BIOLOGICAL WASTEWATER TREATMENT: BASIC CONCEPTS AND STAGES OF CLEANING

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Abstract. *This article contains feedback and information about the main concepts and stages of treatment obtained as a result of paying close attention to the issues of biological wastewater treatment.*

Keywords: *biological wastewater, treatment, organic matter, biochemical treatment, aerotanks, activated sludge.*

Biological wastewater treatment is the main method of wastewater treatment containing pollution of organic origin, which consists in the mineralization of these pollutions due to the vital activity of microorganisms. In the process of respiration of microbes, organic substances are oxidized and energy necessary for vital functions is released. In this process, wastewater sent for biochemical treatment is characterized by two different value bases. These are BOD - biochemical oxygen demand or the amount of oxygen used in the biochemical processes of oxidation of organic substances during a certain time (day), mg O2 per 1 mg of substance. And COD is the chemical demand for oxygen, that is, the amount of oxygen equivalent to the amount of consumed oxidizing agents needed to oxidize all reducing substances in water. COD is also expressed as mg of O2 per mg of substance.

There are also aerobic and anaerobic methods of biochemical wastewater treatment. Aerobic methods of biochemical wastewater treatment continue in the presence of oxygen. They are based on the use of aerobic groups of organisms, whose life requires a constant supply of oxygen and a temperature of 20-40 ° C.

Anaerobic methods of biochemical wastewater treatment continue without access to oxygen. They are mainly used to remove sediments.

The process of biochemical wastewater treatment is not carried out simply by aerotanks. It takes place in certain stages. They can be noted as follows:

- adsorption and coagulation of suspended and colloidal particles by activated sludge;
- oxidation of organic compounds dissolved and adsorbed by mud by microorganisms;
- nitrification and regeneration of activated sludge. In this case, excess activated sludge is removed from the facility.

One can witness the use of single-stage and multi-stage cleaning systems in practical processes.

The wastewater enters the equalizer, where there is an intensive mixing of wastewater with different qualitative and quantitative composition. Mixing is done through air supply. If possible, the required amount of biogenic elements and ammonia water are also fed to the equalizer to create a certain pH value. The residence time in the homogenizer is usually several hours. In sand traps and primary clarifiers, treated water is separated from coarse suspensions and oil products that form a film on the surface.

Biological water treatment is carried out in aeration tanks. What exactly is an aerotank? it is reasonable to ask. Aerotank is an open reinforced concrete structure through which wastewater flows, containing organic pollutants and activated sludge. During its time in the aeration tank, the sludge suspension in the wastewater is exposed to air aeration. Intensive aeration of activated sludge suspension with oxygen restores its ability to absorb organic compounds. Biological water treatment is based on the activity of activated sludge (AI) or biofilm, which is a natural biocenosis formed in each specific production, depending on the composition of wastewater and the selected treatment mode.

Activated sludge is a mixture of microbial biomass and pollutants along with wastewater entering the aerotank.

Activated sludge is a dark brown lump up to several hundred micrometers. It consists of 70% living organisms and 30% solid particles of inorganic nature. Living organisms together with a solid carrier form a symbiosis of populations of microorganisms covered with a common mucous membrane - zoogle. In this case, depending on the external environment, which is waste water, one or another group of bacteria may prevail, and the rest will become companions of the main group.

An important role in the creation and operation of activated clay belongs to the simplest. The functions of the simplest ones are very diverse; they themselves do not directly participate in the consumption of organic matter, but regulate the age and species composition of microorganisms in activated sludge and maintain it at a certain level. When the composition of wastewater changes, the number of one of the types of microorganisms may increase, but other substances will still remain in the biocenosis.

It can also be observed that the formation of activated sludge senoses is affected by seasonal temperature changes, oxygen supply, and the presence of mineral components. All this serves to make the composition complex and practically unrepeatable. The efficiency of treatment facilities also depends on the concentration of microorganisms in the wastewater and the age of the activated sludge. The current concentration of activated sludge in traditional aerotanks does not exceed 2-4 g/l.

An increase in sludge concentration in the wastewater results in an increase in the treatment rate, but requires an increase in aeration to maintain the oxygen concentration at the desired level. Thus, aerobic wastewater treatment includes the following steps:

1. Substrate adsorption on the cell surface.
2. Degradation of adsorbed substrate by extracellular enzymes.
3. Absorption of dissolved substances by cells.
4. Growth and endogenous respiration.
5. Issuance of released products.
6. "Eat" of the primary population of organisms by secondary consumers.

Ideally, this should lead to complete mineralization of the waste: common salts, gases and water. In practice, treated water and activated sludge from the aeration tank are sent to a secondary settling tank, where the activated sludge is separated from the water. Part of the activated sludge is returned to the treatment system, and excess activated sludge formed by the growth of microorganisms falls into the areas where it is dewatered and transported to the fields. Anaerobic treatment of activated sludge is not possible. Recycled activated sludge can serve as both fertilizer and feed for fish and livestock.

The system after complete treatment can consist of many elements, which are determined by the further purpose of the wastewater. Perhaps biologically purified water will create an immunity to the use of biological ponds that are clarified and saturated with oxygen. Ponds also belong to the biological treatment system, in which the oxidation of organic compounds is observed under the influence of active mud biocenosis. The composition of biocenoses of biological ponds is determined by the depth of location of this group of microorganisms. Aerobic cultures develop in the upper layers, and facultative aerobes and anaerobes capable of methane fermentation or sulfate reduction processes develop in the lower layers. Water saturation with oxygen occurs due to photosynthesis processes carried out by algae.

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