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**Incineration**

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In the modern world humanity faces a number of problems that need to be solved. One of them is the increasing pollution of the environment. If we talk about the problems of garbage and the lack of natural resources, then, incinerators are an excellent solution. Industrial incineration appeared in Great Britain in the second half of the 19th century, when incinerators were built at factories.

In 1874, the world's first incineration plant was built in Nottingham, and then the first steam plant was built there, where waste was used as fuel – this is how industrial incineration first found energy use. Garbage at that time was burned in bulk, without sorting, and filtration systems did not yet exist in furnaces and factories [1].

To date, there are more than two thousand waste incineration plants in the world, of which more than four hundred are located in Europe. The undisputed leaders in waste incineration are Switzerland, Finland and Sweden, where there is a well-established waste sorting system, which makes it possible to use waste as a fuel at a lower cost in this type of power plant.

There are two main technologies for waste incineration: layer combustion (first used in 1930 in Switzerland) and pyrolysis (used since the 50s of the last century). The main feature of layer combustion is the distribution of waste in the furnace in a uniform layer, to which hot air streams are supplied, which ensures uniform combustion. A layer of debris is loaded

into the combustion chamber and placed on the grate or air distribution grate. Typically, the combustion chamber is in the shape of a parallelepiped. When using a grate, it is installed at an angle, in which the grates are arranged in a cascade like a tiled roof. In the vertical plane between the grates there are slots or nozzles through which air is supplied. Depending on the chemical composition of the waste, incineration can be carried out at temperatures ranging from 800 to $1500^0$C. Most often, layered combustion on a movable inclined grate is used.

This technology allows you to incinerate any type of waste, except for dusty waste. The air in the combustion chamber is supplied in the same direction as the movement of the debris, also contributing to its movement. At the lowest grate, the combustion process is completed, and ash and slag through the grooves spill into a special tank cooled by water, and then disposed of. One chamber with a movable grate is capable of processing about 35 tons of waste per hour [2].

Pyrolysis is used for the disposal of toxic waste: some types of plastics, rubber, and a number of industrial waste. The technology of low-temperature pyrolysis is more widespread, in which waste decomposition occurs at temperatures below $900^0$C (usually 400-$600^0$C). The pyrolysis furnace, in which the waste is processed, consists of two combustion chambers: a lower waste incineration chamber and an upper generator gas afterburner. Before being loaded into the furnace, the mass of waste is crushed and then placed in the lower chamber, where it is burned in an oxygen-free environment. The gases formed during the decomposition are directed through the injector device to the afterburner, where oxygen and catalytic gases are supplied in limited quantities. There, further decomposition of gases takes place, as a result of which the content of toxic substances in emissions during pyrolysis is approximately 7 times lower than the maximum permissible concentrations.

Thus, the effectiveness of the pyrolysis technology lies in the reduction of the amount of harmful emissions and the destruction of biologically active substances, which allows further storage of pyrolysis waste without much harm to the environment. In addition, solid sediment, as well as liquids and gases formed as a result of waste pyrolysis, can be used as raw materials in the chemical industry or as fuel, thereby recycling waste.

In incinerators, emissions of dioxins (one of the most toxic technological substances) are filtered mainly by adsorption (mainly activated carbon). Also, for the splitting of dioxins and furans, secondary combustion of gases is used, since the temperature in the primary combustion chamber of garbage is not high enough. This allows you to significantly reduce the level of pollution from incinerators, thereby allowing them to be located directly in large cities – a potential source of their future fuel [3].

Incinerators have their drawbacks, such as: environmental pollution, although to a lesser extent than any thermal power plants; is not a complete solution to the waste problem, since ash residues need to be reburied, albeit in much smaller volumes, at this time; the cost of their construction is still high, although they pay off in 15-20 years with minimal risk to the environment – they are still an excellent solution to the problems of waste and lack of natural resources.

Perhaps, with the increased attention of scientists and engineers to this type of energy production, we will see incinerators not only in developed countries of Europe and Asia, but also in countries with weaker economies. Since incinerators have little impact on the environment, their ubiquity will soon be able to solve the greatest problem of humanity – global warming.