Anna HAŁADYJ[1]

The Separate Collection of Biodegradable Waste: The Case of Poland[2]

Abstract

This article presents the principles of collecting biodegradable kitchen waste, including its storage and processing conditions. In Poland, bio-waste is classified as a selectively collected municipal waste fraction, which includes selectively collected bio-waste from hotels, restaurants and cafes (the HORECA sector). The legislator also classifies green waste generated on individual properties, as well as in cemeteries, parks etc., as bio-waste.

In Poland, bio-waste can be composted at source (but only in single-family housing), and is collected according to the rules set out in municipal resolutions, which define the frequency and method of collection (bags/containers) with considerable variation. Municipal resolutions also introduce the possibility of fee reduction for composting at source, as an economic incentive, and penalties as a sanctioning mechanism. The article also presents examples of good practices in this area, including pilot projects. The main challenge for Poland is awareness-raising due to the still insufficient public knowledge on waste segregation, including the separation of bio-waste fractions and their further proper processing in mechanical biological treatment installations and composting 'at source'.

Keywords: Biodegradable Waste, Communal Waste, Environmental Law, Fees And Penalties For Mixed Waste Collection, Composting At Source

1 | Associate Professor, Ph.D., John Paul II Catholic University of Lublin, Chair of Public Commercial Law, Faculty of Law, Canon Law and Administration, Poland; ORCID: https://orcid.org/0000-0002-8827-3657; e-mail: anna.haladyj@kul.pl

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1. Introduction

1.1. The legal framework of the municipal waste management system

According to Barczak,[3] municipal waste management requires a highly complex waste management system, including an efficient collection system, an effective sorting system and proper tracking of waste streams, the active involvement of citizens and businesses, infrastructure tailored to the specific composition of the waste, and a comprehensive financing system. Under the Polish legal system, municipal waste, including bio-waste, is mainly regulated by two acts. In its general scope (definitions, permitting and transport rules, liability etc.), it is subject to the Waste Act of 14 December 2012.[4] In specific matters, municipal waste is regulated by the Act of 13 September 1996 on Maintaining Cleanliness and Order in Municipalities.[5] The latter defines the obligations of municipalities in the field of municipal waste management as their tasks,[6] including, among other things, stipulating that detailed rules for municipal waste collection, the frequency of such collection, fee rates, and exemption rules are determined by resolutions of the municipal council (for each municipality separately). This means that – considering the most general regulation – the manner of municipal waste management, including the bio-waste fraction, may vary on a local basis (there are more than 2,500 municipalities in Poland); hence, the text contains some generalizations on this issue.

According to the joint definition (Art. 3(1)(1) of the Waste Act), whenever the law refers to bio-waste, it means biodegradable waste from gardens and parks, food and kitchen waste from households, catering, including restaurants, canteens and mass catering establishments, offices, wholesalers and retail units, as well as similar waste from establishments producing or marketing food. This definition corresponds to the wording in Art. 3(4) of the Waste Framework Directive (bio-waste means biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesalers, canteens, mass catering and retail establishments, and comparable waste from food processing plants). At the same time, bio-waste is a fraction of municipal waste, which justifies its further legal regulation in the content of the Act on Maintaining Cleanliness, although it also indicates that the definition of municipal waste is not autonomous.[7]

Bio-waste has additionally been classified as a group of biodegradable waste,[8] by which is meant waste that undergoes aerobic or anaerobic decomposition with

3 | Barczak 2023, 266.
4 | Journal of Laws consolidated text 2023, item 1587, as amended.
5 | Journal of Laws consolidated text 2024, item 399.
6 | Korzeniowski 2014, 442.
7 | Barczak and Ogonowska 2018, 9.
8 | Danecka and Radecki 2023, 89.

the participation of microorganisms (Art. 3(1)(10) of the Act on Maintaining Cleanliness). At the same time, according to the wording of Art. 1b para. 1 of the Act on Maintaining Cleanliness, the provisions on the handling of municipal waste constituted of parts of plants from the care of green areas or cemeteries, as well as from marketplaces, apply to the handling of bio-waste constituting municipal waste what Górski critically analyses in detail.[9] Górski[10] also stresses that it is problematic to separate in municipal waste bio-waste from other waste generators, which due to their nature or composition are similar to the waste generated by households. The classification of this waste as municipal waste allows it to be included in the municipal waste management systems. The main guideline should be a direct connection to the satisfaction of the living (subsistence) needs of individuals, which means waste that is identical in composition, nature, as well as quantity, to household waste. According to Górski, the mere inclusion in this definition of waste from food production or marketing facilities cannot result in its automatic inclusion in the category of municipal waste as waste similar to household waste; this does not seem to have been the legislator's goal. Rather, the goal was to emphasise the nature of such waste and, thus, to link it to a specific treatment characteristic of biodegradable waste. This is due to the fact that the definition of "bio-waste" was transferred to the Waste Act from the Waste Framework Directive. The latter justifies the introduction of the concept of bio-waste in the preamble by the need to ensure a special way of managing it, which is also reflected by introducing certain obligations. However, the directive is not about treating all bio-waste as municipal waste. Therefore, there is no basis for including waste classified under codes from the 02 groups or code 16 03 80 (out-of-date or unusable food products) among the waste collected in municipal waste management systems. However, this does not change the fact that these categories of waste will be subject to management in the manner required just for bio-waste.

Due to the statistical data used in the study, which do not make such a distinction, I consider the total group of bio-waste, that is, from households and other sources, if in condition and composition they are similar to household waste.

1.2. Obligation to segregate municipal waste into fractions

The above-quoted definition of bio-waste was introduced into the national legal order by an amendment to the Waste Act of 17 November 2021.[11] Prior to that date, the definition did not include waste from restaurants, office cafeterias, and wholesalers, which also affected the data collected on waste reporting on the amount of municipal waste generated, including bio-waste. Nonetheless, as of July

9 | See more Górski 2024, 67–88.
10 | Górski 2021, 31.
11 | Act of 17 November 2021 on amendments to the Law on Waste and certain other laws, Journal of Laws 2021, item 2151.

2017,[12] regulations were already in effect in Poland, requiring waste to be segregated into five fractions, including "biodegradable waste, with a special emphasis on bio-waste".

Currently, regardless of the local differences in the details of the waste collection and management system,[13] a system of municipal waste segregation into five fractions is in force, including a fraction: bio-waste on the basis of the Decree of the Minister of Climate and Environment of 10 May 2021 on the method of selective collection of selected waste fractions.[14]

In accordance with the will of the legislator, as set forth in Art. 6r(2d) of the Act on Maintaining Cleanliness, in return for the fee for municipal waste management, the municipality ensures that property owners dispose of all types of municipal waste,[15] some of which must be collected directly from the property, some of which must be accepted at selective waste collection points (SWCP, called PSZOK), and some in other ways. However, in the municipal resolution, the law allows (Art. 6r. para. 3a of the Act on Maintaining Cleanliness) a limitation of the implementation of this obligation to, among other things, "waste constituting parts of plants from the care of green areas, gardens, parks and cemeteries, constituting municipal waste". The restriction also applies to the amount of bio-waste from non-residential properties where food service activities are conducted (including restaurants, canteens and mass catering establishments, wholesalers, retail units, as well as similar waste from establishments producing or marketing food). In the resolution, the municipality specifies the types of activities carried out on non-residential properties affected by the restriction.[16]

Municipal councils also have influence over determining how bio-waste that constitutes municipal waste will be collected (frequency of collection), determining how it is to be collected on the property (containers or bags), and introducing a system of incentives for composting from bio-waste on the property (exemption from part of the fee for waste collection and management).

In general, communal waste must be collected in four containers of different colours: glass packaging (green), paper including cardboard (blue), biodegradable waste (bio-waste) (brown), and metals together with plastic (yellow). Mixed waste (fifth one) is collected in black containers. According to the guidelines set by the Ministry of the Environment, the bio-waste fraction can include tree and shrub branches; leaves, flowers, and cut grass; sawdust and tree bark; fruits, vegetables etc. The following cannot go into it: animal bones, meat and animal carcasses, edible oil, treated wood, particleboard and medium-density fibreboard, medicines,

12 | Ordinance of the Minister of 29 December 2016 on the detailed method of selective collection of selected waste fractions, Journal of Laws 2019, item 2028.
13 | Voluntary separation of the ash fraction is also possible.
14 | Journal of Laws 2021, item 906.
15 | Budziarek 2021, 284.
16 | Modrzejewski 2022, 73.

animal excrement, coal ash[17] other municipal waste (including hazardous waste). Local information is more precise (and up-to-date, the range of segregation of bio fraction indicated above from the website of the Ministry of Climate and Environment was published in 2020!) and indicates, for example, that the bio-waste fraction can also include: vegetable and fruit waste, food scraps, coffee and tea grounds, eggshells[18]. Significantly, such waste can be disposed of in plastic bags and will be separated at the waste sorting facility.

1.3. Principles of selective collection in the household

There are fundamental differences between the collection of municipal waste from multi-apartment buildings and single-family houses regarding the method and frequency of collection.

In multi-family developments, the predominant organisation of the municipal waste collection site is the trash shed, which contains containers marked with five colours, allowing the division into fractions of waste from the household. They can be aboveground or underground, take the shape of a bucket or a bell, with the rare modernity of a mesh garbage can (for film and metal waste). The regulations specify minimum requirements for the distance of the garbage shed from the boundaries of the plot and buildings, as well as the need for containers to have a lockable lid if the waste is not stored under a roof.

For single-family houses, waste can be collected in bins or buckets and bags. The cost of acquiring bins can be on the side of the waste producer (the municipality/company offers them for sale). In this case, the containers are owned by the household. Containers can also be substituted by the municipality/enterprise and leased to the property owner. In some municipalities, for the collection of waste of the yellow fraction (metal and plastics), glass, paper are packed the in bags provided by the waste collector. Similarly, bio-waste might be collected in bags or bins/containers. This means that bio-waste processing facilities must be prepared to open the bags.

Waste is collected at different frequencies, depending on the type of property. It is permissible to vary the frequency of waste collection, especially depending on the amount of waste generated and the types of waste, except that, in the period from April to October, the frequency of collection of non-segregated (mixed) municipal waste and bio-waste constituting municipal waste may not be less than once a week for multi-family buildings and not less than once every two weeks for single-family residential buildings, excluding rural municipalities and the rural part of urban–rural municipalities, where the frequency of collection of non-segregated (mixed) municipal waste and bio-waste constituting municipal waste

17 | Ministry of Climate and Environment 2020.
18 | Lublin 2019.

may be less frequent. The frequency of municipal waste collection from property owners determined by the municipal council is subject to the opinion of the state district sanitary inspector to avoid health risks.[19] However, for non-residential properties (e.g. offices, school offices), the municipal council may introduce the possibility of indicating in the declaration the frequency of municipal waste collection of particular fractions. Still, from April to October the frequency of collection of non-segregated (mixed) municipal waste and bio-waste constituting municipal waste may not be less frequent than once every 2 weeks.

1.4. The structure of waste management in Poland

In 2018, the first year in which data were collected at the municipal level on the volume of municipal waste by fraction, including bio-waste, the largest share of municipal waste was waste with code 20 03 01 – non-segregated (mixed) municipal waste, which accounted for 66.5% of collected municipal waste. In addition, 13.3% was represented by subgroup 15 01 – packaging waste, 7.8% by subgroup 20 01 – municipal waste segregated and selectively collected, 7.1% by subgroup 20 02 – waste from gardens and parks (including cemeteries), and 5.3% by 20 03 – other municipal waste (with excluding code 20 03 01). The above mentioned 7.1% of bio-waste (codes 20 01 08, 20 02 01) amounted to a total of 1,022.4 thousand tonnes.[20]

By contrast, in 2023, 122.8 million tonnes of waste were generated in Poland, 11% of which was municipal waste (13.4 million tonnes). Of this amount, as much as 37% of biodegradable waste was collected through separate collection in 2023.[21]

The assumptions regarding the amount of bio-waste for the coming years are set forth in Resolution No. 96 of the Council of Ministers of 12 June 2023 on the National Waste Management Plan 2028.[22] The national strategy is supplemented by regional strategies, for individual (16) provinces. According to Barczak,[23] the so-called Provincial Waste Management Plans are key documents that define the waste management strategy for Poland's individual provinces. A provincial plan deals with waste generated in the area for which it is prepared, as well as waste imported into the area, including municipal waste, biodegradable waste, packaging waste, and hazardous waste also covering waste prevention measures. According to Art. 37 of the Waste Law, these plans are updated at least every six years. Under the current state of the law, some provinces have already adopted updates until 2028 and beyond. When it comes to municipal waste, the regional and national plans are prepared based on the Guidelines for

19 | Budziarek 2021, 285.
20 | Resolution No. 96 of the Council of Ministers of 12 June 2023 on the National Waste Management Plan 2028 Monitor Polski of 2023, item 702.
21 | CSO 2024, 148.
22 | Monitor Polski of 2023, item 702.
23 | Barczak 2023, 270.

the Preparation of National and Provincial Waste Management Plans for Municipal Waste[24] by the Minister of Climate.

The findings of the Waste Management Plan 2028 show that the projected weights of food bio-waste generated during 2020–2040 will be 1,963 thousand tonnes in 2025, 2,013.3 thousand tonnes in 2030, and 1,752.2 thousand tonnes in 2040. As for greenfield bio-waste, its projected amount in 2025 will be 2,316.6, 2,375.9 thousand tonnes in 2030, and 2,363.1 in 2040, which is rather constant.

2. Dealing with bio-waste 'at source'

According to the waste hierarchy, which includes bio-waste, primary importance is given to waste prevention,[25] is primarily aimed at the need to take preventive measures.[26] The principle of waste prevention is the starting point in the waste hierarchy, and means that waste should be handled in such a way as to prevent its generation in the first place, although the literature recognises that the establishment of a ban on the most hazardous substances has exhausted the requirement for waste prevention.[27] According to Wierzbowski and Rakoczy this postulate is practically impossible to fulfil.[28] However, from the perspective of the household, making consumer choices in a fundamental way can be an expression of waste prevention.[29]

Only when the production of waste could not be prevented the next principles of the waste hierarchy come into play. These general principles apply not only to industrial waste but also to municipal waste. The subjective scope of the hierarchy applies to natural persons, legal entities, as well as organisational units without legal personality, including, in particular, entities engaged in economic activity; in the case of municipal waste, these will be the entities that receive this waste.[30]

According to the National Waste Prevention Programme, the production of municipal waste (i.e. also bio-waste) can be prevented through, among other things:

1. educating and influencing residents' consumer decisions to a) reduce unnecessary purchases and b) choose products that are durable and lower in harmful substances;
2. education and promotion of waste prevention in institutions through a) dissemination of green procurement and b) implementation of environmental management systems (e.g., EMAS, Responsible Care);

24 | Ministry of Climate and Environment 2023a.
25 | Zębek 2018, 96.
26 | Górski 2002, 147.
27 | Żurowski 2019, 156.
28 | National Waste Prevention Programme, Warsaw 2014, 6.
29 | Wierzbowski and Rakoczy 2015, 282.
30 | Barczak 2015, 30.

3. promotion and institutional and procedural support for reuse (including support for repair-based services, rentals, used equipment exchanges etc.); and
4. impact on product and packaging manufacturers (implementation of new technologies and eco-design at all stages of the life cycle).

As already mentioned, in Poland, 122.8 million tonnes of waste were generated in 2023, of which 11% was municipal waste (13.4 million tonnes). Of this amount, 6.4 million tonnes were destined for recovery (46% of municipal waste), of which 2.1 million tonnes (16%) were sent for recycling, 2.7 million tonnes (20%) were sent for thermal conversion with energy recovery, and 1.6 million tonnes (12%) were sent for biological processing (composting or fermentation). A total of almost 4.2 million tonnes were diverted to disposal processes, of which 4.1 million tonnes (30% of municipal waste) were destined for landfilling, and the remaining 0.1 million tonnes (1%[31]for disposal by thermal transformation without energy recovery.[32]

These data indicate that the separate collection system is part of achieving EU's goals for reducing the amount of waste going to landfills, according to recital 35 of the WFD. At the same time, municipalities have been required by EU legislation to achieve high levels of recovery and recycling. According to Badach et al.,[33] such high thresholds will be virtually impossible to achieve without undertaking radical changes in local waste management systems, including significantly reducing the possibility of disposing of bio-waste within the mixed waste, undertaking educational campaigns, or tightening controls on residents' waste disposal. An opportunity to improve the achievement of the required recycling levels is also seen in increasing organic recycling by processing bio-waste in home composters, which will be discussed in section 2.2.

2.1. Environmental education

To realise waste hierarchy, that is, preventing waste at the source, it is necessary to raise environmental awareness. According to a study from 2020 only half of the respondents answered 'yes' and as less than 15% of the respondents were completely unfamiliar with the question "Does the household generate municipal waste?" According to the same study, only 3% of the households respected the principles of selective municipal waste collection in rural areas, while in cities the figure was 6%.[34] However, according to a study commissioned by the Minister of Climate and Environment in 2024, regularly segregated waste was declared by

31 |
32 | CSO 2024, 156.
33 | Badach et al. 2024a, 39.
34 | Rajczakowska and Andrzejczyk 2020, 77.

88% of those surveyed.[35] The reasons why Poles do not segregate waste, as defined in the above-mentioned survey, are: "there are no bins in the neighbourhood" (41%) and "there is no place at home to segregate waste" (38%). At the same time, as many as 62% evaluate positively the current system of selective waste management.[36] This is why the Roadmap for Transformation to a Circular Economy (adopted in 2019), as well as the Responsible Development Strategy (accepted in 2017) identified education as one of the key elements of achieving a circular economy in Poland.[37]

Nowadays, for the implementation of environmental education responsibilities, both the Minister of Climate and Environment (at the central level) and municipalities (at the local level) organise awareness-raising campaigns.[38] These take the form of advertising spots, poster campaigns at bus stops and other public places,[39] or logos and information campaigns on waste prevention (e.g. "we segregate textiles"[40] or "recycling and waste reduction"[41]). NGOs and private initiatives, such as municipal waste management facilities,[42] are also involved in such campaigns.

An important obligation of municipalities is to make information available on the authority's website and for the entities collecting municipal waste from property owners in a given municipality. The residents of a municipality are to have access to information on where and how mixed waste, bio-waste, or municipal waste sorting residues are managed. The primary task of the municipalities is to carry out informational activities on the proper management of municipal waste and, above all, to promote selective collection of municipal waste.[43] Remote applications and available online tools are helpful in the proper segregation of waste. Due to the specific nature of municipal waste generation (local level), apps are most often local in nature, such as the app "Where to throw away? Segregation" available on Google Play, which contains almost 1,000 different types of waste. It comes primarily from open data from the City of Warsaw, but users can also submit their concerns and solutions.[44] Another useful app is the waste collection app "My Garbage" for Android and iOS, for the city of Grudziadz; it provides information about the arrival of municipal vehicles to collect municipal waste and helps users learn about waste sorting. It also includes a waste dictionary and descriptions to identify different types of garbage, as well as contact details of the contractor and the office overseeing garbage collection, which makes it possible to report

35 | Which, at the same time, represents a decrease of 8 percentage points compared to the 2022 survey.
36 | Badanie 2024.
37 | Zębek 2024, 342–343.
38 | Ministry of Climate and Environment, 2025a.
39 | Rydygier and Bril 2020, 88.
40 | Ministry of Climate and Environment 2025b.
41 | Ministry of Climate and Environment 2025c.
42 | EZGDK 2024.
43 | Hanczar and Pisiewicz 2015, 205.
44 | App2025.

irregularities.[45] According to Rajczakowska and Andrzejczyk, urban households use logistic and ecologist solutions more often than rural ones.[46]

The "Sorteusz" ("the sorter") smartphone app is a tool available nationwide that allows users to scan the barcodes of product packaging and determines which container to put it in. However, the app, as a rule, is directed toward packaging waste, so it will not apply to bio-waste.

The creators of the National Waste Prevention Programme assumed a decade ago that the promotion of personal composting in the form of education and motivation of residents should achieve a potential effect of preventing bio-waste of 10 to 30 kg per capita per year.[47] The Programme has not been subjected to ex-post evaluation, so it is difficult to assess to what extent these assumptions have been met. Therefore, it is worth looking at other possible tools for reducing the amount of generated bio-waste and managing it at the source.

2.2. Financial support for composting bio-waste at source

Despite the fact that composting at source is not a mechanism per se to prevent the production of bio-waste but only regulates the issue and its management 'at the source', through municipal resolutions defining the principles of payment for waste collection and management, municipalities may introduce an exemption from part of the municipal waste management fee for residents who compost bio-waste on their property. This applies to single-family developments only. The fee relief, as stipulated in Art. 6k(4a) of the Act on Maintaining Cleanliness, is to be "proportional to the reduction in the cost of household waste management". The rates are set individually by each municipal council and the amount of the relief is determined by local conditions, such as, for example, the amount and structure of the costs of operating the municipal waste management system in the municipality, the number and location of properties with single-family residential buildings, the number of owners composting bio-waste, or the share of the bio-waste fraction in the structure of the collected waste.[48]

If the resolution providing for the relief is passed, the household must indicate in the so-called garbage declaration information having a backyard composter and composting bio-waste constituting municipal waste in it. Anyone who, contrary to the information submitted, does not have a backyard composter or does not compost bio-waste constituting municipal waste in it is subject to a fine.

Therefore, the effect of the relief cannot be the absence of a fee, as the reduction is only partial; at the same time, the relief should not be too low, as it will not have the intended economic effect.

45 | Aplikacja odpadowa 2019.
46 | Rajczakowska and Andrzejczyk 2020, 76.
47 | National Waste Prevention Programme 2014, 30.
48 | Gawrońska 2021, 56.

According to research conducted by the Murator service, in 2024, in Wroclaw, residents could expect a discount for municipal waste collection of PLN 10 per month if they had a composter. In Gdynia, in 2024, the discount was also PLN 10 per month (an increase of PLN 4 from the previous discount). However, in Ustka, for example, in 2024, the discount for garbage collection for composter owners was PLN 1.20 per month, while in Pasłęk it was PLN 5.[49] These discounts are not significant and it is difficult to assess whether they really have a mobilising effect on single-family homeowners towards composting.

2.3. Increased fee for lack of segregation

Another mechanism that favours the segregation of municipal waste (including bio-waste) is represented by increased fees for lack of segregation. According to Art. 6ka of Act on Maintaining Cleanliness, in the case of failure by the property owner to comply with the obligation of separate collection of municipal waste, the entity collecting municipal waste shall accept it as non-segregated (mixed) municipal waste and notify both the mayor and the property owner. This entity, after appropriate notification to the generator of waste,[50] initiates proceedings to determine the amount of the fee for municipal waste management and determines, by means of a decision, the amount of the fee for municipal waste management for the month/year in which the obligation of separate collection of municipal waste was not fulfilled. The fee must not be lower than twice the amount and not higher than four times the rate set by the municipal council. For example, in the capital (Warsaw), in 2020, a fixed monthly amount for the collection of segregated waste from a single-family house was PLN 94 and PLN 65 from an apartment in a block of flats or a tenement house. In the event of unsorted waste, the fees doubled.[51] Bril and Rydygier also emphasise that: "Similarly, in multi-flat real estate, e.g. in apartment blocks and tenement houses, the lowest rate was paid by one-person households. The rate for one person to collect segregated garbage is PLN 10, two people – PLN 19, three – PLN 28, and four and more – PLN 37. In the event of unsorted waste, 20% added the amount indicated. Currently, changes in rates are the most severe for those living on their own premises. Their fees will increase by up to 600%", which does not seem fair. In particular, it is problematic to penalise households in multi-family buildings with an increased fee for failing to selectively collect, with no way to personally verify which households have not actually segregated. Then, the undermined fee approaches collective responsibility, unacceptable in a democratic state under the rule of law, which requires a reason for the level of informational instruments as those that can produce the effect of behavioural

49 | Muratordom 2024.
50 | Szalkiewicz 2024, 28.
51 | Bril and Rydygier 2020, 61.

change in the absence of the need to use the authoritative forms of influence on the addressees of legal obligations. Therefore, each situation should be evaluated on a case-by-case basis, considering the surrounding circumstances, including the scale of violations and the type of property on which the violations occurred.[52]

3. Management of bio-waste in Poland

The Environment Protection Institute Report shows that the methods of biological processing of municipal waste in 2022 included processing in digestion facilities, composting facilities and mechanical-biological processing facilities, as well as, although to a very small extent, in biological drying facilities.[53]

The statistics for 2023 show that, of the municipal waste collected in 2023, 6.4 million tonnes were destined for recovery (46% of municipal waste generated), of which 2.1 million tonnes (16%) were sent for recycling, 2.7 million tonnes (20%) were sent for thermal conversion with energy recovery, and 1.6 million tonnes (12%) were sent for biological processing (composting or fermentation).[54] It should be assumed that the latter values refer partly to mixed kitchen waste and partly to bio-waste, which is 'biodegradable' due to its morphology.

Digestion is understood as recovery (R) or disposal (D) processes conducted under anaerobic conditions, with the participation of microorganisms, as a result of which the physical, chemical or biological properties of the waste are changed.[55] However, composting represents recovery (R) or disposal (D) processes carried out under aerobic conditions, with the participation of microorganisms, as a result of which the physical, chemical, or biological properties of the waste are changed.

The process of mechanical and biological processing of mixed municipal waste is carried out in mechanical-biological treatment (MBT, or MBP in Polish) facilities and combines two stages: mechanical and biological, which function as one integrated technological system. Bio-waste can also be processed through a mechanical process. The biological part of the MBP processes not only waste from the mechanical stage, but also other types of waste, including selectively collected waste accepted for management in the biological part of the MBP. According to the data, in 2022, the biological part of the MBP processed 2,669.9 thousand tonnes of municipal waste; however, the data do not isolate the bio-waste stream.

Considering the breakdown between composting and digestion processes, 1,121.0 thousand tonnes of municipal waste were composted at domestic composting facilities (170 facilities in 2022). The amount of waste with code

52 | Nagórek 2022, 40.
53 | Biologiczne przetwarzanie odpadów komunalnych w Polsce 2022, 10.
54 | CSO 2024, 156.
55 | Biologiczne przetwarzanie odpadów komunalnych w Polsce 2022, 8–10.

20 01 08 – biodegradable kitchen waste and 20 02 01 biodegradable waste was 129.2 thousand and 977.1 thousand tonnes, respectively, where municipal waste had a 98% share.

Digestion can proceed as a stand-alone process or be part of the MBP process; hence, the data acquired for analysis are not reliable and comprehensive. The acquired data for 2022 show that 157 thousands of tonnes of waste with code 20 01 08 – biodegradable kitchen waste and 9 thousands of tonnes of waste with code 20 02 01 – biodegradable waste were processed in digestion facilities.

Moreover, 98.2 thousand tonnes of municipal waste were processed in biological drying facilities in 2022, of which waste with code 20 01 08 – biodegradable kitchen waste accounted for 21%, and waste with code 20 03 01 – non-segregated (mixed) municipal waste accounted for 20.7%. The facilities also treated 0.05 thousands of tonnes of waste from group 02 – other than municipal waste in 2022.

The data for 2022 also include bio-waste generated outside of households, primarily on farms (formerly referred to as 'green waste'). Such bio-waste can be used, for example, energetically in biogas plants[56] to produce biogas, but as it is not a fraction segregated from households, a discussion of related trends is beyond the scope of this article.

4. Identified risks of bio-waste management in Poland

The primary risk identified by the national legislator and regulated by law is the prohibition on off-site collection of bio-waste that constitutes municipal waste under Art. 23(2)(6) of the Waste Act. Collecting waste in violation of the prohibitions is an administrative tort under Art. 194(1)(3) of the Waste Act, punishable by an administrative fine ranging from PLN 1,000 to PLN 1,000,000.[57] The prohibition is relative in nature.[58] Exceptions include allowing the collection of bio-waste that constitutes municipal waste collected at a transfer station operated by:

1. the entity collecting municipal waste from property owners;
2. the operator of a municipal installation;
3. the operator of a bio-waste treatment facility;
4. the operator of a selective collection point for municipal waste.

This is a closed list of entities excluded from the ban on collecting bio-waste that constitutes municipal waste off-site. This means that, in other cases, bio-waste must go directly to the treatment process, which raises risks related to transportation and their pre-process storage. In the area of transport-related risks, the

56 | Golaszewski 2011, 69.
57 | For details on torts in waste law, see Danecka and Radecki 2024, 210–222.
58 | Danecka and Radecki 2022, 231–232.

literature highlights the high logistics costs of transporting municipal waste due to the distances between generation and treatment sites,[59] which, due to the above ban, are unavoidable and may be subject to only slight optimization.

However, bio-waste storage (both accepted for processing and stored at the transfer station) is regulated at the national level by the Regulation of the Minister of Climate of 11 September 2020 on detailed requirements for waste storage[60] and the EC conclusions on BAT for waste treatment,[61] which is directly applicable. Leaving aside the EU regulation, which is identical for all member states and addresses to entities that are required to obtain an integrated permit, it is worth presenting the basic assumptions of the national system. They apply to entities operating installations below the capacity threshold required for obtaining an integrated permit, and the resulting prohibitions mainly concern the prevention of odour nuisance.

The purpose of § 12 of this regulation is, among other things, to prevent the odour nuisance experienced on neighbouring properties, the source of which is biodegradable waste.[62] According to this regulation, bio-waste shall be stored only in premises, including storage halls, equipped at least with: ventilation systems and ventilation devices that limit, in particular, the penetration of dust into the air, as well as possible odour nuisances, and high-speed gates. It is permissible to store bio-waste outside the premises in sealed containers, containers or tanks – in case the storage time does not exceed 7 days.

Another category of risk, deeply analysed by the doctrine, not directly related to bio-waste management, but to reporting to EU institutions, concerns the calculation of recycling levels from individual composters. As emphasised in the literature,[63] in accordance with the obligation set forth in the Act on Maintaining Cleanliness, the mayor is obliged to prepare an annual report on the implementation of tasks in the field of municipal waste management by 31 March. According to the new method of calculating the achieved level of preparation for reuse and recycling from 2021, the aforementioned level is calculated as the ratio of the mass of municipal waste prepared for reuse and recycled to the mass of municipal waste generated. Therefore, all fractions of waste, including bio-waste composted "at the source" can be included in the calculation of the level achieved. This means that higher levels of preparation for reuse and recycling of municipal waste can be demonstrated. However, to count bio-waste composted at the source among the required levels, specific prerequisites must be met, as indicated in the regulation on

59 | Bril and Rydygier 2020, 60.
60 | OJ. 2020, item 1742.
61 | Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing the best available techniques (BAT) conclusions for waste treatment under Directive 2010/75/EU of the European Parliament and of the Council (notified under document number C (2018) 5070).
62 | Haładyj 2022, online.
63 | Badach et al. 2024a, 31.

how to calculate levels of preparation for reuse and recycling of municipal waste.[64] To consider bio-waste as recycled waste, one of the following three methods for determining the weight of waste composted by residents in home composters must be adopted: direct measurement, indirect measurement, or a combined method.[65] In the case of direct measurement, which is the recommended method of calculation, it would be necessary to calculate the mass of bio-waste that has been placed in the composter, that is, by residents who compost bio-waste in home composters, which obviously raises controversy about the reliability of the measurements carried out and, thus, the risk of their questioning by EU institutions. At the same time, empirical studies indicate that considering composting at the source, a proper sampling methodology[66] is possible and can significantly facilitate the achievement of recovery and recycling levels by the municipality.[67]

5. Summary

In conclusion, although the general trend in the collection of bio-waste and its treatment pros is positive, den Boer and Szewczyk emphasise that the problem is represented by the underdeveloped legal conditions relating especially to the management of bio-waste and the possibility of using the final treatment products (composts, digestates).[68] Another barrier, in their opinion, is often the lack of demand for the product produced, that is, non-compliant compost classified under code ex 19 05 03 for certified plant support or even compost. Additionally, the procedure for obtaining a decision from the Minister of Agriculture and Rural Development takes up to two years and entails substantial costs.

The level of education of the public is also questionable, as the data cited in the study indicate that environmental awareness in the area of separating fractions of municipal waste, including bio-waste, is low, and the main instruments of change in this area are, unfortunately, mainly of a punitive nature.[69] There is no doubt that the educational function of the legal liability[70] may result from the need to pay an increased fee, but it is difficult to assess how much the risk of collective responsibility (for all households in a block of flats) promotes and/or demobilises waste segregation. One of the most recent surveys of Poles' environmental awareness conducted by the Zymetria agency on behalf of RLG in February–March 2024 showed that only 40% of respondents separate all waste into five

64 | Regulation of the Minister of Climate and Environment of 3 August 2021 on how to calculate levels of preparation for reuse and recycling of municipal waste (Journal of Laws, item 1530).
65 | Ministry of Climate and Environment 2023b.
66 | Badach et al. 2024b, 65.
67 | Płonka et al. 2025, 201.
68 | den Boer and Szewczyk 2019, online.
69 | On the relationship between Polish waste law and criminal law, see Wielec 2024, 307–328.
70 | Danecka and Radecki 2024, 106.

fractions, while 14% do not separate at all or do so in a highly selective manner.[71] Therefore, to achieve the municipal waste management goals, including bio-waste management, the key to success is awareness raising. As such, we need to focus on information-based policy instruments, not penalties in the future. Weiss and Tschirhart found information-based policy instruments to be substantive tools for eliciting desired policy outcomes.[72] However, research confirms that environmental awareness is not the sole driver of environmentally friendly behaviours. Both a desire to care for the environment and economic consideration play similarly significant roles in influencing respondents' actions.[73] However, by supplying a target audience with information, policymakers seek to influence their thinking, knowledge, or beliefs toward a particular behaviour, and thereby increase the attainment of desired policy goals.[74] In other words, information about segregation rules might be seen as a policy tool necessary to achieve goals of the waste management hierarchy, including both prevention of bio-waste and its selective generation and collection. An interesting solution, but for the time being of a purely pilot nature, are the so-called smart trash shelters. These are devices that open to barcodes read from bags, including data on the resident and type of waste. Stickers with barcodes are given to residents in their mailboxes; the barcode opens only a specific sorter; on this basis, it is possible to directly determine who threw mixed waste into the container, without giving it to sorting.[75] The effects of such pilot solutions seems to be interesting, but require further research.

71 | Electro3000 2025.
72 | Weiss and Tschirhart 1994, 92.
73 | Podkowińska 2025, 69.
74 | Weiss 2002, 251.
75 | Portal Samorządowy 2025.

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