

Scientific article

ANALYSIS OF THE WASTE MANAGEMENT AND RECYCLING SYSTEM IN UST-KAMENOGORSK

Shyngis Sabit*^{ID}, Ekaterina Kuznetsova^{ID}, Guldana Minzhanova^{ID} candidate of chemical sciences,
Korlan Khamitova^{ID} candidate of technical science

al-Farabi Kazakh National University, Almaty, Kazakhstan; sabitshingys@gmail.com (ShS), katrinka-2000@mail.ru (EK),
guldana.mg@gmail.com (GM), khamitovakorlan@gmail.com (KK)
Corresponding author: Shyngis Sabit, sabitshingys@gmail.com

KEYWORDS

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ABSTRACT

This article analyzes the current state of waste management and recycling systems in Ust-Kamenogorsk, highlighting key problems and potential solutions. The study examines the condition of waste collection, sorting, and recycling infrastructure, along with statistical data and legal frameworks. The low level of waste recycling, insufficient development of separate collection systems, and the dominance of landfill disposal exacerbate environmental issues. Although a waste sorting line has been launched, a fully functional recycling system in Ust-Kamenogorsk is still in its formative stage. As a result, comprehensive measures to improve waste management efficiency are proposed, demonstrating their contribution to enhancing the city's environmental situation.

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1. INTRODUCTION

In Ust-Kamenogorsk, a city in East Kazakhstan and the administrative center of the region, rapid industrial growth has fueled a steady population increase, currently around 372,477 residents. With an annual population growth rate estimated between 1...2 %, the city faces significant challenges in managing its waste, a critical issue for urban development.

According to Kazakhstan's Ministry of Ecology, Geology, and Natural Resources, Ust-Kamenogorsk generates approximately 66...67 thousand tons of waste annually, contributing to a national total of 4,5...5 million tons. However, the city's current recycling rate remains dismally low, hovering at just 1...2 %. The primary sources of waste include residential areas (77 %), industrial sectors (18 %), and public institutions and businesses (5 %) [1]

This study aims to assess the current state of Ust-Kamenogorsk's waste management system, identify key challenges, and propose strategies to improve recycling efficiency. By analyzing regulatory frameworks, statistical data, and the existing infrastructure for waste collection and processing, the research seeks to enhance sustainability practices and mitigate environmental impact.

2. MATERIALS AND METHODS

The share of waste recycling and disposal in the East Kazakhstan region over the last three years shows different data: if in 2020 the share of recycling in the total volume of education was 3,2 %, in 2021 it was 17,9 %, and in 2022 it decreased again to 11,3 %.

The dynamics of waste generation and recycling in Ust-Kamenogorsk is shown in figure 1.

Information on waste recycling in Ust-Kamenogorsk is 12 % in 2020, and 1,1...1,2 % in 2021...2022. According to the National Bureau of Statistics, recycling includes separately collected and sorted waste, which is then transferred to third parties for processing.

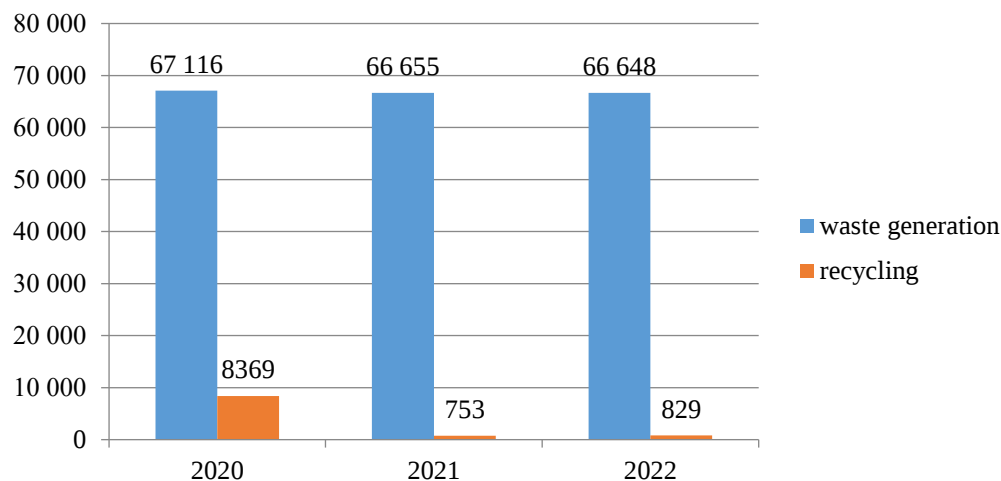


Figure 1. Dynamics of waste generation and recycling

According to the National Bureau of Statistics, 98 percent of waste generated in the last two years was sent to landfill, while only 1...2 percent was sent to third-party organizations for recycling [2].

Table 1

Waste collection (generation), recycling and disposal in 2020...2022 in the Republic of Kazakhstan, East Kazakhstan region and Ust-Kamenogorsk city [3]

№	Name	Unit of measure	Years		
			2020	2021	2022
1	Collection (knowledge)				
1.1	Republic of Kazakhstan	thousand tons	3,674.0	3 441,6	4 006,5
1.2	East Kazakhstan region	thousand tons	192,5	186,7	190,4
1.3	Ust-Kamenogorsk	ton	67 116	66,655	66,648
2	Recycling				
2.1	Republic of Kazakhstan	%	14,9	18,6	21,1
2.2	East Kazakhstan region	%	3,2	17,9	11,3
2.3	Ust-Kamenogorsk, including	ton	8369	753	829
2.7	cardboard and paper waste	ton	2363	730	605
2.8	plastic	ton	232	23	224
2.9	Secondary raw materials were sorted at the landfill	ton	5704	-	-
3	Funeral				
3.1	Ust-Kamenogorsk	ton	58,747	65,902	65,819

Morphological composition of waste

The methodology, the following classifications are included: food waste (vegetables, fruits, etc.); paper and cardboard; polymers (plastic, plastics); glass; ferrous metals; non-ferrous metals; textiles; wood; hazardous waste (batteries, dry and electrolytic accumulators, containers for solvents, paints, mercury lamps, television picture tubes, etc.); bones, leather, rubber; the remaining part of the waste after removing the components (small construction waste, stones, street garbage, etc.), etc.

According to the study, the average morphological composition of waste in the republic is as follows: food waste (37,2 %), plastic (16,2 %), waste paper (11,1 %) (Figure 2). At the same time, a significant part (11 %) belongs to the remaining part of the waste after removing the components (small construction waste, stones, street sweepings, etc.) [4].

According to this study, biodegradable (food) waste constitutes the largest proportion of waste in many cities.

In recent years, no studies have been conducted on the morphological composition of waste in Ust-Kamenogorsk. According to the Department of Housing and Communal Services, the last time the morphological composition of waste was conducted was in 2013. It is necessary to study the morphological composition of waste in Ust-Kamenogorsk.

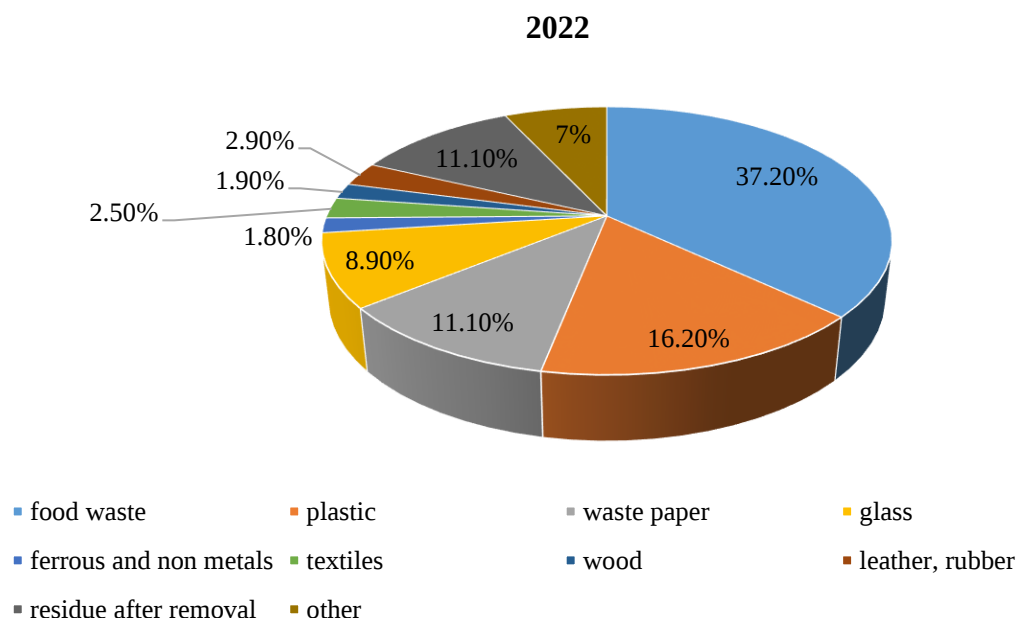


Figure. 2. Morphological composition of waste in the Republic of Kazakhstan (2022)

Norms and tariffs for waste generation and accumulation

By decision № 19/6-VII of the Maslikhat of Ust-Kamenogorsk city of the East Kazakhstan region dated March 10, 2022, standards for the generation and accumulation of waste in Ust-Kamenogorsk were adopted.

According to this document, the average annual water supply per capita for comfortable households is 2,68 m³, and for uncomfortable households it is 2,54 m³.

Table 2

Tariffs for waste collection, transportation and disposal in Ust-Kamenogorsk [5]

Name	Unit of account	Monthly cost (tenge)
for individuals, comfortable households	1 resident	431
for individuals in poorly equipped households	1 resident	409
Annual tariff per unit (volume)	1 m ³	1930,11

This tariff was approved by the Ust-Kamenogorsk city maslikhat № 27/3-VII dated September 2, 2022. Tariffs (Table 2) will come into effect from October 1, 2022.

In general, the tariff in Kazakhstan varies from 84 tenge to 550 tenge. The highest tariffs are in the cities of Almaty (553 tenge) and Kokshetau (500 tenge). The lowest rates are in the cities of Taraz (84 tenge), Turkestan (105 tenge), Zhezkazgan (110 tenge), Shymkent (171 tenge) and Aktope (180 tenge).

The tariff adopted for the city of Ust-Kamenogorsk is considered average for the Republic of Kazakhstan.

Assessment of the existing waste treatment and disposal system

Collection, accumulation and separate collection

Waste collection and storage in Ust-Kamenogorsk is carried out in two ways:

- in containers located in container yards
- containerless (heap) method - walking around the area and collecting waste in bags/sacks placed in designated places according to a schedule.

According to the Statistics Committee, 3,225 enterprises are serviced by business entities engaged in waste collection and disposal. According to statistics, a total of 10,980 enterprises are registered in Ust-Kamenogorsk. More than 7,500 enterprises are not covered by waste collection and disposal services or do not meet legal requirements, do not submit reports, that is, use the services of fake companies. Low collection and disposal coverage leads to unauthorized dumping

of waste in the city. It is necessary to strengthen work not only with the population, but also with legal entities.

Table 3

Information about container yards and containers [6]

Name	Container platforms (CP), parts	Containers, parts	Note
All in Ust-Kamenogorsk.	490	1983	
Among them:			
OskemenSpetsKommunTrans LLP	265	1200	40 % needs updating
Oskemen - Tazalyk LLP	225	783	35 % needs updating

Waste sorting line

As part of the «Roadmap for the Implementation of the Project for Separate Collection and Sorting of Solid Household Waste», approved in 2021, the city was transferred to the waste sorting network of the Greek company SABO. According to the sorting complex, the housing and communal services department of Ust-Kamenogorsk is located at «Ust-Kamenogorsk, Polzunov Street, 116/9» [7].

The sorting line was transferred to the EPR operator, and the city administration financed the costs of other hangar construction and infrastructure. The sorting line was opened in October 2023. The sorting line is almost completely automated. The production line has ballistic and optical sorting. Biodegradable waste, metals, plastic and paper are sorted separately. The production capacity of the sorting line is 25 tons/h, 40,000 tons/year, including: glass - 6.5 thousand tons/year, plastics - 5 thousand tons/year, metals – 3,8 thousand tons/year, paper – 24,7 thousand tons/year.

Current in time in containers waste current to the landfill is transported, then waste by hand sorted. Trustworthy The landfill is managed by OskemenSpetsKommunTrans LLP.

The recyclable materials collected during separate collection, as well as those that enter the sorting line, are further sorted by hand, pressed into bundles, and stored for sale.

In Ust-Kamenogorsk, the VTS Ust-Kamenogorsk waste collection company collects paper and cardboard waste, Poligrand LLP - plastic and plastic products, Turarova LLP - PET containers, Shyg LLP operates. In Maikoben - waste paper, Vostok-MetalTrans LLP recycles tires, etc. [8]

In processing plants, the plastic is washed, crushed to the required fraction, and the binders are removed.

Funeral

There are 335 units of landfills and landfills in the East Kazakhstan region, of which 30 units (8,96 %) comply with environmental and sanitary requirements and standards.

Today, waste disposal is carried out at the only landfill in the city. The landfill is the property of the city akimat and, by decision of the akimat of Ust-Kamenogorsk № 1103 dated 05.08.1997, was transferred to the trust management of OskemenSpetsKommunTrans LLP for a period of 50 years [9...10].

The environmental permit is valid until the end of 2023. Currently, according to information, documentation is being prepared to obtain a new permit until 2025, before the new engineering site is put into operation.

According to the Statistics Committee, as of January 1, 2023, 7,436,626 tons were buried at the landfill, while the design capacity is 7,574,193 tons [11].

The landfill is overflowing with waste that does not meet sanitary and environmental standards and requirements, and is buried without sorting, which makes the landfill a source of intensive environmental pollution and a carrier of various infections.

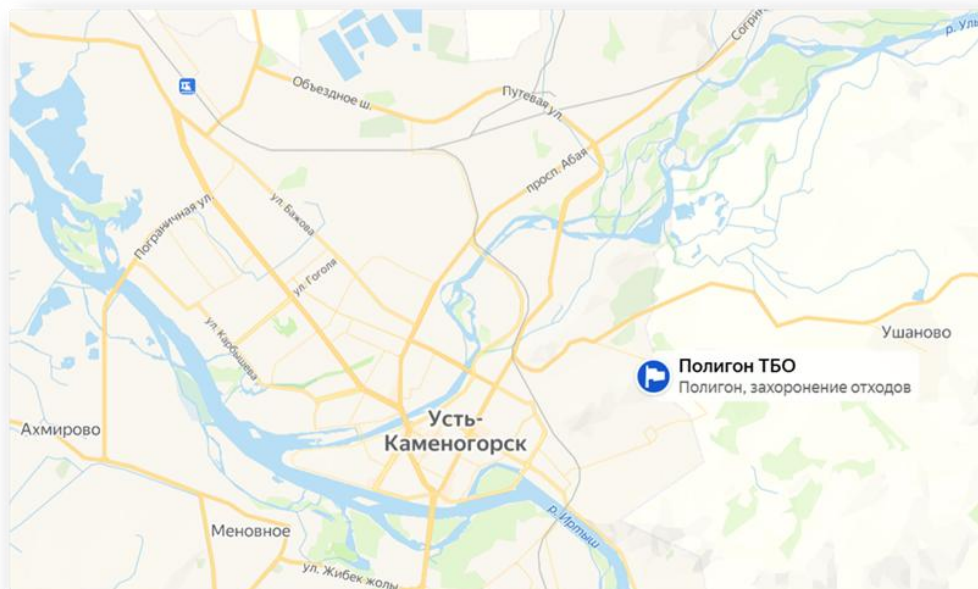


Figure. 3. Ust-Kamenogorsk city landfill [12]

3. RESULTS AND DISCUSSION

Analysis of strengths, weaknesses, opportunities and threats in the waste treatment and recycling sector

To objectively analyze a waste treatment and disposal system, it is necessary to clearly identify its strengths and weaknesses, as well as existing opportunities and threats.

Table 4

Analysis of strengths and weaknesses, opportunities and threats

Main points	Weaknesses
- Construction and commissioning of the KSC - Planning and working on the construction of a new technological platform.	- Low coverage of waste collection and disposal. - Lack of a system for collecting hazardous waste from residents - Low waste recycling rate - Public debt on tariffs - Public awareness is low
Features	Danger
- Business interest in developing a waste collection and recycling system - Availability of modern technologies, a wide range of facilities for composting food waste, processing construction waste, etc. - There is great potential for developing businesses in the area of introducing separate collection and processing food and construction waste. - The city's location on the border with neighboring countries, a large potential for demand for secondary raw materials	- Public dissatisfaction and dissatisfaction with the condition of container sites, waste collection and transportation services. - Overcrowding of the landfill. - Emissions into the atmosphere from landfill waste that contribute to climate change.

Measures to introduce separate waste collection

To implement a personal collection system, the following measures should be taken:

Ensure the installation of containers for separate collection of dry waste fractions at container sites and the separate removal of secondary raw materials.

Organization of a system for collecting and recovering waste components.

4. CONCLUSION

Ust-Kamenogorsk in the city waste main weapon and re processing system analysis as shown, the current when again processing level down as sit down, this is city to the ecology negative the effect Waste collection and processing not enough level, separate to collect system absence and again processing of power inferiority main problems as was determined. So along with waste funeral level very high, this of the city environmental situation from it further worsens [13...20].

Comparative analysis Ust-Kamenogorsk city waste again processing system improvement for a number of opportunities and measures to offer opportunity gives. Modern technologies and new

infrastructure projects input, waste separately to collect system development, people environmental to literacy education, as well as waste again processing and disposal to create the process improvement for special economic incentives necessary.

Upcoming in the years in the city waste separately collection and recycling processing effective done implementation for planned purposeful indicators and measures This is marked. measures Ust-Kamenogorsk city environmental the situation to improve and waste again processing system efficiency to increase opportunity gives.

The remains management and reconstruction processing current level and system according to of the results comparative analysis urban ecology and waste management system improvement for a number of important conclusions and recommendations to do opportunity gives. This of research practical importance waste management system in development new methods and technologies to introduce, environmental requirements provide to do, as well as city of the inhabitant's environmental culture to increase based on.

DATA AVAILABILITY

The data used in this study were obtained by the authors from public and paid sources.

AUTHORS' CONTRIBUTION

Conceptualization – KK; resources – ShS, EK; formal analysis – ShS, GM; methodology – GM; software – ShS; supervision – GM, KK; visualization – ShS; writing—original draft preparation – ShS; writing—review and editing – ShS, EK.

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ӨСКЕМЕН ҚАЛАСЫНДАҒЫ ҚАЛДЫҚТАРДЫ БАСҚАРУ ЖӘНЕ ҚАЙТА ӨНДЕУ ЖҮЙЕСІН ТАЛДАУ

Шыңғыс С. Сәбит*, Екатерина А. Кузнецова, Гульдана М. Минжанова х.ғ.к., Корлан К. Хамитова т.ғ.к.

әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан; sabitshingys@gmail.com, katrinka-2000@mail.ru,

guldana.mg@gmail.com, khamitovakorlan@gmail.com

Автор корреспондент: Шыңғыс С. Сәбит, sabitshingys@gmail.com

ТҮЙІН СӨЗДЕР

қалдықтарды қайта өңдеу
қалдықтарды басқару
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АБСТРАКТ

Бұл мақалада Өскемен қаласындағы қалдықтарды басқару және қайта өңдеу жүйесінің қазіргі жағдайы талданып, негізгі проблемалар мен оларды шешу жолдары қарастырылады. Зерттеу барысында қалдықтарды жинау, сұрыптау және өңдеу инфрақұрылымының жағдайы, статистикалық мәліметтер мен заңнамалық негіздер сарапталды. Қалдықтарды өңдеу деңгейінің төмендігі, бөлек жинау жүйесінің жеткіліксіз дамуы және қалдықтарды көмудің басымдылығы экологиялық мәселелерді күрделендіреді. Өскеменде қалдықтарды сұрыптау желісі іске қосылғанымен, толыққанды қайта өңдеу жүйесі әлі де қалыптасу сатысында. Нәтижесінде Өскемен қаласында қалдықтарды басқарудың тиімділігін арттыруға бағытталған кешенді шаралар ұсынылып, олардың қала экологиясын жақсартуға қосатын үлесі көрсетіледі.

АНАЛИЗ СИСТЕМЫ УПРАВЛЕНИЯ И ПЕРЕРАБОТКИ ОТХОДОВ В ГОРОДЕ УСТЬ-КАМЕНОГОРСКЕ

Шыңғыс С. Сәбит*, Екатерина А. Кузнецова, Гульдана М. Минжанова к.х.н., Корлан К. Хамитова к.т.н.

Казахский национальный университет имени аль-Фараби, Алматы, Казахстан; sabitshingys@gmail.com, katrinka-2000@mail.ru,

guldana.mg@gmail.com, khamitovakorlan@gmail.com

Автор корреспондент: Шыңғыс С. Сәбит, sabitshingys@gmail.com

КЛЮЧЕВЫЕ СЛОВА

переработка отходов
управление отходами
сортировка отходов

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АБСТРАКТ

В данной статье анализируется текущее состояние системы управления отходами и их переработки в городе Усть-Каменогорск, рассматриваются основные проблемы и пути их решения. В ходе исследования были изучены состояние инфраструктуры сбора, сортировки и переработки отходов, статистические данные и нормативно-правовая база. Низкий уровень переработки отходов, недостаточное развитие системы раздельного сбора и преобладание захоронения отходов усложняют экологическую ситуацию. Несмотря на запуск линии сортировки отходов, полноценная система переработки в Усть-Каменогорске еще находится на этапе становления. В результате предложены комплексные меры по повышению эффективности управления отходами, а также показан их вклад в улучшение экологической обстановки города.

Примечание издателя: заявления, мнения и данные во всех публикациях принадлежат только автору (авторам), а не журналу "Гидрометеорология и экология" и/или редактору (редакторам).