



## Gravity Bioreactor

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The main problem of mankind's waste disposal is the growth of landfills and landfills. 4,000,000 hectares is the area used for landfills in Russia. This figure is quite comparable to the size of some countries, for example, Switzerland (4.12 million hectares) or the Netherlands (4.15 million hectares).

The dynamics of landfill growth is surprising - every year the figure increases by the size of the territory of Moscow within its new borders.

In other countries, for example, in Kazakhstan, they come to a decision - to burn garbage. "Vremya" newspaper 11/25/21. Kazakhstan. This is generally a backward technology - atmospheric poisoning and problems with the placement of combustion products. Ash and slag dumps still require new territories.

In nature, everything is organic and rational. For millions of years, nature and climate have evolved in the interaction of various substances, their transformations and circuits.

The emergence and development of industrialization began to disrupt the circulation of chemical elements. Each of them and their combinations, after use, becomes garbage and, when storing large volumes for a long time, creates a new phenomenon for nature. Nature has never had and does not know such volumes of garbage. The object is not alive, but has some signs of a living organism.

In the absence of oxygen, nitrogen, moisture, microorganisms, organic matter in the compacted waste begins to protest by rotting and raising the temperature to spontaneous combustion. As a sick organ of a living being, inflammation occurs - an abscess. Vari-

ous gases, liquids, thermal reactions, stench appear. The numerous fires of large piles of debris lead to the idea that the temperature in the sources of fire reaches 230 degrees Celsius. This is the ignition temperature of paper - the closest material to ignition in waste. Burning paper sets fire to the rest of the mass. Is it free heat from garbage? In an enclosed space with little or no access to oxygen. All that remains is to extract the heat. If you do not allow the ignition temperature, then this is the heat of boiling water, or rather steam can be used. The simplest contour of pipes running through such heaps can provide steam removal to turbines and heaters. The movement of water in pipes can stabilize the temperature at a given level.

Such a tool in the form of a "tower of Babel" is proposed in: <https://actascientific.com/ASMI/pdf/ASMI-04-0908.pdf>, which theoretically shows a new waste treatment technology. It is necessary to develop and supplement this direction. The shape of the truncated cone of the waste massif ensures the collection and processing of their significant volumes. However, constructively it is not so simple and not technologically advanced in implementation.

Using the Tower of Babel principle, heaps of rubbish are stacked into cylindrical containers such as grain elevators. The sizes of the cylinders should correspond to the volume of waste of the entire city - 10, 20, 200 meters in diameter and 20 - 200, 500 meters in height. Under the influence of gravity, rotting waste, which has given off heat, sinks into the lower layers, where water and air are supplied and the temperature drops to the specified values for humidity, the presence of oxygen - organic waste begins to be processed by microorganisms and worms, compost is formed, which is discharged at the very bottom.

Almost everything is subject to the processes of decay, combustion, oxidation, rusting, decomposition by microorganisms. This innovation proposes making all such processes manageable.

The volumes of the massif are mixed under the action of gravity at speeds corresponding to the specific gravity, size and shape of individual waste elements. Heating and composting zones are formed along the height, where air and water are supplied, the temperature decreases - conditions are created for the vital activity of microorganisms and worms. Heating and composting zones are determined by the quality of the waste and the conditions created. Fecal water supply seems to be the most rational. Gases, mainly - methane can be removed through special ventilation pipes and burned in the burners of heating furnaces. All processes are controlled and automated. The pressure of the rock mass and its looseness can be additionally controlled by changing the flow area or its shape. The heights of the zones of action of all these transformations and the speed of movement are determined by the composition of the waste, the quality, the ratios of the components, are determined empirically and are regulated by the change in temperature, the supply of gases and water.

At the bottom of the tower, through special devices, the finished compost is unloaded and transported to the fields. With a high variety of waste types, mechanical sorting of the output product through sieves is possible. Large and "indigestible" parts can be separated and sent to their intended purpose or for repetition.

The essence of the technical solution lies in the fact that all garbage without preliminary sorting, except for glass, rubber and plastic, harmful and radioactive elements, fits into a single collection. The upward feeding of material can be done with skip or mine hoists. Travel speed flow is controlled by the speed of unloading compost and braking devices as needed.

Experimental - design and research developments of the project should lead to the creation of a completely new engineering structure. Perhaps from cylindrical towers, up to 500 meters in diameter, placed in a circle, forming an extra-large cavity 20-200 meters high inside the circle. Height and dimensions are determined by the volume of waste, experimentally and the required processing speed. Various personal cycle processes can take place inside and between the towers. The covering of the top of a single structure - can be made in the form of a mountain with a variable height -

is combined for various purposes of various types. For example, for recreation areas with observation platforms, for greenhouses. Structurally, you can use the height of the structure to design inclined surfaces for ski slopes.

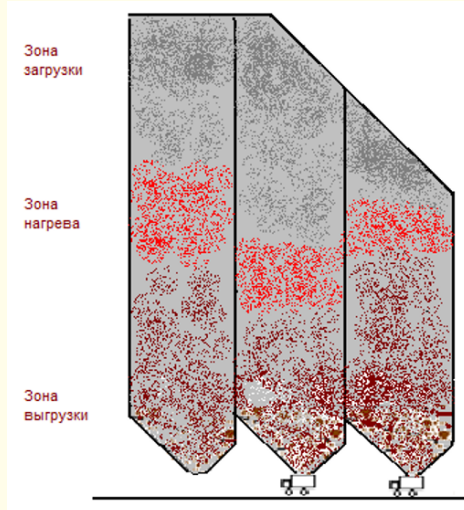


Figure 1

The recycling diagram shows the current mechanism for recycling household waste. It is fed to the very top with a mine hoist. As it oxidizes, burns, transforms, it turns into compost, is poured out of bunkers and taken to the fields.

Such a gravitational bioreactor can collect garbage from the entire city and dispose of waste from existing landfills and unauthorized landfills. This will allow the liberation and improvement of large areas around the cities. Pre-sorting and separation of different types can be reduced.

Such devices on a smaller scale seem to be rational and promising. Indeed, if you look at catering establishments - restaurants, canteens, sanatoriums from this point of view, you can see that the waste goes to the trash. At each of these enterprises, it is possible to create a device of a smaller volume, for example, a cylinder from standard barrels - shells without a bottom and a lid, stacked on top of each other 5-10 meters high. Heat and gas can be used for space heating and water heating, and compost can be scattered in flowerbeds and sold.

If we reduce the scale even further, the principle is applicable to individual private houses and cottages.

We use water as a working fluid and collected it in sedimentation tanks and reservoirs: <http://www.ijeska.com/index.php/ijeska/article/view/94/41>. The result is a distortion of the water cycle.

We also collect all other substances in heaps, and have reduced the rate of their return to nature. For millions of years, they have destroyed the accumulated cycles of the circulation of all natural elements. And the circulation of substances in nature is the main mover of all life on the planet and the climate.

Thus, as a result of industrialization and all economic activity, we influence nature, taking away from it the natural cycles of the circulation of all substances. And the climate and the future of our descendants and all life on the planet depend on them.

To restore the natural circulation of substances means to preserve the climate.

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