Science, Technology and Innovation
ISSN 2544-9125 ▪ 2022; 15 (1-2): 22-28
doi: 10.55225/sti.452

STI • 2022;15 (1-2): 22-28

The municipal waste management in the Skrzyszów commune

Tomasz Kolak[1] A-G,I, Katarzyna Maj-Zajezierska[1] A,D,E,H-J

[1]University of Applied Sciences in Tarnow, Faculty of Mathematics and Natural Sciences, ul. Mickiewicza 8, 33-100 Tarnów, Poland

Original article

Abstract

In the article, the municipal waste management system was analyzed in the rural commune of Skrzyszów in the years 2016–2021. The analysis was prepared based on annual reports prepared and published by the Commune Office. The analysis showed that the selective waste collection system is functioning properly and that residents deliver municipal waste to the Municipal Waste Selective Collection Point (MSWCP) Pogórska Wola. Every year, the mass of municipal waste generated by residents of the Skrzyszów commune increases, in 2021 it amounted to 309 kg per person. The analysis of the fraction of municipal waste collected from households showed that biodegradable waste, bulky waste, and glass packaging have the largest mass share. Bulky waste, especially used car tires, was the dominant fraction of municipal waste delivered to MSWCP. The Skrzyszów commune has achieved the assumed recycling levels for biodegradable waste, construction waste, and paper, metals, plastics, and glass waste specified in the Waste Management Plan for the Małopolskie Voivodeship for 2016–2022.

Keywords

- waste management
- municipal solid waste management
- selective collection system
- municipal waste

Authors contributions

A – Conceptualization
B – Methodology
C – Formal analysis
D – Resources
E – Data duration
F – Visualization
G – Writing – original draft preperation
H – Writing, reviewing & editing
I – Project administration
J – Supervision

Corresponding author

Katarzyna Maj-Zajezierska
e-mail: k.majzajezierska@gmail.com
Akademia Nauk Stosowanych w Tarnowie
Wydział Matematyczno-Przyrodniczy
Katedra Ochrony Środowiska
ul. Mickiewicza 8
33-100 Tarnów, Poland

Article info

Article history

- Received: 2022-10-02
- Accepted: 2023-02-12
- Published: 2023-03-31

Publisher

University of Applied Sciences in Tarnow
ul. Mickiewicza 8, 33-100 Tarnow, Poland

Financing

This research did not received any grants from public, commercial or non-profit organizations.

Conflict of interest

None declared.

Introduction

Municipal waste is generated in households and public utility buildings or workplaces, wherever the generated waste has a composition and nature similar to that generated in households. In 2020, a statistical Pole produced 342 kg of municipal waste. In the same year, 1130 Mg of municipal waste were produced in the Małopolskie Voivodeship of which 313 Mg were recycled, 353 Mg were thermally transformed, 134 Mg were composted or fermented, and 331 Mg were landfilled [1].

Municipal waste management is the responsibility of the commune in which we live, which is in line with the Act of September 13, 1996, which maintains cleanliness and order in communes [2]. Municipalities are responsible for collecting municipal waste from residents and handling it further in accordance with the waste management hierarchy, i.e., only waste that cannot be neutralized in any other way to landfills. Municipalities are responsible for organizing the waste management system, including selective waste collection. Art. 3 sec. 2 point 5 of the Act on maintaining cleanliness and order in municipalities states that selective collection of municipal waste covers at least the following waste fractions: paper, metals, plastics, glass, multi-material packing, and biodegradable municipal waste, including biodegradable packaging waste [2].

From 2017, all municipalities are required to selectively segregate waste, and their success depends largely on the residents' ability to segregate waste at the source. Certainly, a great support for the selective waste collection system is the introduction of colored containers dedicated to waste belonging to a specific fraction. However, there is still a need to constantly increase the knowledge and awareness of the inhabitants, especially the elderly. These activities are important in the context of meeting the EU regulations contained in the circular economy waste package, which require Poland to recycle waste and prepare it for reuse in the amount of 65% by 2035 [2–4].

The purpose of the study is to analyze waste management and the morphology of waste collected from the property and handed over to the Municipal Waste Selective Collection Point (MSWCP) by residents of the Skrzyszów commune in the years 2016–2021.

Materials and methods

The analysis of the waste management system was based on data published in the annual analyzes of the municipal waste management status in the Skrzyszów commune, which are published on the commune website. The amount and type of waste collected from households and delivered to the Municipal Selective Waste Collection Point were analyzed.

Characteristics of the Skrzyszów commune

The Skrzyszów commune is a rural commune in the Tarnów Poviat, in the Małopolskie Voivodship. The commune is situated on the border with the province of Podkarpackie. The area of the commune is 86.23 km^2 and includes the villages of: Ładna, Łękawica, Pogórska Wola, Skrzyszów, and Szynwałd [5,6].

The number of inhabitants of the commune is 14 304 (as of December 31, 2020). The number of inhabitants increased by 154 people compared to 2016. The population density is 167 people/km^2 [2,5].

Table 1. Summary of the number of residents registered and covered by the fee system [based on 5 and 7]

Year	2016	2017	2018	2019	2020	2021
Number of residents registered	14 148	14 214	14 259	14 320	14 308	14 304
Number of residents covered by declarations	11 761	11 686	11 697	11 714	11 970	11 832
Number of households covered by the waste management system	3242	3293	3342	3397	3474	3563
Percentage of municipal waste segregation declaration	94%	94%	96%	97%	100%	100%

The number of people registered in the commune is important for waste management because each household fills in a declaration containing information about the number of people living on the property. The method of waste collection allows the correct calculation of the cost of waste collection. The number of inhabitants does not correspond to the number of people covered by declarations on the amount of fees for municipal waste management because they include people who live in a given property. The difference is most often the result of going to study, working in another place, having more than one flat or filling out a declaration incorrectly. In the period analyzed, the largest difference was 2606 people in 2019, and the smallest was 2338 people in 2020. From 2020, all residents of the commune declare selective waste collection (Table 1) [2,5].

Description of waste management in the Skrzyszów commune

In the Skrzyszów communal area, there are no municipal waste landfills and there is no possibility to process the municipal waste. There is a Municipal Selective Waste Collection Point (MSWCP) in Pogórska Wola. The MSWCP Pogórska Wola is located in the vicinity of a scrap car, on the national road No. 4. In the MSWCP residents of the commune can deliver the municipal waste free of charge on Tuesdays from 2:00 p.m. to 6:00 p.m. and Saturdays from 8:00 a.m. to 12:00 p.m. [5,6,8].

Table 2. The size of the container depends on the number of people living in the property [based on 7]

Number of people living on the property	Container size
1–4	120 L
5–8	240 L
9–12	360 L
13 and more	2 × 240 L

The commune, as administrator, equipped all properties with mixed waste containers and segregated waste bags according to the size of the household (Table 2). Additional bags for waste segregation are available for collection in the building of the commune office during working hours. Every 2 weeks, municipal waste collected in containers is collected from residents, and biodegradable waste is collected selectively in brown bags. The waste collected selectively and collected in bags of appropriate color (blue – paper and cardboard, green – glass, yellow – plastics) are collected once a month according to the agreed schedule [5,7,9].

Table 3. Fees for the collection of municipal waste in the years 2016–2021 in the Skrzyszów commune expressed in PLN [based on 7]

Number of people living on the property	2016–2018		2019		2020		2021	
	S[a]	M[b]	S	M	S	M	S	M
1	10	20	12	24	18	36	17.4	34.8
2	16	32	23	46	35	70	34.8	69.6
3	22	44	33	66	52	104	52.2	104.4
4	27	54	42	84	66	132	69.6	139.2
5	30	60	47	94	75	150	87.0	174.0
6	32	64	50	100	79	158	104.4	208.8
7 and more	34	68	54	108	86	172	17.4 × NoR[c]	34.80 × NoR

[a]S – segregated waste; [b]M – mixed waste; [c]NoR – the number of residents.

From July 2015, the municipal waste from the MSWCP Pogórska Wola is collected by Trans-formers Karpatia Ltd., ul. Odległa 8, 33-100 Tarnów. The company belongs to the company FBServis Karpatia Ltd. which has a municipal waste processing installation. Since 2014, this installation has the status of a Regional Municipal Waste Processing Installation and since 2016 the company has a bulky waste disassembly station [5]. Every year, the commune sets monthly rates for the collection of municipal waste from the property, and its summary in the analyzed period is presented in Table 3.

In the event of a breach of the obligation to collect municipal waste separately, the entity collecting the waste accepts it as mixed municipal waste and notifies the municipality about it. As a result of an incorrect or lack of waste segregation, the amount of the fee for the collection of unsorted municipal waste increases [7,9].

Results and discussion

Analysis of municipal waste collected in the Skrzyszów commune

Municipal waste includes all waste that cannot be thrown into a bag or container intended for a specific fraction, which is why animal or multi-ingredient food remains, hygiene articles, damaged clothing, broken glass and ceramics, packaging with contents, disposable gloves, chewing gum, and much more. The amount of mixed municipal waste (code: 20 03 01 [10]) collected from the property in Skrzyszów commune in the years 2016–2021 varied (Figure 1). No downward trend was observed, despite the growing number of separate waste collection declarations. The decreasing trend of waste sorting residues is visible, which is marked as waste with the code 19 12 12 – in 2021 it amounted to less than 162 Mg [10]. The increase in the amount of mixed waste in 2020 and 2021 compared to 2019 is due to the presence of the COVID-19 pandemic and restrictions on movement resulting from quarantine.

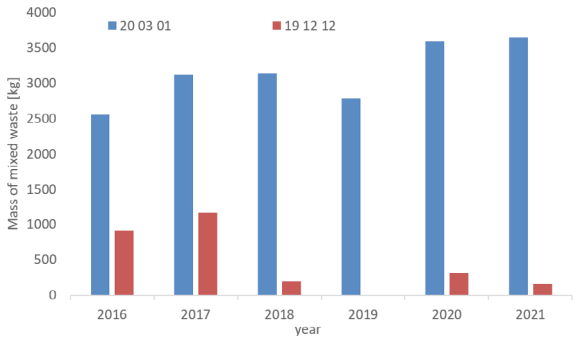

Figure 1. Amount of mixed waste [in kg] collected in individual years [based on [7]

The analysis of the morphological composition of the waste showed changes in the share of individual fractions in the period analyzed. In 2016–2018, bulky waste and glass waste clearly dominated, while in 2019–2021 a significant share was achieved by the 'other' fraction and biodegradable waste (Figure 2).

The group 'other' includes waste with code 20 01 32 – drugs other than cytotoxic and cytostatic, and waste with code 20 02 03 – other non-biodegradable waste. In 2020 and 2021, an increase in the amount of waste with this code was observed, which is related to the COVID-19 pandemic. Concerning 2019, when 0.04 Mg of waste with this code was collected, an increase of 225% was observed in 2020, and 425% in 2021.

In 2020 and 2021, there was a significant increase in the amount of mixed packaging waste (15 01 06)

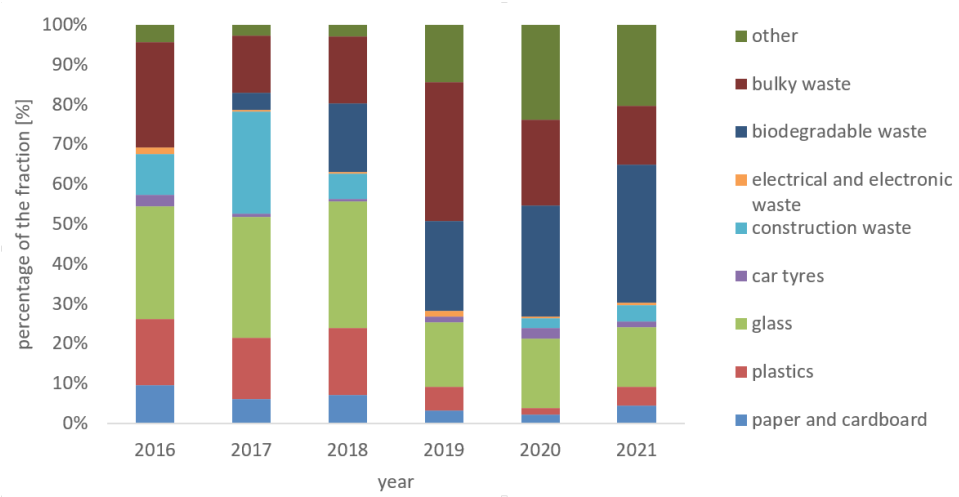

Figure 2. Morphological composition of selected fractions of municipal waste collected selectively in the Skrzyszów commune in 2016–2021 [based on 7]

compared to 2019. This may be due to restrictions on leaving the home due to the COVID-19 pandemic, which resulted in a reduced amount of correctly segregated packaging waste.

Waste delivered to the MSWCP Pogórska Wola

The MSWCP Pogórska Wola was partially closed in 2020 due to the COVID-19 pandemic and was renovated in October 2020. From 2020, mixed waste and waste from economic activities may not be returned to MSWCP. In 2019, there is no data on the weight of individual waste fractions delivered to the MSWCP, as these data were not included in the annual report [7].

The dominant fraction of waste delivered to the MSWCP in the analyzed period was a bulky waste, which is justified by the large volume and weight of such waste (Figure 3). In 2016, construction waste was clearly dominant, and in the following years, its share decreased. In 2020 the fraction of car tires delivered by residents dominated. The share of electrical and electronic waste is negligible and decreases every year, which may be related to the donation of electronic waste in stores when buying new devices or donating to various types of charity fundraising. The weight of construction waste delivered to MSWCP was the highest in 2016 and 2017, and a decrease was returned in the following years. The number of this type of waste, compared to 2016 and 2021, decreased by 82%. Among the 'other' fraction, there was a waste that in the analyzed period was returned in less than 3 years, it was waste with codes: 15 01 01 (paper and cardboard packaging), 15 01 02 (plastic packaging), 20 01 23 (devices containing freons), 20 01 32 (medicines other than those mentioned in 20 01 31), 20 01 40 (metals), 20 03 99 (municipal waste not specified in other subgroups). The share of waste fractions defined as 'other' decreases from year to year.

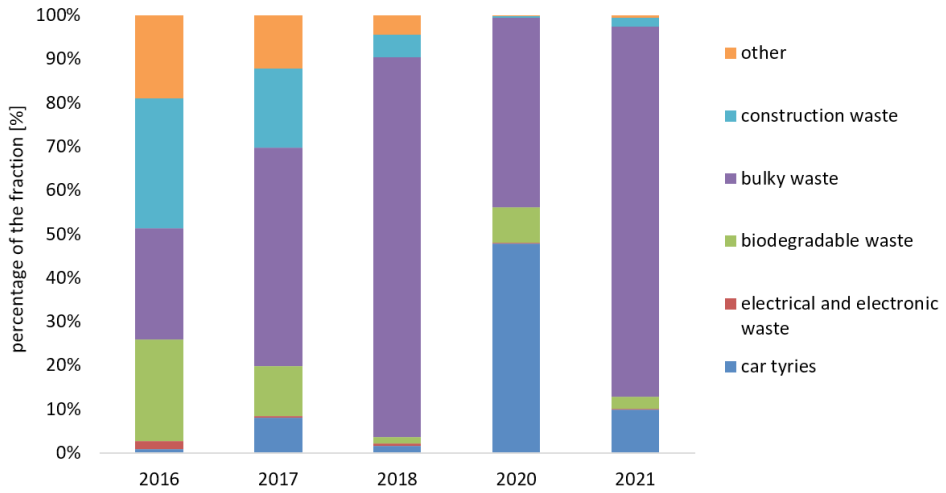

Figure 3. Morphological composition of selected fractions of municipal waste delivered to the MSWCP Pogórska Wola by residents of the Skrzyszów commune in 2016–2018 and 2020–2021 [based on 7]

Comparing the weight of individual waste collected from the property and delivered to MSWCP was found that the commune residents gave more bulky waste during the collection of waste from the property than at the MSWCP point. Such a situation may result from the fact that not every resident has adequate transport for transporting bulky waste and it is easier to gave this type of waste during cyclical collections. The residents of the commune were more willing to return used car tires during the collection of bulky waste, directly from the property than to give them in the MSWCP. The exception was in 2020 when more than 229 Mg of used car tires (waste code 16 01 23) was delivered to the MSWCP, and more than 35 Mg was collected during the collection from household. The year 2020 was a record year in terms of the collection of the bulky waste and the collection of this type of waste at MSWCP. This is probably related to the COVID-19 pandemic and cleaning the common house and yard during the lockdown.

The level of recycling achieved in the Skrzyszów commune

Biodegradable waste, according to the Regulation of the Minister of the Environment on the limits for the storage of biodegradable municipal waste landfilling in 2021, it could not be more than 35% [11]. The Skrzyszów commune managed to meet the requirements in the analyzed period.

In the annual waste management analyzes in the Skrzyszów commune, biodegradable waste includes waste with code 15 01 01 – paper and cardboard packaging, and biodegradable waste (code: 20 02 01). Waste with the code 15 01 01 is transferred for management to other entities for use according to the recovery process with the R3 (recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes)) and R12 (exchange of wastes for submission to any of the operations numbered R1 to R11 in annex 1 to the Waste Act [9]). The share of waste with code 15 01 01 subject to R3 processes in 2021 was 4.1% and R12 – 95.9%. The waste with code 20 02 01 is transferred to other entities and undergoes R3 or D8 (biological treatment resulting in final compounds or mixtures which are discarded by any of the operations numbered D1 to D12 in annex 2 to the Waste Act [9]) processes. In 2021, the share of waste with the code 20 02 01 subject to the R3 process was 46.8% and D8 – 53.2%. In 2018, all waste with the code 20 02 01 was subjected to the D8 process, while in the remaining years, 100% was subjected to the R3 process. The summary lacks data for 2019, which is due to the lack of detailed data in the annual reports of municipal waste management for this year.

Another municipal waste collected selectively by the residents of the Skrzyszów commune is paper, plastics, glass, and metals. The level of recycling of this type of municipal waste is specified in the Regulation of the Minister of the Environment on the Detailed Method of Selective Collection of Selected Waste Fractions [3]. The required level for 2020 was 50%, which has been achieved (Table 4).

Table 4. The level of recycling of individual fractions of municipal waste in 2016–2021 in Skrzyszów commune [based on 7]

Recycling and reducing individual fractions	Recycling and waste reduction (%) in individual years					
	2016	2017	2018	2019	2020	2021
The level of recycling, preparation for reuse of the following fractions of municipal waste: paper, metals, plastic, and glass	27	35	42	50	61	67
The level of recycling, preparation for reuse, and recovery by construction and demolition waste, other than hazardous	100	100	100	100	100	100
The level of limitation of the mass of biodegradable municipal waste going to landfill	—	—	15	18	23	10

The mass of waste code 15 01 02 (plastic packaging) collected from the inhabitants of the Skrzyszów commune was varied, in the years 2017–2018 its weight increased by approximately 40 Mg per year. In 2019, their mass decreased to 52 Mg and decreased almost twice in 2020. In 2021, the mass of this waste increased to a mass of 66.4 Mg.

The mass of waste in the form of glass packaging (code 15 01 07) increased in 2016–2018, while it decreased by half in 2019, to increase again in 2020. In 2021, the mass of waste code 15 01 07 decreased in relation to the year previous by approximately 20 Mg, while in relation to 2016, it increased by approximately 80 Mg.

The recycling level of construction waste is also specified in Act on Maintaining Cleanliness and Order in Municipalities [1]. Construction waste includes waste with codes 17 01 01 (waste concrete and concrete rubble from demolition and renovation), 17 01 03 (waste of other ceramic materials and elements of equipment), 17 01 07 (mixed waste of concrete, brick rubble, waste materials ceramics and fittings other than those mentioned in 17 01 06). In the Skrzyszów commune, construction waste is recycled or recovered as an R5 process (recycling/reclamation of other inorganic materials), which allows 100% recycling or recovery of this waste fraction.

Conclusions

The analysis of the municipal waste management system in the Skrzyszów commune showed that the developed system works correctly. Requirements that are precised in the Act on Maintaining Cleanliness and Order in Municipalities have been achieved. A small part of the waste from the commune is landfilled. The amount of waste per capita in the commune is increasing, which is a trend that is noticeable throughout Poland.

1. In 2021, there was an average of 255 kg of waste per capita of a commune, which is 32% lower than the value per capita of the Małopolskie Voivodeship.
2. In 2021, there was a decrease in the amount of mixed waste collected from households. This may demonstrate the growing awareness of inhabitants of the problem of selective waste segregation.
3. In 2019, the Skrzyszów Commune achieved the required level of recycling specified in the Waste Management Plan for the Małopolska Region for 2016–2022, this level increased in 2020 and 2021.

References

[1] Database of the main statistical office. [Internet]. 2022 [cited 2022 Sep. 10]. Available from: www.stat.gov.pl.

[2] Act on Maintaining Cleanliness and Order in Municipalities (J.L. 1996 No.132, item 622). [Internet]. 1996 Nov. 20 [cited 2022 Sep. 10]. Available from: https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU19961320622/U/D19960622Lj.pdf.

[3] Regulation of the Minister of the Environment on the Detailed Method of Selective Collection of Selected Waste Fractions (J.L. 2017, item 19). [Internet]. 2017 Jan. 4 [cited 2022 Sep 10]. Available from: https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20170000019/O/D20170019.pdf.

[4] Waste management plan for the Małopolskie Voivodeship for 2016–2022. [Internet]. 2017 Mar. 27 [cited 2022 July 28]. Available from: https://www.malopolska.pl/_userfiles/uploads/PGOWM_2016-2022.pdf.

[5] Skrzyszów Commune Office. [Internet] 2022 [cited 2022 May 12]. Available from: https://skrzyszow.pl.

[6] Study of conditions and directions of spatial development of the Skrzyszów commune. [Internet] 2011 Sep. 16 [cited 2022 May 12]. Available from: https://bip.malopolska.pl/e,pobierz,get.html?id=14458.

[7] Analysis of the state of municipal waste management in Skrzyszów commune 2016–2021. [Internet] 2022 [cited 2022 Feb. 24]. Available from: https://skrzyszow.pl/ochrona-srodowiska/.

[8] Statute of the Municipal Selective Waste Collection Point in Skrzyszów Commune. [Internet, cited 2022 Feb. 24]. Available from: https://skrzyszow.pl/wp-content/uploads/Regulami-Pszok.pdf.

[9] Waste Act (J.L. 2013 item 21). [Internet] 2013 Jan. 8 [cited 2022 May 10]. Available from: https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20130000021/O/D20130021.pdf.

[10] Regulation of the Minister of Climate of January 2, 2020 in the Waste Catalog. (J.L. 2020, item 10). [Internet] 2020 Jan. 3 [cited 2022 May 10]. Available from: https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20200000010/O/D20200010.pdf.

[11] Regulation of the Minister of the Environment on the limits for the storage of biodegradable municipal waste mass (J.L. 2017, item 2412). [Internet] 2017 Dec. 22 [cited 2022 May 10]. Available from: https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20170002412/O/D20172412.pdf.