbestos elements (insulations, roofs), sometimes lead waterpipes. When operating demolition, it is necessary to separate materials directly on the construction area.

Mainly concrete, tiles, bricks, metals and cables, packaging, dangerous materials, including packaging from paint materials, are separated. We only point out that it is dangerous for human health to remove insulation from cables by burning them in domestic conditions.

Asphalt recycling is used in the construction and reconstruction of roads, while asphalt milled from the same road that is being repaired is used directly on the construction site. If granulate from waste tyres is added to the asphalt, the road surface is more resistant to wear.

In developed countries the recycling of construction and demolition wastes is obligatory from legislation.

Picture 7: What is made from construction and demolition wastes?

<table>
<tr><td>Construction materials
  </td><td>Asphalt recycling
  </td></tr>
<tr><td>Recycled packaging wastes
  </td><td>Recycled metals
  </td></tr>
</table>

3.8. Hazardous wastes

Households generate a small amount of hazardous waste, consisting mainly of paint and varnish packaging, pesticides, mineral oils and other chemicals. These wastes do not belong in the container for mixed municipal waste, because they can cause environmental problems at the landfill.

Hazardous wastes are usually not recyclable, although some metal packaging (cans) can be recycled at ironworks.

3.9. Electrical and electronic wastes, end-of-life vehicles, waste batteries and accumulators

All three types of waste are important both in terms of their quantity and the share of hazardous components. Therefore, it is necessary to collect these wastes separately at the source and do not throw them into the container for mixed municipal waste.

All these wastes can be processed by the usual procedures used in waste processing (disassembly, sorting, crushing, separation in separators, subsequent recycling of the obtained materials). It is important to remove hazardous parts and materials before processing and process them separately.

After sorting, batteries and accumulators are processed by metallurgical processes. Pure metals (lead, cadmium, nickel, lithium) and other recycled materials are obtained (sodium sulphate, polypropylene).

Picture 8: What is made from waste batteries and accumulators?

Lead	Cadmium	Nickel
		

The main product of processing these wastes are various metals (steel, iron, copper, aluminium, lead, cadmium, lithium), but other wastes are also created for processing, which are more difficult to recycle and usually require more advanced recycling technologies.

Picture 9: What is made from waste electrical and electronic equipment?

Ferrous metals	Non-ferrous metals	Presious metals
		

Picture 10: What is made from end-of-life vehicles?

Ferrous metals	Insulation materials	Non-ferrous metals
		

3.10. Textile wastes

Textile wastes are formed by various natural or artificial materials. Textile wastes can be prepared for reuse (second-hand shopping, upcycling), recycled or used as an alternative fuel.

It is possible to recycle all types of textile waste - clothing, household and other textiles, carpets, production waste, waste from the processing of end-of-life vehicles, polyurethane foams, work gloves, etc. Not all materials are suitable for recycling into fibres, but most materials can be used for the production of insulating materials and materials for waterproofing measures.

When separately collected textile wastes should be prevented before pollution (e.g. packed in plastic bags). Polluted textiles cannot be reused, they can be only incinerated (used as a fuel).

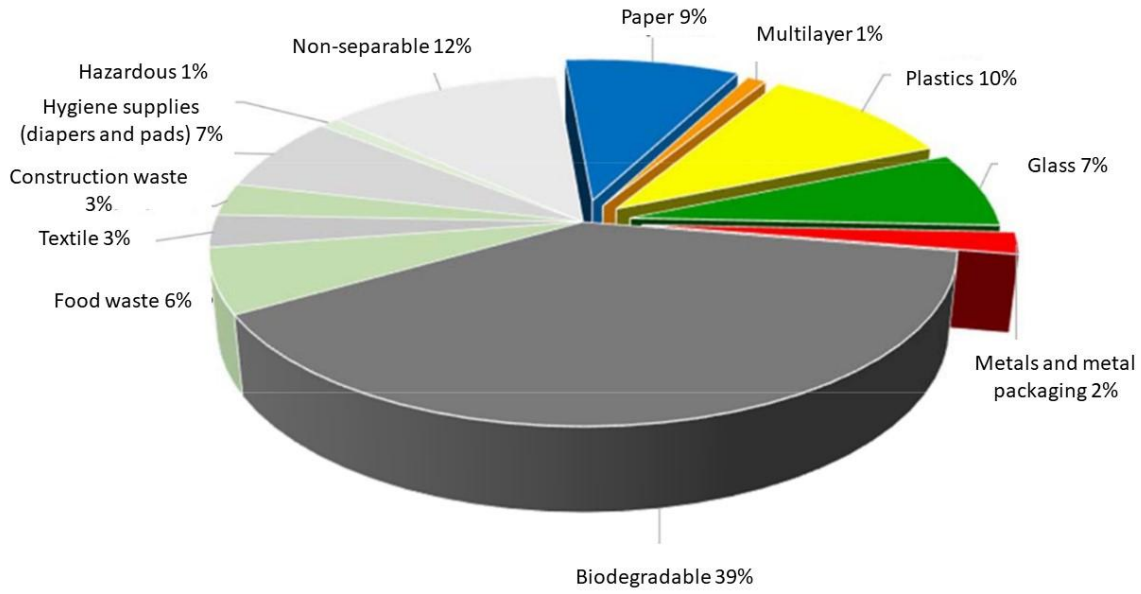
Picture 11: What is made from textile wastes?

New textile materials	Insulation materials	Alternative fuel
		

4. What are the options for the separate collection of municipal waste streams?

Every activity that is carried out with waste after it has been collected is financially costly. Many activities, especially sorting, must be done manually. This work is unpleasant, dirty and smelly. Some waste can also be sorted mechanically, but such technologies are expensive and energy-intensive. If recyclable waste, such as paper waste, is mixed with biodegradable waste, e.g. food scraps, the recyclable material is degraded and cannot be recycled. Therefore, it is important that wastes are not mixed and that they are separated and collected in separate containers as soon as they are generated.

The municipal waste is a mixture of several waste streams that are separable and recyclable. The analysis of municipal wastes from several Slovak municipalities in 2018 – 2019 show the average composition of mixed municipal waste (picture 12).

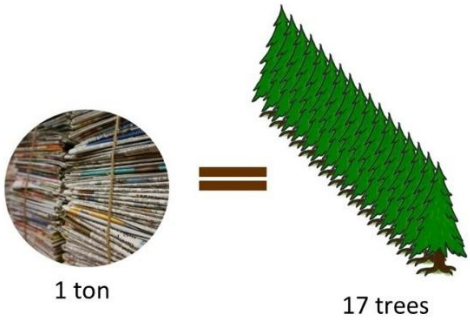


Picture 12: Composition of municipal wastes in over 100 municipalities in Slovakia in 2018 – 2019 (source: Envipak, www.envipak.sk)

By separate collection of waste, we return secondary raw materials back to the production process. Thanks to proper separation, we devastate the environment less by extracting raw materials.

One ton of waste paper saves 17 trees[3].

[3] Source of next pictures: several Producer Responsibility Organisations in Slovakia

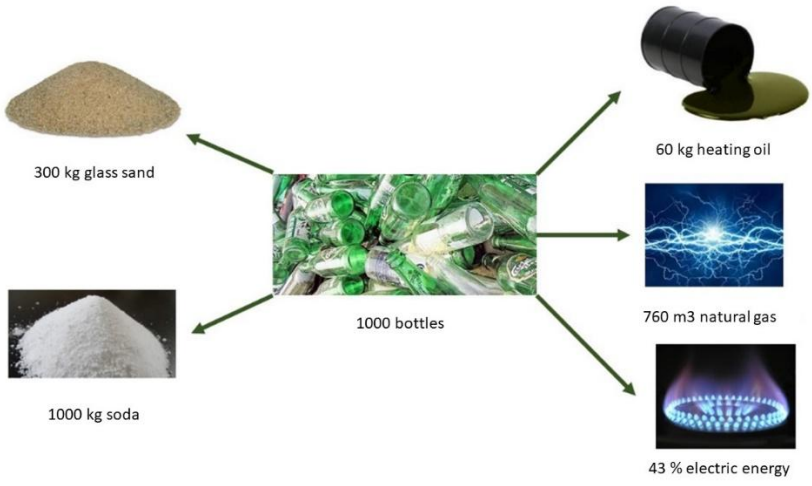


Picture 13: Saving primary raw materials in paper recycling

Plastics take 500 to 1000 years to decompose in nature. By recycling one plastic PET bottle, we save the energy that we would use when lighting with an LED bulb for 18 hours.

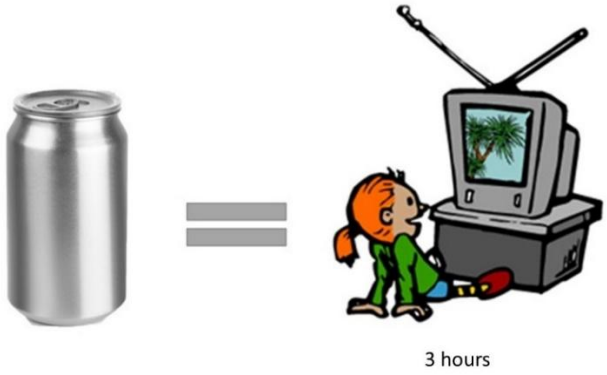
Picture 14: Saving primary raw materials in PET bottles recycling

The 1,000 pieces of glass bottles and glasses that we return to the glass factory save up to 300 kg of glass sand, 1,000 kg of soda, 60 kg of heating oil, 760 m³ of natural gas and 43% of electricity. Glass can be endlessly recycled without losing quality.



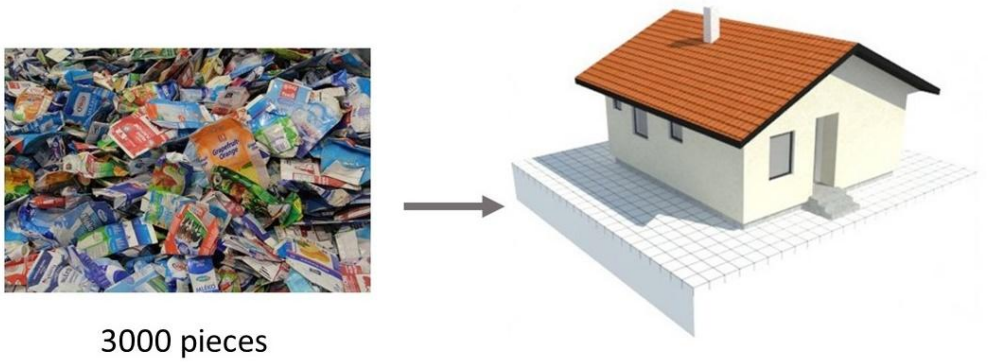
Picture 15: Saving primary raw materials in glass recycling

By recycling one aluminium can, energy equivalent to three hours of watching TV is saved. Metals can be recycled indefinitely; they do not lose their properties through recycling. When recycling aluminium, only 5% of energy is consumed compared to the production of aluminium from ore - bauxite.



Picture 16: Saving primary raw materials in metal cans recycling

Tetra Pak beverage packaging is made of a combination of three materials - 70% of the weight is paper, 25% plastic foil and 5% aluminium. Up to 9,000 tons of beverage packaging are sold annually in Slovakia. 3,000 pieces of multi-layer combined materials will be used to make building boards for one family house.



Picture 17: Saving primary raw materials in Tetra Pak recycling

4.1. Plastic, paper, metals, glass wastes

Waste from the materials paper/cardboard, plastics, glass and metals is generated in households primarily from packaging. It is estimated that packaging wastes make up more than 30% of all household waste.

For the separate collection of waste from packaging and other similar waste, it is possible to use both methods of separate waste collection - delivery and curb side.

Delivery method means, that residents bring their wastes to designated place where containers for separate waste collection are placed. Containers are available (not locked) and appropriately marked. Municipality provides for regular emptiness of containers to avoid mess around them. Advantages of this system are:

- simple logistic,
- easy availability of emptying of containers,
- lower shipping costs.

Disadvantages of this system are:

- anonymity,
- mess around the containers,
- low separate rate of waste,
- low quality of secondary materials leading to the necessity of next sorting steps before purchasing materials.

In delivery system bigger volume containers are used – 1100-litre containers (DIN EN 840) or bell containers with bottom discharge (fiberglass or plastic) with the volume of 1100 litres or 2150 litres)[4].

Picture 18: Most used containers for separate collection of municipal wastes

Recently, semi-underground containers have started to be used with the volume of 2000 – 5000 litres. Their advantage is:

- a large volume,
- the underground location prevents the formation of odours,
- people and animals not entering the container,
- low operational costs for emptying the container due to the small number of exports,
- no special vehicle is required, a vehicle with a hand is sufficient.

[4] Source of next pictures: several purchasers of containers in Slovakia

Disadvantage is high investment costs and a need of appropriate space for manipulation with containers (the need for an access road and handling area).

Picture 19: Semi-underground containers for separate collection of municipal wastes

With a delivery system, the delivery distance is important. The larger it is, the less willing residents are to carry their garbage to containers. Observations show that the optimal delivery distance is within 100 meters of the residence.

A curb side system is based on the principle of proximity of the service. In this system, there is zero delivery distance, so residents do not have to carry their garbage anywhere, they just place it near their home, and the municipality will ensure the removal of garbage from every street and from every house. This system can be used to store waste in plastic bags or in containers with a smaller volume.

Plastic bags of different colours are used for different separated waste streams, usually marked with the logo of the municipality or the waste company, with the volume about 120 litres. Bags are usually transparent which ensures high purity of the separated material (if there is waste in the bag that does not belong there, the waste company will not take away such a bag and leaves it for households to next separation).

At the specified time, the residents place the bags on the sidewalk in front of the house and the garbage company takes the bags away.

Picture 20: Plastic bags for separate collection of municipal wastes

Coloured containers are also often used, especially in apartment buildings. Containers can be of a volume of 120 litres, 240 litres or 1100 litres (DIN EN 840).

Picture 21: Most common containers for households for separate collection of municipal wastes

Containers are intended either for one household or for named households. These containers are placed either on the household's property (behind the fence) or in a designated place, usually fenced off, or locked and protected from access by strangers to avoid the mess around containers.

It is important that residents close the bags to prevent light waste (plastics, paper) from blowing around. With this system, the most important thing is to familiarize every household with the export calendar and to follow this calendar exactly so that the bags do not remain on the sidewalks for a long time.

Main advantages of this system are high quality of material, convenient service for residents. Disadvantage is huger operational costs connected with the transport of vehicles in every street.

Large-volume containers can also be used for separate collection. It is not recommended to place these in accessible areas, because they would mostly be used to store all kinds of waste, including bulky waste (construction waste, furniture). Large-volume containers are suitable for **collection yards** (fenced with staff). In collection yards several types of containers can be placed depending on the possibilities of waste company and availability of suitable vehicles.

Bulk containers can be open or closed. Closed containers are recommended mainly for absorbent waste, especially paper and cardboard, as well as for light wastes (plastics) which can be easily blown away by the wind. Open containers can be used for glass or metal wastes.

Picture 22: Large-volume containers for separate collection of municipal wastes

In all systems, it is necessary to ensure sufficient awareness of residents and regular emptying of containers. It is very important to ensure that residents see that the waste they separate is taken for recycling separately, not together with other waste, because they need to see with their own eyes that separation makes sense and is a good thing.

In order to ensure the appropriate quality of the separated material intended for recycling, it is necessary to ensure that residents are informed about which wastes to put in the container. The following are examples of the requirements of recycling companies for the cleanliness of separated collection.

The example of container for paper / cardboard in blue colour:

The blue container contains:	The blue container does not contain:
✓ newspaper ✓ magazines ✓ advertising leaflets ✓ boxes ✓ cardboard ✓ paper / cardboard packaging ✓ paper bags ✓ copy paper ✓ shredded paper	× books × greasy paper × asphalt or tar paper × used diapers × aluminium foil × multilayer material × carbon paper × wax paper

The example of container for plastics in yellow colour:

The yellow container contains:	The yellow container does not contain:
	
✓ uncontaminated compressed or trampled PET bottles ✓ plastic bags ✓ packaging foils ✓ packaging polystyrene ✓ jars of yogurts ✓ covers for CDs and DVDs ✓ empty containers from laundry and cleaning products ✓ cosmetic packaging ✓ empty plastic vials	× greasy packaging with food residues × floor coverings, × PVC pipes × packaging made of hazardous substances (chemicals, pesticides) × used hygiene items × rubber × multi-layer material × polyurethanes × used menu boxes (food packaging)

The example of container for glass in green colour:

The green container contains:	The green container does not contain:
	
✓ non-returnable packaging for drinks ✓ jam jars ✓ glass containers ✓ plate glass (without frames) ✓ empty vials ✓ glass shards	× dirty glass (with remnants of contents) × porcelain × ceramics × wire glass × mirrors × technical glass, cooking glass × auto glass, safety glass × light bulbs × plexiglass × TV screens × gilded and plated glass × art glass

The example of container for metals in red colour:

The red container contains:	The red container does not contain:
	
✓ beverage cans ✓ tins ✓ aluminium tubes from cosmetics ✓ aluminium foils ✓ top aluminium foils from dairy products ✓ empty tea candles ✓ small metal scrap ✓ other metal wastes (cables, iron tools…)	× dirty packaging × large objects × sharp objects × other materials × combined materials

4.2. Biodegradable wastes

Biodegradable wastes form up to 50% of municipal waste. Most of this waste is green waste from gardens. Green waste consists of grass clippings, branches, leaves, weeds, unused garden products, flowers that have bloomed, etc. In rural areas, various residues from livestock farming (manure) are often added.

In the case of biodegradable waste, it is most suitable to separate them directly at the source, i.e. already in households. This will prevent the pollution of recyclable waste and at the same time obtain clean raw material for further processing of this waste. Sorting and re-sorting of biodegradable waste are problematic from the point of view of hygiene and cost.

The simplest and cheapest solution is to store biodegradable household waste in separate containers (buckets, containers). In family houses with a garden, these wastes can be composted in home composters[5] and the resulting compost can be used to fertilize the garden, lawn, trees or flower beds.

[5] Source of pictures: several purchasers of containers in Slovakia

Picture 23: Several types of home composters

In apartment buildings that do not have land suitable for composting, biodegradable waste can be placed in separate containers, usually brown, which are emptying by municipality and composting in municipal/business composting plant.

Picture 24: Two most commonly used containers for households for separate collection of biodegradable wastes

Waste from brown containers is taken away directly for recovery by biochemical processes, therefore it is necessary that this waste does not contain other substances, especially plastics (plastic bags), dangerous substances (e.g. used batteries, oils...), because these will prevent waste processing.

The brown container contains:	The brown container does not contain:
✓ flowers ✓ wooden chips ✓ sawdust ✓ mowed grass	× meat × bones × other animal waste (eggs) × milk products

✓ small pieces of branches ✓ leaves ✓ waste vegetables and fruits ✓ weeds ✓ egg screws	× meat products × residues of food (soups, sauces…)

Home composting especially in rural areas is the most appropriate way of biodegradable waste management, because it does not incur costs for the municipality, does not cause problems with odours and insects, and the household produces its own high-quality fertilizer.

Even though animal waste such as meat or bones are assumed as biodegradable waste, it is not advisable to put it in brown containers or in a home compost bin, because in larger quantities they can deteriorate the quality of the resulting compost and attract rodents and flies, which is undesirable near homes.

Biodegradable waste is created not only in households, but also when taking care of public greenery in parks, lawns, cemeteries. This waste must also be taken away separately and not mixed with other waste, so if there is a container intended for biodegradable waste at the cemetery, artificial wreaths or burnt candles must not be placed in it, because then the entire contents of the container would have to be deposited at the waste dump and not to the composting plant.

Fertilizer made from biodegradable waste is preferable to industrial fertilizers because it contains a high proportion of organic substances that are missing in our soils and need to be supplied in order to increase the fertility of the fields and prevent desertification (turning into infertile sandy soils).

4.3. Construction and demolition wastes

Construction waste is usually the most frequently dumped waste in nature. The reason is the lack of a collection system within the municipality. Construction waste is inert in terms of its impact on the environment, i.e. it usually does not decompose due to weather conditions, but causes other problems. The municipality should therefore ensure their collection.

Three methods of collecting construction waste have proven themselves:

- calendar collection, on the announced day, residents can bring their construction waste to the designated place, most often directly into the attached container, and in the evening the container is taken to the landfill, or

Picture 25: Calendar collection of construction wastes (picture: blog.sme.sk)

- collection in waste yards, where a special large-volume container is placed,

Picture 26: Collection of construction wastes in waste yard (Picture: Dnes24.sk)

- if necessary, the household can borrow a large-volume container for construction waste from the waste company and, based on the agreement, the company will take it away on the agreed date, this service is usually for a fee, the amount of which depends on the volume of the container and the number of days during which the household has it at its disposal.

Picture 27: Collection of construction wastes to borrowed container (Picture: TopByvanie.sk)

4.4. Hazardous wastes

Households also generate a small amount of hazardous waste. These are mainly packaging and unused residues of paints, solvents, glues, mineral oils, pesticides, etc. Since there is not a large amount of this waste, the calendar collection of hazardous waste has proven itself, i.e. on a pre-announced day, residents can bring hazardous waste to the designated place, or to the collection yard. The municipality will ensure the removal of these wastes on the same day, if possible, in order to prevent unauthorized persons (especially children) from accessing these wastes.

4.5. Electrical and electronic wastes, waste batteries and accumulators, end-of-life vehicles

Since electrical and electronic waste contains many rare secondary raw materials, mainly various metals, it is important that it does not end up in mixed communal waste, but is collected separately. When collecting, it should be taken into account that some electrical and electronic waste is considered hazardous.

The collection is most often carried out at collection yards, where the conditions are created (hard paving, roofing, sewered area of the collection yard, lockable areas).

Picture 28: Separate collection of electrical and electronic waste in waste yard (Picture: https://samosprava.detva.sk/?program=51&module_action__0__id_ci=472302)

Special containers for small and very small electrical and electronic waste distributed in the territory of the municipality are often used.

Picture 29: Special containers for small electrical and electronic wastes (Source: https://www.asekol.sk/zberna-siet/zberne-nadoby/)

In smaller villages, calendar collection is used, i.e. at a predetermined date, a vehicle is brought into which the residents of the municipality deposit their electrical waste, and then the vehicle is transported to a waste processing facility.

Picture 30: Calendar collection of electrical and electronic equipment (Picture: https://www.vysokanadkysucou.sk/sk/aktualne-dianie-v-obci/3816-zber-elektroodpadu-a-vymena-papiera-april-2020)

The take-back collection of electrical and electronic waste in stores is practical and convenient for customers. When buying a new product, the distributor is obliged to take the old appliance and hand it over to the electrical and electronic waste collection and processing system, i.e. either producer responsibility organisation or the electro-waste treatment facility.

Waste batteries and accumulators are collected into special boxes placed in every selling place, as well as in public buildings like authority buildings, schools, gas stations, pharmacies, etc. The owners of the boxes in Slovakia are producer responsibility organisations.

Picture 31: Several types of boxes for waste batteries and accumulators used in Slovakia (source: several PROs)

The collection of end-of-life vehicles is in a special mode with a connection to the police. If the owner needs to get rid of his car wreck, he is obliged to take it to a facility for the collection and/or treatment of car wrecks. The facilities are obliged to take over the car wreck free of charge and register its takeover in the central vehicle registration information system managed by the police. The police will delete the vehicle from the register only after the transfer of the car wreck to the relevant facility has been registered. In this way, environmentally appropriate disposal of end-of-life vehicles is ensured.

In the case that the owner of the car wreck does not hand it over to the relevant facility and the car wreck is located in a public space (on a sidewalk, road, parking lot), the municipality has the competence to declare such a vehicle as waste and have it taken away for treatment, while the owner of the vehicle bears all costs. The law establishes the exact conditions under which the municipality can declare a vehicle as waste.

4.6. Textile wastes

When collecting textile waste, it is important to ensure that the textile is not contaminated and can be reused, e.g. for charity or to second-hand shops. Therefore, textiles are usually collected in special containers protected against rain. It is recommended that residents place their textile wastes in the container in plastic bags.

Picture 32: Several types of containers for textile wastes (Source: several operators)

4.7. Mixed municipal waste

Mixed municipal waste is the waste that remains after separation of all the waste streams that we separate in the household. If it is separated honestly, very little mixed municipal waste is generated in the household, some households that behave responsibly create so little mixed municipal waste that they do not fill even one 120 litre container in a year.

In many municipalities, however, the conditions for the separate collection of all waste streams have not been created, so that some amount of mixed municipal waste will be generated.

Mixed municipal waste cannot be recycled, it is possible to produce heat from it if it is burned, but in there are not enough such facilities available, therefore nearly all mixed municipal waste is deposited in landfills / dumps, which represent a large environmental burden. It is very important to produce as little mixed municipal waste as possible and, if possible, to separate as much waste as possible in households.

Mixed municipal waste is stored in black or metal containers, usually with a volume of 120 litres and 1100 litres in the case of apartment buildings. We are all certainly familiar with the unpleasant smell that surrounds these containers, this is because they contain biodegradable wastes that have not been separated and start to decompose in the container. When containers contain biodegradable waste, they must be emptying frequently to prevent odours and insects or rodents. Frequent exports cause more movement of garbage trucks, air pollution from exhaust fumes, more diesel consumption and traffic congestion, which only worsens air pollution, noise and dust.

It is important to operate effective system of mixed municipal waste collection. It is recommended to prefer smaller 120-litre containers for every household or 1100-litre containers for apartment houses with appropriate frequency of emptying. It is reasonable if the containers are personified, i.e. marked with the name / address of the owner / person authorized to deposit waste. In this case, it is easier to set waste fees and control exports. In the case that households pay their waste fee for every emptying of the container, then the household is interested in reducing the amount of mixed municipal waste produced, maintaining cleanliness around containers and fencing/locking containers so that they cannot be used by other persons who do not pay for waste.

It is convenient if in mountain villages the containers are secured against the access of wild animals. It is possible:

- to close the containers in shelters,

Picture 33: Container shelter (Picture: odpady-portal.sk)

- to use special containers developed against wild animals or

Picture 34: Special anti-bear container (Picture: spis.korzar.sk – SME)

- to use underground or semi-underground containers.

Picture 35: Semi-underground containers in Chamonix, France (Picture: Chamonix.fr)

The amount of mixed municipal waste generated depends on the set system of separate collection. If a sufficient number of containers for separate collection is provided, then a smaller amount of mixed (non-recyclable) municipal waste is generated.

Picture 36: Insufficient number of containers for separate collection cause the production of a large amount of non-recyclable mixed municipal waste (Picture: https://www.odpady-portal.sk/)

Picture 37: The correct method of general waste management – sufficient number of coloured containers for separate collection also means a clean environment around rubbish bins (Picture: https://www.odpady-portal.sk/)

5. The role of the municipality

For the collection of municipal waste, the municipality is the most important institution on which all obligations lie. The task of the municipality is to create a municipal waste collection system that is efficient, economically sustainable and comfortable for residents.

Municipalities must first of all **design a waste collection system** and decide whether this system will also include separate collection. If the municipality introduces separate collection, it is necessary to decide which components of municipal waste will be separated. This decision mainly depends on whether the municipality will be able to hand over the separated waste for further processing. If the separated waste ends up in a landfill / landfill, then separation does not make economic or environmental sense.

It is necessary that before the implementation of the waste management system, the municipality has prepared contracts with waste recipients (landfill operator, if there is one, sorting and recycling facilities).

When implementing a suitable municipal waste collection system, the municipality must **decide which waste containers** will be used. This decision depends on the capabilities of the local waste collection company, mainly from the type of vehicles it has available. Determining the exact type of container is important from the point of view of the cost of waste collection; if the containers are uniform, then the collection routes of the vehicles can be made more efficient and fuel consumption can be saved.

When deciding on containers, the municipality must determine **who will finance the purchase of containers**. If the municipality has sufficient funds, it can buy containers from its budget, but we know from experience that if people get something for free, they do not value it and do not treat the containers carefully. In most cases, the municipality does not have enough funds available to purchase containers, so it is possible to establish an obligation in local legislation for households that sign up for waste collection to purchase the appropriate container. Often, the municipality buys a certain number of containers (usually with a favourable volume discount) and then sells them to households. A cheaper alternative is plastic bags.

If the municipality introduces a separate collection of municipal waste, it is more appropriate to start with containers. These mainly have an educational role, residents will gradually learn to separate, and subsequently it is possible to introduce bag collection, which is more materially efficient.

One of the most important parts of municipal waste management is the establishment of **local fees** for waste. The fee must be motivational, it must not be flat-rate, i.e. the same for everyone, but it must reflect the impact of the amount of separated waste on the amount of the fee. For example, if a household proves that it composts all its biodegradable waste in a home composter, it can get a discount on the fee.

It is important to ensure that the vast majority (more than 90%) of households **pay local fee** for waste removal, so that the municipality has sufficient funds to ensure waste management in the municipality. This can be achieved in several ways, but **none of them are popular**. The municipality can fine households that have not paid the fee. The municipality can refuse the export of waste from

households that have not paid the fee, if the household disposes of waste in violation of the law, the municipality can subsequently fine it. The obligation to pay the fee for waste can be linked to other services provided by the municipality, for example, if the household has not paid the fee for waste, it cannot apply for an allowance for a pupil of the local school or for the provision of social services.

Last but not least, the municipality must ensure **awareness raising** among residents. Residents must be informed in detail not only about the waste management system in the municipality, but also about the importance of waste collection and the impact of waste on the environment. Information campaigns are one of the most important tasks of the municipality, if citizens do not know what, how and why they should separate, then even the best-established separate collection system will not fulfil its function.

5.1. Awareness raising activities

Information campaigns are crucial for the separate collection of municipal waste. Without them, results in the amount of separated waste will not be achieved.

When introducing sorted collection, it is necessary to implement a massive information campaign. Its goal is to inform the residents of the village:

- with a separate collection system,
- with the impact of waste on the environment and human health,
- with the potential of waste as a source of secondary raw materials and the possibilities of using waste,
- with a system of financing separate collection,
- with practical instructions for separate individual waste streams of municipal waste.

The target group of information campaigns are:

- households,
- pupils in schools,
- teachers in school,
- local small business companies (small shops, services, administrative companies).

The following forms of information campaigns are suitable for raising the awareness of residents at the local level:

1. Individual specialized training and similar activities,
2. Publication of methodological teaching texts,
3. Publication of a manual for waste producers as well as plastic producers / importers
4. Elaboration and distribution of leaflets and information materials,
5. Providing information via the Internet, including social networks and influencers,
6. Other activities.

5.1.1. Trainings for state authorities

Target groups:

- Local authorities, local administration employees

Content of trainings:

In training for the local administration, it is necessary to focus attention on existing and prepared national and local legislation in the field of prevention and environmental sound management of municipal waste.

5.1.2. Trainings for stakeholders

Target groups:

- Local waste companies
- Waste producers (small business entities)

Content of trainings:

These trainings will be aimed at fulfilling the legal obligations of individual target groups, with an emphasis on the necessity of prevention and separate collection of municipal waste. In the case of the target group waste producers, the trainings will also focus on the issue of financing the separate collection and recovery of municipal waste.

5.1.3. Trainings of a preventive and educational nature

Target groups:

- Teacher of environmental education in basic and secondary schools

Content of trainings:

These trainings are aimed more generally at protecting the environment and people's health from the negative effects of waste, with a focus on municipal waste. It is useful to introduce other information materials (in written form, introduce information published in web pages etc.).

5.1.4. Publication of methodical teaching texts

To support environmental education in schools, it will be useful to publish methodological texts that will help teachers in educating pupils/students to behave in an environmentally appropriate manner in the field of waste. Texts can have a broader scope focusing on waste in general with one section dealing with the issue of municipal waste.

Target groups:

- Teachers of environmental sciences at schools

Content of teaching texts:

The texts should contain general information about environmental protection and the main focus on the issue of waste (definitions, examples, distribution of waste, separate collection, recovery and recycling, inappropriate waste management). One part should be focused specifically on municipal

waste, its impact on the environment. A separate chapter should be devoted to the issue of prevention, reducing the use of packaging, especially single-use plastic products. The materials shall be gender sensitive, placing focus on gender-specific adverse impacts upon the women, children from unsound waste management practices.

5.1.5. Publication of a professional manual for waste producers as well as plastic producers / importers

It is advisable to prepare manuals for waste producers, as well as waste producers, with information on their legal obligations in the field of waste.

Target groups:

- Waste producers,
- Plastic producers

Content of manual:

The manuals should contain a list of current obligations arising from the Waste Act as well as from the relevant secondary legislation, including recording and reporting obligations and an explanation of the form and method of filling out the relevant forms.

5.1.6. Elaboration of infographics, publication of leaflets and information materials

This form of communication is suitable for the general public, because it can provide a lot of necessary and precisely targeted information in an interesting graphic form in a small space. It is also suitable for less educated classes of the population.

Target groups:

- Households,
- School teachers and pupils,
- Municipalities and local public administration.

Content of materials:

Leaflets or other brief informational materials (e.g. brochures) contain simple information about the separate collection of waste, about the prevention of the production of waste, or about the negative impact of waste on the environment if it is deposited in dumps. They mainly contain many images or photographs; full colour printing is recommended.

5.1.7. Providing information via the Internet, including social networks and influencers

The Internet is currently a space for the most effective advertising and marketing, which can also be used in the case of educating the general public about environmental protection. It is possible to use all forms and possibilities of the Internet, including paid advertising, use of the YouTube platform, social networks or cooperation with selected influencers.

Target groups:

- Public,
- Waste producers,
- Plastic producers,
- Multiplicators.

Content of presentations:

The content depends on the form used, but it is possible to focus it on the needs of individual target groups.

5.1.8. Other activities

It is also possible to implement other activities that will help raise awareness of environmentally appropriate waste management. One of them can be the organization of **press conferences**, to which professional journalists dealing with the issue of waste management and environmental protection will be invited. They will inform the general public through their media.

Another possibility is the issuing of **press releases** through press offices or the publication of articles on the given issue in selected newspapers that have been devoted to the issue of waste management for a long time.

Television shows that deal with the issue of environmental protection can be devoted to the issue, as well as specialized **radio shows** can be prepared.

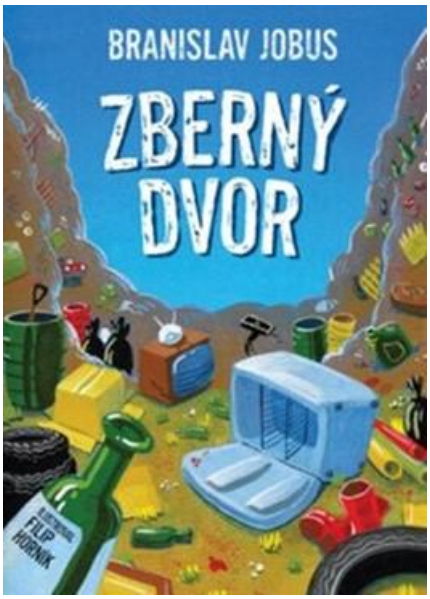
A relatively successful way of informing the public is the use of **large-scale advertising billboards**, which is, however, financially demanding.

5.1.9. Examples of successful information campaigns in Slovakia

For target group school children and public in general materials with many pictures and infographics are suitable. Video is also a tool which helps children to understand the theme.

It is possible to mention other activities that were created for this target group in the Slovak Republic:

- book for small children (B. Jobus: Zberný dvor – Waste collection yard) in the cooperation with PRO Natur-pack, a. s.



Picture 38: Book for children B. Jobus: Waste yard (Source: martinus.sk)

- educational projects for primary school teachers organised by Slovak Environment Agency (https://www.sazp.sk/zivotne-prostredie/environmentalna-vychova-a-vzdelavanie)
- professional publications for primary school teachers published by Slovak Environment Agency (https://www.sazp.sk/zivotne-prostredie/environmentalna-vychova-a-vzdelavanie/ponuka-vydanych-publikacii)
- environmental programs for schools prepared in the Environmental Centre Dropie (https://dropie.sazp.sk/sk/programy)
- theatre performance about separate collection of wastes (https://www.odpady-portal.sk/Dokument/107094/interaktivne-divadelno---hudobne-predstavenie-ucilo-deti-ako-triedit-odpad.aspx)

Picture 39: Educational project International Children´s Music Theatre (Photo: ENVI-PAK)

- ecology puppet show Morgonrock: Lovec plastov Zero Waste (Plastics hunter) (https://novacvernovka.eu/program/divadlo-morgonrock-lovec-plastov-zero-waste-5)

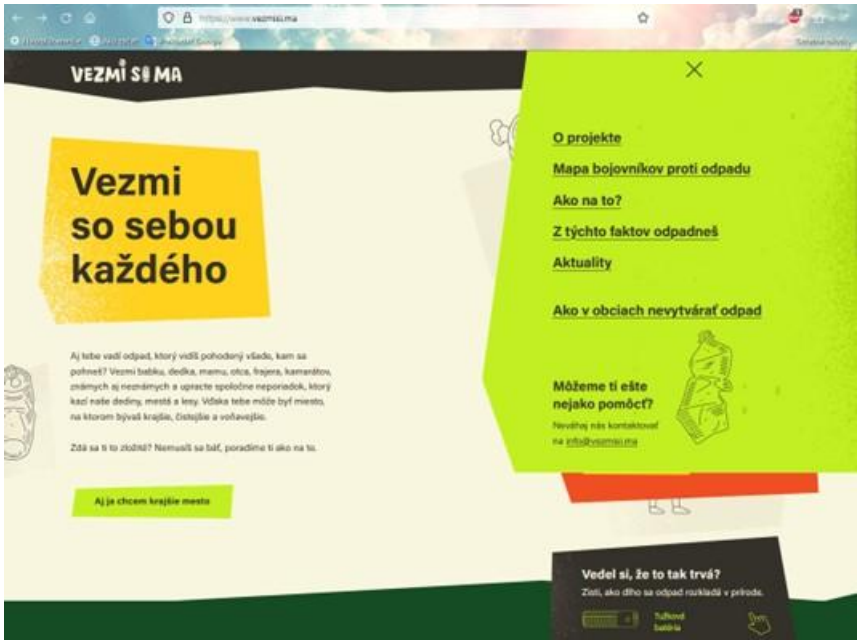
Picture 40: Puppet show Morgonrock: Plastics hunter (Photo: Nová Cvernovka)

In Slovakia, PROs provide the most information campaigns for households/communities in the area of support for the separate collection of plastic waste. Most popular campaigns:

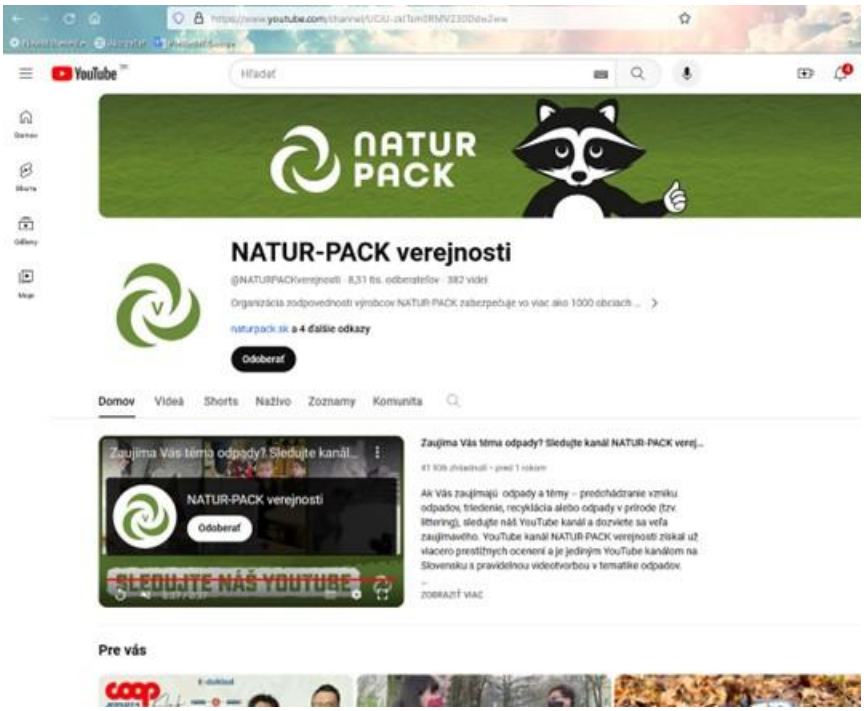
- PRO ENVI-PAK – distribution of information leaflets to households

- special web page on separate collection of municipal wastes http://www.triedime.sk/ operated by PRO ENVI-PAK

- special webpage for municipalities operated by PRO ENVI-PAK https://www.vezmisi.ma/



- special youtube channel on separate collection of municipal wastes operated by PRO Natur-pack, a.s.



- cooperation with popular personalities of Slovak culture (e.g. Vincent Vince – popular Slovak TV moderator and youtuber) https://www.youtube.com/watch?v=JPT8WLx5U38

6. List of pictures