

# Recyclability of separate collected municipal solid waste fractions: a case study for Kaunas, Lithuania

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## Introduction

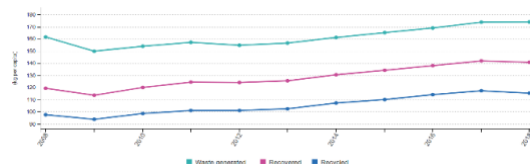
Municipal waste accounts for about 10 % of the total waste generated than the data reported according to the Waste Statistics Regulation (tab env\_wasgen). For 2019, municipal waste generation totals vary considerably, 472 kg in Lithuania. (Table 1)



*Fig.1. Municipal waste generated, 2005 and 2019; Source: Eurostat (online data code: env\_wasmun)*

**Figure 1** shows the amount of municipal waste treated in the European Union (EU) from 1995 to 2019 by treatment method, in a million tonnes and kg per capita.

Based on the literature, the landfilling rate in the EU dropped from 61 % in 1995 to 23 % in 2019. This reduction can partly be attributed to European legislation implementation, for instance, Directive 62/1994 on packaging and packaging waste. The European Commission adopted an ambitious Circular Economic Package, which includes revised legislative proposals on waste with a higher common target for recycling municipal and packaging waste and lower limits for landfill of municipal waste. According to the recent statistics on packaging waste in the 27 European Union (EU), the Member States, and some non-member countries, in 2018, packaging waste generated was estimated at 174 kg per inhabitant in the EU (varying from 80 to 128 kg per inhabitant in Lithuania, 2008-2018). From 2008 to 2018, paper and cardboard were the primary packaging waste material in the EU, followed by plastic and glass (**fig. 2**).



*Fig. 2. Packaging waste generated, recovered, and recycled, EU-27, 2008-2018; Source: Eurostat (online data code: env\_waspac)*

In the EU, the recycling rate for packaging waste increased from 60.4 % in 2008 to 66.3 % in 2018. The recovery rate, including incineration at waste incineration plants with energy recovery, rose from 73.8 % in 2008 to 80.9 % in 2018.

Modern packaging made our life more comfortable. These packaging materials are used in everyday life: medicine, take-out food, longer shelf-life products, snacks, frozen foods, and more. Materials used for polymer packaging are various: PET, LDPE, HDPE, PP, PS. Also, you can find paper, metal, and multilayer composite packaging. Unfortunately, such convenience has come at an environmental price.

## Material and methods

Material for a case study was collected in Kaunas waste management company “Kauno švara”. Packaging wastes come from private households. A group of students sorted 206,35kg a randomly picked pile of packaging waste. Firstly, waste was sorted by different materials based on markings on packaging by international standards. Secondly, every group was assigned to one of five groups: currently recyclable, can be recycled in not local companies, possible to recycle, recycle possibilities are under investigation, non-recyclable.

## Results and discussion

The waste mixture consisted of 15.99% paper and board, 42.72% plastics and composites, 11.73% metal, 4.85% glass, and 7.75% textiles (**fig. 3**)

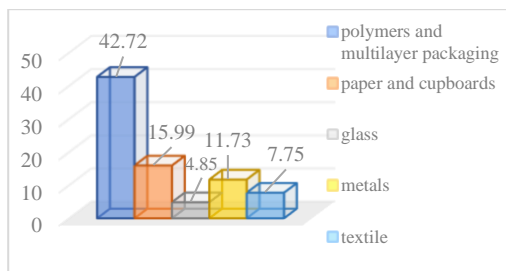


Fig. 3 Distribution of packaging waste mixture, %

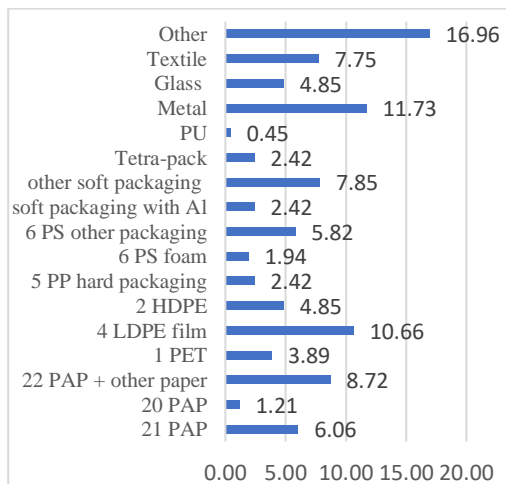


Fig. 4 Packaging mixture morphological composition percentage collected in private households in Kaunas, Lithuania. Number in the name means packaging identification number by International Resin coding system.

As you can see in figure 4, packaging waste contains various types of materials. The most popular polymer used in this type of packaging is low-density polyethylene (LDPE). Other polymers used in packaging are high-density polyethylene (HDPE), polystyrene foam, and another type of packaging (PS), polyethylene terephthalate (PET). Only 0,45% of the packaging was made from polyurethanes (PU). Another popular packaging waste is paper (22 PAP). Uncorrugated cardboard (21 PAP) is the second favourite cellulose-based packaging. Corrugated cardboard (20 PAP) is the least used as packaging material. Other materials (16,96%) did not belong in packaging containers among packaging waste.

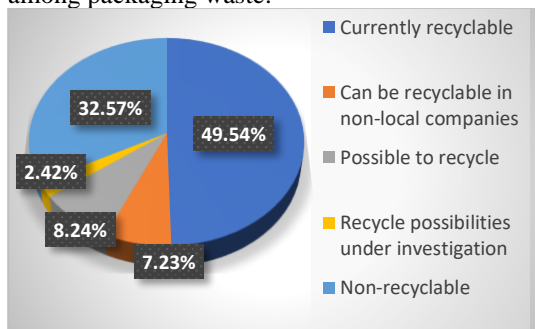


Fig. 5 Recyclability of packaging waste mixture, %.

As mentioned earlier, all waste was divided into five groups according to the possibilities for recycling. Only 49.54% of packaging waste,

including all paper, PET, LDPE film, HDPE packaging, tetra-packs, and all-metal, is currently recyclable. 32.57% of the studied waste is unsuitable for recycling (another soft packaging, textile, others), suitable only for incineration. The rest of the waste can be recycled elsewhere (PS foam, PU, glass), recycling options are under investigation (soft packaging with aluminum) or could be recycled with additional equipment (PP rigid packaging, PS another packaging). See figure 5.

## Conclusions

The study has shown that according to the obtained result studied from Lithuanian municipal waste, it is possible to recycle about 65,01% of waste. Non-recyclable wastes are incinerated. 2,42% of waste, whose recycling possibilities are under investigation, and this type of waste become actual in the last few years, they are currently incinerated. In addition to developing a recycling method for this waste is a favourable way to save natural resources, because based on several studies, recovered materials from waste can be used as a secondary raw material in a different production.

## References

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