

THE PRINCIPLE OF OPERATION OF MECHANICAL WASTEWATER TREATMENT

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ABSTRACT

Wastewater treatment is a set of measures aimed at removing pollutants contained in wastewater. Special equipment is installed to perform the task in question. Often, the process of wastewater treatment is divided into 4 main stages: biological, mechanical, physico-chemical, disinfection. In this article we will consider the features of the mechanical method of wastewater treatment in more detail.

Keywords: dirty water, wastewater, physical and chemical cleaning, mechanical cleaning, sedimentation, filter.



Determination of mechanical wastewater treatment

There are a large number of methods of wastewater filtration and recycling. At the initial stage, the removal of suspended and solid particles is carried out. The mechanical method prepares the effluents for further biological and physico-chemical treatment.

Mechanical wastewater treatment is found both in everyday life and in industry. An example of a household application of the method can be called the installation of septic tanks – the initial filtration consists in separating large particles that simply cannot be processed by bacteria. This filtration method is also used in industry, but only other processes are used.



How mechanical filtration is carried out

For a long time considering the process of wastewater treatment, quite a lot of methods of wastewater treatment have been created:

Filtering. The primary stage of wastewater treatment consists in its passage through a steel grate with small sections. As a result of straining, an impurity remains on the grate, the particles of which are larger than the mesh holes. After straining, it is necessary to clean the mesh from impurities, since its throughput is significantly reduced. After this treatment, the effluents go to the next stage, which can be biological, physico-chemical or otherwise.

Settling is the most common method of mechanical cleaning, as it can be carried out with a small frequency of maintenance of the equipment used. The method is based on the basic laws of physics: under the influence of gravity, suspended particles under the influence of their weight settle at the bottom of the sump, after which a part is pushed to the surface. This method was used in the creation of clarifiers, sand traps and settling tanks, oil traps. An example is the situation when heavy particles, for example, mineral particles, are released from wastewater in sand traps. Sand and small stones settle on the bottom, a silt formation is formed, which is removed by cleaning. Modern rapid cleaning devices allow filtration to be carried out within 2 minutes, but in settling tanks this time increases to 2 hours. Depending on the characteristics of the sewer system, the settling tanks can be vertical, radial and horizontal, combined type. It is important in which direction and under what pressure the water is supplied. In the process, substances whose size is not less than 0.25 mm can be released.

Filtration involves the passage of wastewater through materials that have a porous structure. Filter materials can be represented by quartz sand, gravel, anthracite and other natural materials. Filtration is also carried out when using a grid with very small holes. As a result of the passage of effluents through filtering materials, a sediment remains, which is simply removed from the surface during maintenance of the equipment.

Centrifugation involves the use of special equipment – hydrocyclones. Such cleaning plants are of pressure and non-pressure action, in which the particles are screened out due to centrifugal force during the rotation of the liquid. Note that such equipment has high performance and compactness, it is possible to automate the process.

A cylindrical "package" represented by polymer disks. In this case, the surface of polymer disks forms a structure, when water enters it, it is cleaned of large impurities. This method has quite a few advantages: simplicity of the design used, reliability – these moments determine the distribution of this type of filtering equipment. The practicality of the application lies in the fact that, if desired, disc filters can be washed quickly and easily. At the same time, special tools do not need to be used to clean the structure. The use of modern cylindrical "packages" of polymer disks allows for filtration of approximately 20% of wastewater.

Flotation is another common method that has been widely used in the oil refining, chemical, metalworking and food industries. The features of this method are as follows: the gas is fed into the liquid and causes bubbles to appear, which squeeze out particles of dirt onto the surface. After some time, foam with a high content of pollutants forms on the surface. It is worth considering the fact that the degree of filtration is about 90-95%. The gas is supplied by electrolysis, and special coagulant substances are added

to increase the efficiency of the method. They are able to significantly accelerate the process of precipitation of pollutants.

The considered methods of purification allow for filtration of wastewater by about 10-30%. Deeper cleaning involves the use of other methods.

Used equipment for mechanical filtration

1. The grid is used extremely often to block moving large particles in the flow of drains. Its design features will consist in the presence of a metal frame on which metal rods or plates are fixed. They are located both vertically and horizontally or at an angle. Many structures have a system for removing the blockage that is formed during the filtration of wastewater. In some cases, the grate is installed together with the crusher – it reduces the size of fractions.

2. Sand traps have high reliability in case it is necessary to ensure filtration of effluents from various mineral substances. Due to the high density, they settle at the bottom of the structure. When choosing this filter unit, attention should be paid to the conditions under which they can be installed. An example is the slow movement of water, when small particles settle on the bottom, but this is undesirable. The suitable flow velocity is 15-30 cm per second. Sand traps are often installed on horizontal sections of the system and have two main elements: working and sedimentary. The working element passes sewage, the sedimentary element is intended for their accumulation. After a long period of operation of the filter unit, it is necessary to clean the bottom, for which a pump or a hydraulic elevator or other mechanism is installed – it all depends on the volume of drains. An important point is that a good sand trap is able to clean drains by 75%.

3. Settling tanks are a fairly common type of equipment that also allows you to remove particles from drains. Settling tanks are classified according to the purpose of the device: they are installed before or after the treatment plant. According to this indicator, the device is divided into primary and secondary settling tank.

4. Silt platforms. Such structures ensure the drying of wet precipitation that enters the system. When the humidity of the drains is about 100%, it decreases to 75%, after which the amount of impurity is significantly reduced. The filtration process involves the use of a sufficiently large plot of land, around which earthen ramparts are placed. As a result, several layers of sediment are formed, part of the liquid evaporates, and the other passes into the ground. As a result of the completion of this filtration process, the sediment is collected and removed manually, the sludge water is diverted to other treatment facilities.

5. The above methods are more common in industry. Due to the high cost and large size of cleaning structures, their use in everyday life is impractical.

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