

WASTE-FREE TECHNOLOGY AND ISSUES OF ITS ORGANIZATION

Oripov M.A., Tursunova Kh.S

Bukhara State University

Relevance: *In the process of evolution, man gained the opportunity to influence the course of development of nature itself, using more and more new natural resources, inventing more and more innovative ways of obtaining means of subsistence, due to which he found himself in a situation where nature was no longer able to cope with his ever-growing needs and began to lose the natural self-healing mechanism. The population of the planet, especially large cities and industrial zones, is beginning to feel a lack of unpolluted air and experience a shortage of fresh water. The problem of sustainable development of civilization, ensuring the satisfaction of the needs of the community, but not threatening the existence of humanity today and its subsequent generations, must and can be solved so that the impact on the environment is within acceptable limits.*

Target: *Study the scientific literature on waste-free technologies and its organization.*

The term “waste-free technology” was proposed by academicians N.N. Semyakov and I.V. Petryanov-Sokolov and became widespread in Russia and abroad. However, the very idea of waste-free technology was outlined back in 1885 by D.I. Mendeleev in the article “Letters about factories”.

The theory of waste-free technological processes is based on two premises:

- a) natural resources should be extracted once for the complex production of all possible products, and not every time to obtain each of them;
- b) the created products must have a form that would allow them, after being used for their intended purpose, to be cost-effectively converted into the starting elements of a new production.

However, each new type of technology based on the principle of raw materials - finished product - raw materials is associated with wear and tear of materials and requires new energy costs and, therefore, additional natural resources outside the closed system. Thus, recognizing the progressiveness of the concept of waste-free technology, one should take into account its conditional nature, the ability to reduce environmental pollution, but not eliminate it completely. Zero-waste technology is understood as an ideal production model, and a theoretical limit that can only be partially realized.

Waste is formed mainly due to the presence of impurities in the raw materials that are not used in this process to obtain the finished product: side chemical reactions leading to the formation of unused substances; incompleteness of the process and consumption of the useful component in the raw material. The amount of waste generated can be reduced by using clean, concentrated raw materials. At the same time, the speed of the process increases and labor productivity increases. The same effect is achieved by reducing the rate of side reactions, for example, by increasing the selectivity of the process, increasing the completeness of the process by selecting optimal catalysts, etc. This not only reduces the amount of waste, but also increases production efficiency. The creation of waste-free technological processes involves both the development of rational methods and techniques for separating impurities from gases, and a fundamental change in the technological process or its

individual parts. Technology changes should follow the path of reducing emissions and reducing the cost of cleaning gases circulating in the system. An example of such a change in technology is the transition from purifying converted gases from ammonia production with copper-ammonia solutions to gas washing with liquid nitrogen (to release CO). The use of this cleaning method made it possible to abandon an expensive and complex unit and increase overall labor productivity in ammonia production. At the same time, there was no need to remove ammonia from gases and to discharge inert gases circulating in the system, and hence their purification.

According to the definition of the UN Economic Commission for Europe, waste-free technology is the practical application of knowledge, methods and means to ensure, within the framework of human needs, the most rational use of natural resources and energy, as well as environmental protection.

Waste-free technology- this is a method of producing products (process, enterprise, TPK), in which raw materials and energy are used most rationally and comprehensively in the cycle raw materials - production - consumption - secondary resources, in such a way that any impacts on the environment do not disrupt its normal functioning.

There are three main points here.

1. The need to use raw materials in a cycle that also includes the sphere of consumption is emphasized, which means that such a closed cycle can only be at the level of the industrial complex, i.e. waste-free production should be an almost closed system, organized by analogy with natural ecosystems.

2. Mandatory inclusion in production and consumption of all components of raw materials. At the same time, the maximum possible use of the potential of energy resources, naturally limited by the second law of thermodynamics, must be ensured. There is also a direct analogy with natural ecosystems, which, being practically closed, are not isolated, because a flow of energy passes through them.

3. Preservation (taking into account possible thermal pollution) of the existing economic equilibrium. In other words, environmental damage caused by production should not exceed an acceptable level.

In a broad sense, the concept of “waste-free technology” refers not only to technological processes, but also to a set of organizational and management activities, design and research work.

It must be emphasized that the main thing in waste-free production is not the recycling of waste, but the organization of production in such a way that all its components are used in the process of processing raw materials. Waste-free technological processes exist, but they are very rare, waste-free production is more common, and waste-free industrial and industrial complex can be organized almost always, but not in every territory.

In order to generalize and systematize the features of waste-free production, a number of interrelated principles underlying it can be identified:

-systematic principle (takes into account the interrelationship of production, social and natural processes);

-principles of integrated use of raw materials and energy resources (have environmental and economic significance);

-the principle of cyclicity of material flows (the most important of them are closed water circulation cycles).

-the principle of environmental safety (its most important consequence is the preservation of public health);

- the principle of rational organization (this implies that an increase in production volume and expansion of the range of products does not lead to unrecovered losses of natural resources in the region).

Creating low-waste and waste-free production is a very complex task that puts forward special requirements.

To technological processes:

1. Development of fundamentally new processes, the implementation of which significantly reduces or virtually eliminates the generation of waste and negative impact on the environment.

2. Integrated use of all components of raw materials and the maximum possible use of potential energy resources.

3. Possibility of maximum replacement of primary raw materials and energy resources with secondary ones.

4. Implementation of continuous processes.

5. Intensification, automation of processes.

6. Creation of energy technological processes, etc.

For raw materials, materials, energy resources:

1. The validity of their quality.

2. Preliminary assessment and division of raw materials and fuel into non-traditional, local, usefully extracted.

For finished products:

1. Providing the possibility and conditions for returning products to the production cycle after physical and moral wear and tear.

To neutralize and eliminate non-recyclable waste:

1. Justification of specific methods of neutralization and liquidation, including the design of installations and structures.

2. Assessment of the possible impact on the environment depending on the method of neutralization and disposal.

To the organization of production:

1. Cyclicity of matter flows (closed cycles).

2. The possibility of combining production based on the integrated use of raw materials and energy resources.

3. The possibility of industry cooperation of production based on the processing and disposal of secondary resources.

4. Validity of the area and construction site, taking into account background environmental pollution, prospects for the development of this production and other industries in the area.

5. Development of standards that limit the impact on the environment.

6. Accounting for unorganized, salvo and other short-term emissions.

7. Organization of continuous monitoring of the state of the environment in the area of the enterprise.

8. Improving the environmental service of industrial enterprises.

For economic activities:

1. Accounting for the cost of additionally produced products, saved natural resources and preventable economic and economic damage.

2. Environmental pollution leads to the emergence of 2 types of costs in the national economy:
- costs of preventing the impact (damage) of the polluted environment on certain types of objects (usually called recipients) and costs caused by the impact itself (damage caused to the environment by corresponding emissions).

Conclusions. The creation of waste-free technologies at any level requires simultaneous compliance with all interrelated principles, while the most important condition for its existence remains the system of neutralization, storage and disposal of waste, primarily toxic. When organizing low-waste and waste-free industries, their combination and intersectoral cooperation based on the integrated processing of raw materials and waste disposal are of great importance.

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