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Development of a Scheme for the Thermal Processing of Solid Household Waste

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ABSTRACT. The article presents a brief analysis of the experience in the use of municipal solid waste in Uzbekistan. The article has shown the volumes of solid waste accumulation and their morphological composition. The article presents the developed installations for thermal processing of solid waste using solar energy and presents a technique for the technical and economic analysis of systems for processing household solid waste based on solar energy. Energy saving in systems of solid household waste. The parameters of thermal and anaerobic fermentation of the processes occurring in this installation.

KEY WORDS: recycling, solid waste, processing, analysis, accumulation, hydrocarbon, landfill, solar energy, installation, morphological.

I.INTRODUCTION

Solid waste includes production and consumption waste - "the remains of raw materials, materials, semi-finished products, other products or products that were formed in the process of production or consumption, as well as goods (products) that have lost their consumer properties ...".

Solid household waste (SHW) - solid substances that cannot be disposed of in everyday life and formed as a result of depreciation of household items and in the course of people's lives. Recently, the solid component of municipal wastewater - their sediment [1].

The problem of the complete destruction or partial disposal of solid household waste - household garbage - is extremely relevant, first of all, from the point of view of negative environmental impact, especially in urban conditions. On the one hand, municipal solid waste is the richest source of secondary resources (including ferrous, non-ferrous and rare metals), and on the other hand, it is a "free" energy carrier, as household waste is a renewable carbon-containing energy raw material for fuel energy.

The most difficult task is the disposal of solid waste generated in residential and public buildings as a result of the life of the population. The approximate composition of the waste generated in residential and public buildings in the cities of Uzbekistan is shown in Fig. 1. [2].

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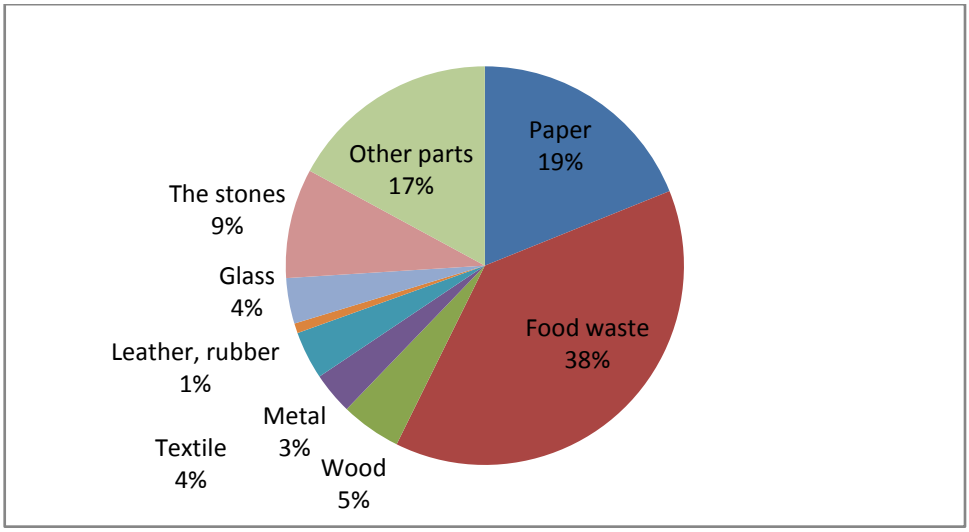

Fig.1. The approximate composition of solid waste generated in residential and public buildings

The volumes of solid waste accumulation and their morphological composition are diverse and depend on the economic conditions of the region, climatic zones, season, and many other factors (Table 1.1).

Table 1.1
Composition of municipal solid waste in the USA, Russia and Uzbekistan

№	Components	Content (% by weight)		
		USA	Russia	Uzbekistan
1	2	3	4	5
1.	Paper	40	20,85	18,9
2.	Plastic	8,0	6,5	5
3.	Food waste	7,4	46,55	38
4.	Wood	3,6	2,15	4,9
5.	Black metal	6,5	1,8	2,8
6.	Non-ferrous metal	2	0,35	0,6
7.	Bones	1,0	1,2	1,4
8.	Leather, rubber	2,5	0,35	0,8
9.	Textile	2,1	3,2	3,9
10.	Glass	6,0	4,75	3,7
11.	Stones, ceramics	1,9	0,85	8,9
12.	Other	19	11,49	11,1

The technology and organization of the collection, transportation and equipment parameters of waste processing plants are greatly influenced by the fractional composition of solid waste - the percentage of the mass of components passing through sieves with cells of various sizes. About 10 thousand hectares of land quite suitable for other purposes are allocated annually for the placement of solid waste, which are especially valuable in that they are located near cities and could be used as gardens and vegetable gardens, country rest houses, etc. At the same time, on average, about 410 kg of compost, landfill gas 140 m^3, 50 kg of the first screening of rough elements and scrap metal, 250 kg of the second screening (glass, fabric, wood, plastic) can be obtained from one ton of waste. About 70% of all screenings can be used to generate heat [2,4].

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II. SIGNIFICANCE OF THE SYSTEM

At the same time, the organization of the export of solid household waste from the population in the cities and regions of the Republic of Uzbekistan is in poor condition, practically all cities do not carry out the removal of solid household waste from the population on a systematic basis, the material and technical base of specialized sanitation organizations is not equipped with special equipment in the required amount, existing landfills do not meet sanitary rules and norms, in a number of places spontaneously formed landfills are used [2].

III. LITERATURE SURVEY

The problem of the use and disposal of municipal solid waste is currently one of the most important and at the same time far from the final solution. One reason is that a relatively small change in the composition of solid waste often requires a significant change in treatment technology. The main reason is that the processing and disposal of solid waste is a special case of the sanitary and environmental situation, which in the Republic of Uzbekistan leaves much to be desired. The amount of waste is growing, and their recycling is too small.

IV. METHODOLOGY

Thus, to date, considerable practical experience has been accumulated on the use of biogas from solid waste storage facilities. Currently, no such facilities have been built in the city of Karshi and Uzbekistan, which, in addition to the loss of economic benefit, leads to environmental gas pollution Fig.2 [3].

A) System Design

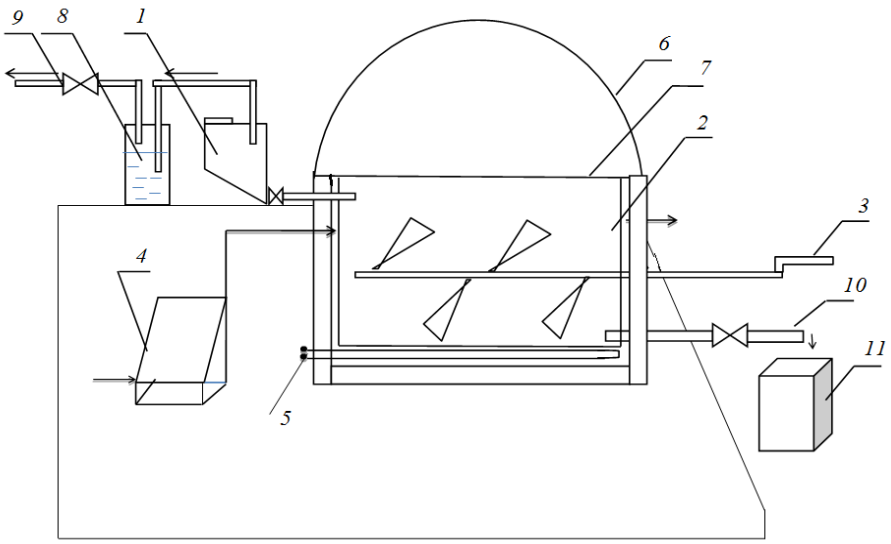

Fig.2. Scheme for the thermal processing of municipal solid waste

B) Dataset Description

Scheme for the thermal processing of municipal solid waste containing a receiving hopper (1), a landfill reactor (2), a mechanical mixer (3), a solar air heater (4), an electric heater (5), a polycarbonate coating (6), a metal sheet, i.e. absorber (7), and water filter (9),. To increase energy efficiency, the device is additionally installed electric heater is a backup heater (9), valve (10), exhaust pipe (11), exhaust hopper (12).

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Unsorted household, municipal and agricultural solid waste is loaded into a landfill reactor. Then the landfill reactor is sealed. Every 2-3 hours, the mixing of the mass of solid household waste occurs with the help of a mechanical stirrer, driven manually. In the initial stage of fermentation, the temperature in the landfill reactor is ensured up to 50-55 ° C by a heating system, namely, a passive and active solar system, and then additionally in a heating element. After 15-20 days, the fermentation process ends, the landfill gas is finally sucked into the water filter. Part of the landfill gas is sent to the consumer. The spent masses of municipal solid waste from the landfill reactor go to the storage, partially composted or to the landfill for solid household waste.

V. EXPERIMENTAL RESULTS

Preliminary calculations and tests show that the developed installation ensures a stable temperature regime of solid waste fermentation and saves thermal energy by 30-40% [2,3].

VI. CONCLUSION AND FUTURE WORK

Thus, the main and most rational direction in the elimination of many types of waste is their disposal - use as a "recycled" (secondary) raw material in the production of various materials. In this regard, the development of perfect and most effective methods for processing various types of waste is necessary. In general, it is economically viable, because compared with the use of traditional natural raw materials, the costs of exploration, construction and operation of quarries are eliminated, the cost of production is reduced and, along with this, environmental problems are solved.

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