

# Issues of municipal wastes utilization in urban territories

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**Abstract.** In present work the analysis of the solid municipal waste management system of the city of Samara was carried out. The utility garbage generated by the city district of Samara and its handling methods were assessed. The experimental studies were carried out to determine the morphological composition of SMW formed from the activity of different age groups of the population. It was found that municipal waste composition was dominated by food, plastic and paper wastes which could be easily used as secondary raw materials. The lack of primary sorting was found to impede waste recycling processes. The measures to change the existing garbage disposal system in Samara were proposed.

## 1. Introduction

For a dozen years municipal waste utilization is one of the most acute environmental problems characteristis to urban territories. In the end of 2018 several changes were made to the Federal law № 89 from 24.06.1998 "On production and consupction waste". The familiar term solid household wastes has been replaced on the new one - solid municipal wastes (SMW). At the same time, the groups and varieties of waste that can be classified as solid municipal waste have expanded. This was also reflected in the Federal waste classification catalogue.

The environmental situation of large cities in terms of waste management is largely determined by the state of the system of cleaning from household garbage. However it is necessary to take into account that a properly organized container site with the necessary number of containers for waste accumulation is only a stage in the further "cycle of life" of household garbage. In most cases, this is followed by the final, standard for Russia stage of the " life cycle " of waste - placement at the landfill.

## 2. Analysis of waste management system in Samara region

According to the scientific and practical journal "Solid household waste" the annual volume of formation of SMW in Russia is 55-60 million tons [1]. In the best-case scenario, only 4-5% of them are directed to recycling or burning. Analysis of statistical reporting data for Samara region for 2015-2017 on the form of 2-TP (wastes) shows that the average annual amount of SMW formation and similar wastes of IV and V hazard classes is 543 thousand tons [2-4]. In fact, the amount of waste generated is much larger, as the reports are delivered only by legal entities. It does not take into account waste disposed of in natural landfills of garden sites, rural settlements, etc. There is no centralized garbage collection at all in some settlements of the region. According to the information presented in the Territorial Scheme of waste management, only the city district of Samara annually supplies to the environment about 970,000 tons of municipal garbage [5].

In 2018 the territory of the region was served by 16 landfills of solid household wastes and 5



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garbage sorting stations[5]. The real situation with the landfills is as follows: two of them will be taken out of service in 2019, and 11 of the existing ones will be decommissioned in 2021-2022. As far as the quantity of household garbage is not expected to decrease in the future, there is a need to build the new ones. Thus in 2021-2022 it is expected to put into operation 10 subjects of waste disposal. This means only one thing that the urbanized areas will be surrounded by millions of tons of communal debris. The prospects for recycling the bulk of waste are rather vague.

The ratio of soil to laid garbage at the landfill is such that the waste layer of one and a half or two meters is covered by the soil layer of 20-25 centimeters. Sometimes soil is replaced with ground or other inert materials. Under such conditions, the process of decomposition of garbage can last more than 100 years.

In our opinion, one of the main problems preventing the garbage processing is the lack of separate collection on place of its formation. According to 2018 data, the current waste sorting stations process only 37.6% of the total rubbish volume with the release of glass and metal from it. Eventually, the share of waste used as secondary raw materials is 3.8%. The amount of municipal solid waste disposed of is 96.2% [5]. It is a huge figure, as municipal garbage is an excellent source of raw materials.

In order to assess the resource potential of municipal waste, it is necessary to know their qualitative and quantitative composition, since its morphological structure is one of the main characteristics of SMW.

### 3. Study of waste morphological composition and its quantitative assessment

Pilot studies were conducted to determine the qualitative and quantitative composition of SMW for different age groups. The experiment was attended by 30 people, who were separated into 3 groups. The first group included people between the ages of 60 and 80, the second - between 40 and 59 and the third - among young people aged 22-30. The representatives of the first - non-working pensioners, most of whose life activity flows in apartments, they regularly prepare food. Distributed to the second group - working people, who are engaged in cooking 2-3 times a week, have lunch outside the house. The third group includes young people who spend minimal time for cooking (not more often than 1 times a week), prefer fast food, ready lunches and dinners, which are purchased in supermarkets, bakeries, etc. The main criteria for division are age and employment.

The morphological composition was examined and quantified within a month. The wastes were divided into 8 categories and then weighed. Electronic scales of Gosmetr brand were used for the experiment. The results of the experiment are shown in Table 1.

**Table 1.** SMW qualitative and quantitative composition for different age groups

Name of waste	1-st group		2-nd group		3-d group	
	Weight, kg	Weight content,%	Weight, kg	Weight content, %	Weight, kg	Weight content, %
Food waste	19.75	76.1	14.27	64.6	9.42	64.0
Plastic	1.67	6.4	1.25	5.6	2.12	14.4
Glass	0.87	3.4	4.35	19.7	0.56	3.8
Paper, cardboard	1.57	6.1	0.53	2.4	0.93	6.3
Clothes, rags	1.42	5.5	1.08	4.9	0.86	5.9
Metal	0.33	1.2	0.28	1.3	0.18	1.2
Ceramics	0.08	0.3	0.13	0.6	0.39	2.7
Dust from cleaning	0.27	1.0	0.20	0.9	0.25	1.7
Total	25.96	100	22.09	100	14.71	100

The results of the experiment show that the first and the second groups of people produce about the same annual amount of waste. These data correlate well with the literary ones [5]. The analysis of components of the garbage basket points out that in different age groups the mass of generated wastes of the investigated categories is different. The second group produces waste by 45% less than the first. The analysis of the qualitative composition showed that all three groups were dominated by food waste. Plastic waste are in the second place. It is first necessary to organize its recycling because they are formed most.

Thus, the organic fraction can be used to produce compost. Textile, paper and cardboard can be recycled to produce products of similar designation. The same can be suggested for plastic, glass and metal-containing waste. The works on recycling of organic fraction were carried out and are carried out at domestic waste processing plants. Such complex is available in Tolyatti. The main problem of such production is that the obtained final product of low quality, as it contains glass waste. The main reason why glass gets there is the lack of sorting. The glass removal technologies used are inefficient. Accordingly, it is difficult to realize the compost because of its poor quality.

In our view, the main barriers to the processing of municipal wastes are the lack of primary separation and the absence of educational explanatory work with the population [6]. Because the main part of people are far from understanding the problems of garbage recycling. The main difficulties associated with the need for garbage sorting are likely to arise with the first age group.

Container sites existing in the city generally serve a certain area with several residential buildings located on it. About 3 years ago the first attempts of separate collection of municipal waste were made in Samara. Thus, separate mesh containers for the collection of plastic began to be installed on the sites, and information about which types of plastic are collected appeared on them very recently. Information plates with specific indication of collected materials are installed on the front side of the container.



**Figure 1.** Separate mesh containers for plastic waste collection in Samara: a – usual container; b,c - containers with information plate.

The problem resolution of processing household garbage lies in the obligatory primary sorting of plastic and organic food waste by the population at the place of its formation. Therefore, it is advisable to organize a container site for each house, where at least 3 containers of different colors (for food

waste, plastic and unsorted part of garbage) must be installed. It is necessary to provide the population with paper bags for collection of food waste and polyethylene bags for plastic and unsorted rubbish part.

Deeper waste sorting involves fractionating them into metal, glass, textiles and paper. The equipment for collecting them can be installed at supermarkets, as has long been the practice in Germany. In addition, within the framework of social advertising, it is necessary to indicate to the population the already existing organizations in the city that accept these types of waste.

Direct monetary compensation can be offered as incentives for people to separate waste, and reduction of waste disposal tariffs can be an incentive tool.

#### 4. Conclusion

Despite the presence of waste collection stations, the plant for processing household waste the main method of utilization of solid municipal waste in the Samara region - landfill burial. This method can be considered as a half-measure to solve garbage problems, as valuable SMW components are not used and become a source of environmental pollution. After the decommissioning of the household waste landfill, it remains the object of a delayed negative impact. The period of preservation and post-operation observation of landfills is from 50 to 100 years. During this period there will be decomposition of waste and accordingly pollution of air, water, soil.

The construction of new landfills leads to the rejection of useful areas where new residential areas and places of recreation of the population could appear.

The experimental studies showed that annually every resident of the city of Samara supplies 200 to 300 kg of municipal garbage to the environment (excluding large-scale waste). The main share of solid municipal waste is in food and plastic. The third place is given to paper and cardboard waste.

Sorting the above-mentioned components is not very difficult for the population. It is not produced at present due to the lack of equipped container sites and free garbage sorting packages.

Even in the implementation of the measures proposed above, the efficiency of sorting will not reach 50% due to the low level of ecological culture of the population and misunderstanding of waste processing problems. With the need to improve the environment of the urban territories and to save natural resources, it is necessary to fundamentally change the population attitude towards waste management. A successful problem resolution is possible only with the interest and active participation of the urban population.

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