INFRASTRUKTURA I EKOLOGIA TERENÓW WIEJSKICH
INFRASTRUCTURE AND ECOLOGY OF RURAL AREAS

No IV/1/2018, POLISH ACADEMY OF SCIENCES, Cracow Branch, pp. 1021-1031
Commission of Technical Rural Infrastructure

DOI: https://doi.org/10.14597/INFRAECO.2018.4.1.070

METHODS OF DISPOSAL AND MANAGEMENT OF PACKAGING WASTE USED BY RESIDENTS OF WADOWICE COUNTY

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Abstract

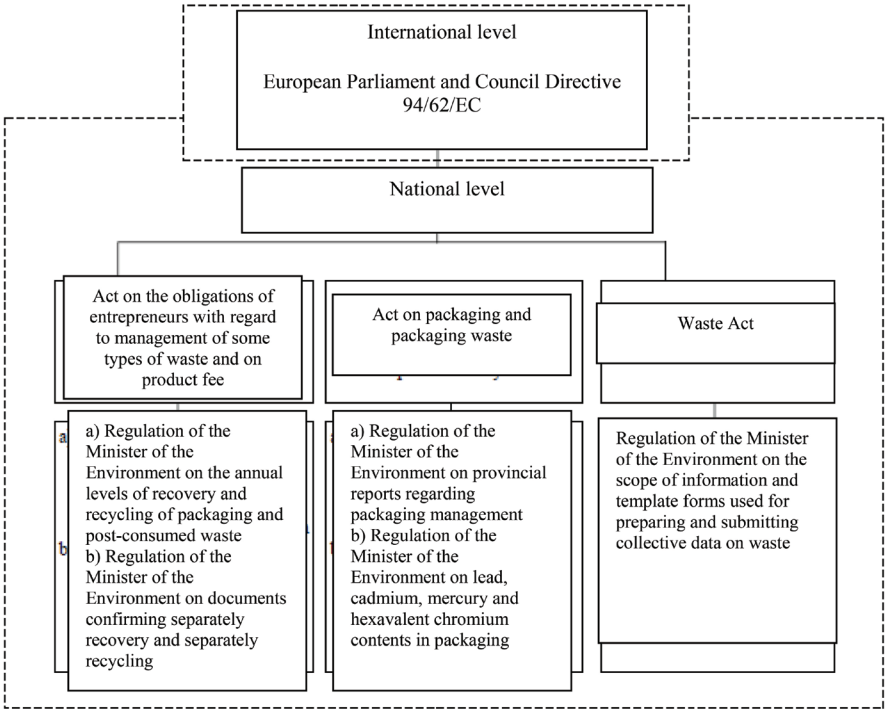
The aim of the paper was to examine the methods of disposal and management of selected packaging waste used by the residents of Wadowice County. Packaging, based on its function, can be made of different materials, which may make its correct segregation more difficult. This may influence the way the consumer manages of packaging waste. The study was carried out in 5 rural municipalities in Wadowice County in the period of 2015-2017. The scope of the study included different types of packaging: plastic, metal, paper and cardboard, glass, wood and multi-material. An anonymous survey was the research tool employed in the study. The paper showed a correlation between people interested in getting back a deposit for returnable glass packaging and actions taken in the scope of waste segregation.

Keywords: packaging, waste, segregation, waste management, survey

INTRODUCTION

European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste imposed obligations on member states with regard to packaging and packaging waste management systems. Such obligations include, among others, supporting the use of reusable packaging systems, ensuring specific levels of packaging waste recycling and recovery, establishing

return systems, collecting and recovering reusable packaging and packaging waste (Pawlak *et al.* 2002; Hryb 2015). According to Żakowska (2007, 2008, 2015) and Kisperska-Moroń *et al.* (2009), to respect the principles of sustainable development, the flow of waste needs to be established in such a way so as to maintain the value recovery hierarchy. In case of packaging waste, in order to maintain the value hierarchy, it is necessary to build packaging trade systems and packaging flow management systems (reverse logistics), build efficient logistic chains (remanufacturing level), establish a sorting, collection and acceptance system for used goods and facilitate their transport to waste disposal stations (recycling level) and to create a system for sorting, collecting and accepting used goods, facilitating their transport to incinerators and landfill facilities (storage with energy recovery level and long-term storage level) (Bril *et al.* 2012, 2016). Packaging waste should be understood as end-of-life packaging which constitutes waste in the definition of the act (Journal of Laws 2013, item 21), except for waste created in the process of packaging production. The general structure of the legal system with regard to packaging waste management is shown in Figure 1 (Skowron 2011).



Source: Skowron (2011)

Figure 1. Legal system structure with regard to packaging waste management

In the definition of the act (Journal of Laws of 2013, item 888; Journal of Laws 2001 No. 63 item 639), packaging is an article, including a non-returnable article, made of any material, intended for storing, protecting, transporting, delivering or presenting products ranging from raw materials to processed goods. There are the following packaging categories: unit (used to hand the product over to the user at an outlet), collective (containing multiple pieces of unit packaging, irrespective of whether they are being handed over to the user or are used for stocking up outlets and which can be removed from the product without interfering with its characteristics) and transport (used for transporting products in unit packaging or collective packaging to prevent damage, except for containers used for road, rail, sea or air transport). In line with the current regulations, packaging is:

1. An article which serves the functions of packaging without detriment to other functions which packaging may serve, except for articles whose all components are intended to be used, consumed or disposed of jointly, which constitute an integral part of the product and are necessary for storing, keeping or protecting the product throughout the whole cycle and period of its functioning;
2. An article serving the functions of packaging:
   a) manufactured and intended to be filled at an outlet,
   b) disposable – sold, filled, manufactured or intended to be filled at an outlet;
3. A component of packaging and an auxiliary element joint with the packaging, serving the functions of packaging, while the auxiliary element attached directly or fixed to the product is considered packaging, except for elements which constitute an integral part of the product, intended to be used or disposed of jointly.

Based on the function served (storage, protection, presentation etc.), packaging can be made of different materials (glass, metal, wood or mixed materials), which may make their correct segregation more difficult. This may influence the way the consumer manages of packaging (Garcés *et al.* 2002, *Adams et al.* 2000; Malinowski 2014, 2016).

The aim of the paper was to examine the methods of disposal and management of selected packaging waste types used by the residents of Wadowice County.

MATERIAL AND METHODS

The study was carried out between 2015-2017 in 5 rural municipalities in Wadowice County (a municipality code was adopted as *Mn*, where *n* takes a value from 1-5). The study examined the residents' methods of packaging waste disposal. The scope of the study included different types of packaging waste: plas-

tic, metal, paper and cardboard, glass, wood and multi-material. The research tool used was an anonymous survey.

The survey consisted of 2 parts: the first part concerned the respondent's profile (sex, age group, education) whereas the second one related to the aim of the study, i.e. the way the respondent disposes of packaging waste. All questions found in the survey were closed-ended. In total, 750 people were surveyed, based on which 619 correctly completed surveys were obtained. Respondents could allocate one selected disposal method to packaging waste types listed in the survey questionnaire, according to the diagram found in Table 1.

Table 1. Selected components of the survey questionnaire examining packaging waste disposal methods

Packaging waste type	**Disposal methods**
Returnable glass packaging (with a deposit fee)	– return to the store/purchasing centre – segregation and disposal of with waste – binning – other
Non-returnable glass packaging (without a deposit fee)	– segregation and disposal of with waste – binning – other
Wood packaging	– segregation and disposal of with waste – binning – incineration – other
Paper or cardboard packaging	– segregation and disposal of with waste – binning – incineration – other
Metal packaging	– segregation and disposal of with waste – binning – return it to the purchasing centre – other
Multi-material packaging	– segregation and disposal of with waste – binning – incineration – other

The waste disposal/management methods listed in Table 1 should be understood as:

- "return to the store/purchasing centre" – returning packaging waste to the store or to a secondary materials purchasing centre,

- "segregation and disposal of with waste" – segregating at source at the respondent's residence,
- "binning" – placing packaging waste in a mixed waste container,
- "incineration" – thermal treatment of packaging waste at the respondent's residence,
- "other" – activities other than listed above.

The data obtained from the survey were presented in a table form, with an indication of the municipality where the answers were obtained and of the respondents' characteristics. The results were expressed as percentage values. The variation in the percentage of respondents declaring to use a given packaging waste disposal method in the period of conducting the survey oscillated between 2-11% (low variation), which facilitated an aggregated analysis of the results from the entire study period. The respondent's profile in the context of the preferred packaging waste disposal method was analysed through their selected method of returnable glass packaging management. This is justified by the fact, which is characteristic for returnable packaging, i.e. reusable packaging, that by returning it to the store or purchasing centre, the consumer receives monetary gratification (refunded deposit). In the paper, a research assumption was made that a person interested in being refunded the deposit for returnable glass packaging, i.e. monetary gratification, will also be willing to take action with regard to waste segregation in order to avoid higher fees for collection of unsegregated waste (Mamoor *et al.* 2013; Yau *et al.* 2010).

RESULTS AND DISCUSSION

Only correctly completed surveys were analysed (619 surveys, which is 82.5% of the surveys provided to respondents). Table 2 shows the structure of the respondents broken down into individual municipalities, while Table 3 shows disposal methods used by the respondents with regard to the individual types of packaging waste.

The respondents' sample composed of 48.7% females and 51.3% males. Most respondents were up to 30 years old and in the age range from 31 to 51 (40% and 39% respectively), followed by individuals who were over 51 years old (21%). 64% of the respondents completed secondary education, 28% – higher education degrees and only 8% of the respondents had only completed vocational or lesser education.

Around 71% of the respondents stated that they incinerated wooden packaging waste and 31% of the respondents incinerated paper and cardboard packaging waste at their own property. Nearly 8% of the respondents used similar disposal methods with regard to multi-material packaging. Respondents saying

that they disposed of packaging waste with mixed waste usually mentioned multi-material packaging (22%), metal packaging (12%), paper and cardboard packaging (11%) and returnable and non-returnable glass packaging (9% and 6% respectively). Metal packaging was mainly returned to secondary materials purchasing centres (45% of the respondents).

Table 2. Respondent structure taking into account the municipality where the survey was conducted (%)

Characteristic		Municipality				
		M1	**M2**	**M3**	**M4**	**M5**
Sex	Female	46.1	51.0	55.2	39.8	51.4
	Male	53.9	49.0	44.8	60.2	48.6
Age group	Up to 30 years old	44.0	39.1	41.1	36.9	38.8
	31 – 50 years old	39.3	41.2	36.6	39.5	38.9
	Over 51 years old	16.7	19.7	22.3	23.5	21.3
Education	Vocational (or primary)	6.2	7.9	9.4	6.8	10.1
	Secondary	76.0	77.1	55.9	61.3	49.1
	Higher	17.8	15.0	34.7	31.9	40.8

Table 3. Declared method of management of individual packaging waste types (%)

Packaging waste type	Packaging waste disposal method				
	return to the store/purchasing centre	**segregation and disposal of with waste**	**binning**	**incineration**	**other**
Returnable glass packaging (with a deposit fee)	89	2	9	X	0
Non-returnable glass packaging (without a deposit fee)	X	92	6	X	2
Wood packaging	X	16	3	71	10
Paper or cardboard packaging	X	55	11	31	3
Metal packaging	45	37	12	X	6
Multi-material packaging	X	69	22	8	1

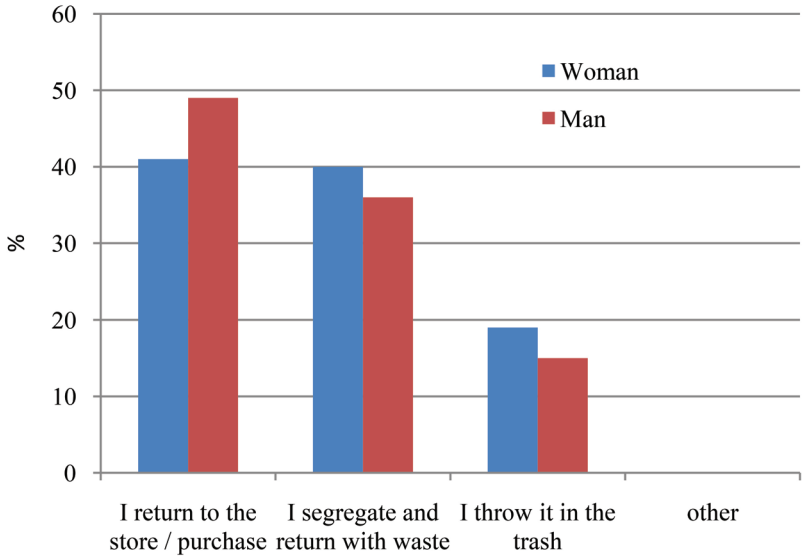


Figure 2. Share of males and females in the individual returnable glass packaging management methods

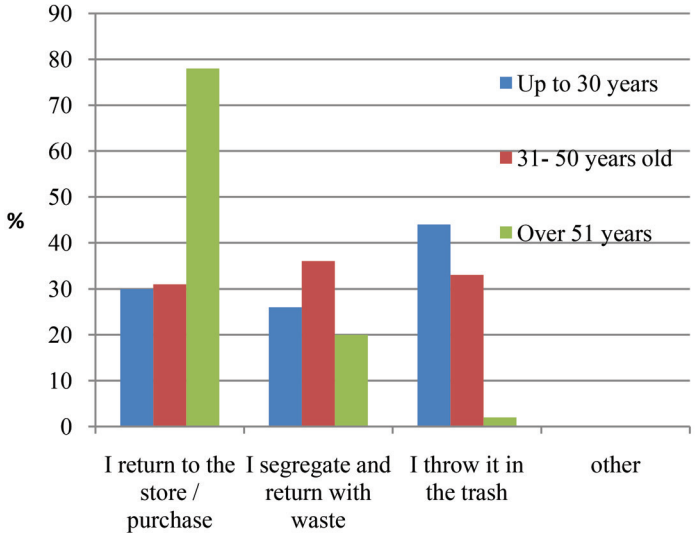


Figure 3. Share of age groups in the individual returnable glass packaging disposal/ management methods

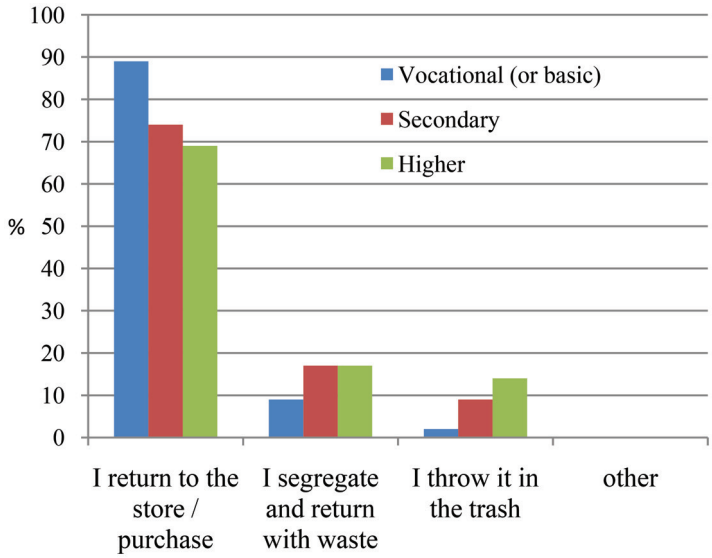


Figure 4. Share of respondents in the individual returnable glass packaging disposal/ management methods depending on educational background

The respondents said that they segregated waste at their property when it came to non-returnable glass packaging – 92%, multi-material packaging – 69%, paper and cardboard packaging – 55% and metal packaging – 37%. The lowest percentage of respondents (2%) said that they segregated returnable glass packaging at their property (this problem is discussed further on). At this stage of the research, it is difficult to explain statements of some respondents (up to 10%) which indicated that with regard to the packaging waste types listed, they used disposal methods other than the ones proposed in the survey. This matter needs to be further examined, as 10% of people at a municipality level may be a significant number of people engaged in prohibited waste management practices. 89% of returnable glass packaging is returned to shops, but as many as 9% of the respondents dispose of such packaging with mixed waste and 2% segregate it with other glass waste. Similar statements can be found in papers written by Kwapisz (2005) and Satora (2006) examining waste management in rural municipalities (Gródek n/Dunajcem and Trzciana).

Respondents who return returnable glass packaging to shops are mainly males over 51 years of age with vocational (or primary) education degrees. Segregation of returnable glass packaging at home is preferred by females aged 31 – 50 with secondary or higher education degrees. Disposal of returnable glass packaging with mixed waste is a method mainly used by women under 30 years

old with higher education degrees. This shows that in the examined municipalities of Wadowice County we can distinguish resident profiles with varying levels in interest in monetary gratification for complying with the obligation to segregate waste. The result of the survey partially confirms the research assumption adopted (a person interested in being refunded the deposit for returnable glass packaging will also be willing to take action with regard to waste segregation) as the desired actions in the scope of waste segregation tend to be performed by males and females aged over 51 with vocational or primary education degrees, while such waste is disposed of with mixed waste by males and females under the age of 30 with higher education degrees. Similar issues were examined in studies by Tałaj (2012), Szymańska-Pulikowska (2012) and Przydatek (2013).

SUMMARY

The results of the survey can be explained, on one hand, by the financial situation of the two groups, and on the other hand, by a lack of environmental awareness. That correlation should be the subject of a public educational campaign carried out by local authorities in the county. All actions aimed at increasing environmental awareness in the society, providing information about the correct methods of disposal of packaging waste, possible impact of packaging waste on the environment and human health, and available return, collection and recovery systems, including recycling of packaging waste, should create an added value in terms of waste management.

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Received: 03.07.2018
Accepted: 28.12.2018