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MODELING OF AEROBIC BIOLOGICAL WASTEWATER TREATMENT PROCESSES WITH ACTIVATED SLUDGE

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ABSTRACT

The article under discussion depicts modeling of aerobic biological wastewater treatment processes with activated sludge. The authors of the article consider that methods of biological wastewater treatment are currently widely used, namely - aerobic biological treatment methods with the help of activated sludge microorganisms. The main elements of the technological scheme of aerobic biological treatment facilities are aeration tanks - aero tanks for biochemical processes of oxidation of organic pollutants and secondary settling tanks for separation of activated sludge from treated wastewater. Organic substances in fine, colloidal and dissolved states are subjected to biological treatment, during which the biochemical processes of oxidation by microorganisms of activated sludge are realized.

KEY WORDS: *modeling, aerobic wastewater, activated sludge microorganisms, organic pollutants, biological treatment, colloidal, technological processes of production, mineral contaminants.*

DISCUSSION

At present, the ecological protection of the natural environment from its pollution by industrial wastes and domestic sewage of settlements is a great scientific and technical problem. Entry of organic and mineral contaminants into water and soil basins occurs with the discharge of municipal and industrial wastewater generated during the implementation of technological processes of production and processing of products and in the process of human activity. A distinctive feature of wastewater discharged into municipal sewage treatment plants is that they are largely free of large inclusions of mineral origin, largely contaminated with organic matter. In this

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regard, there is a need for construction of complex treatment facilities, providing indicators of purification from organic compounds, set by the state environmental authorities [1].

Treatment of highly contaminated wastewater has a number of features that significantly complicate the use of conventional, widespread methods of treatment of organ-containing wastewater. Municipal wastewater contains a wide range of organic carbon-, nitrogen- and phosphorus-containing contaminants in dispersed, colloidal and dissolved states. Dispersed contaminants (mainly coarse- and medium-dispersed particles), which are in suspended state, are separated from the waste water by various methods in the process of mechanical treatment (mainly by gravitational sedimentation in primary sedimentation tanks) and removed from sewage treatment plants to sludge beds. Organic substances in fine, colloidal and dissolved states are subjected to biological treatment, during which the biochemical processes of their oxidation by microorganisms of activated sludge are realized. In this case, the effectiveness of biological treatment facilities (aero tanks, biofilters, secondary settling tanks) is largely determined by the concentration of wastewater contaminants that have previously undergone mechanical treatment [2].

Currently, methods of biological wastewater treatment are widely used, namely - aerobic biological treatment methods with the help of activated sludge microorganisms. The main elements of the technological scheme of aerobic biological treatment facilities are aeration tanks – aero tanks for biochemical processes of oxidation of organic pollutants and secondary settling tanks for separation of activated sludge from treated wastewater. Organic substances in the fine, colloidal and dissolved state are subjected to biological treatment, during which the biochemical processes of oxidation by microorganisms of activated sludge are realized [5].

The effectiveness of sewage treatment plants is determined primarily by the perfection of the technological scheme, the optimal coordination of modes of its main elements (aero tank and secondary settling tank) and the choice of scientifically based design and technological solutions in the design and construction.

Therefore, to achieve high cleaning performance, satisfying the requirements of environmental authorities, it is necessary to study the biological and hydraulic processes occurring in cleaning systems during their operation in industrial conditions.

According to modern views the solution to the problem of optimizing the performance of treatment systems can be found only by modeling the biological and hydrodynamic processes taking place in the treatment facilities. The existing biological models, in particular, the most commonly used Mono and Herbert models are considered. Existing theoretical and experimental works on the research of microbiocenoses of biological wastewater treatment facilities and compositions of organic substrate coming for treatment have been analyzed.

Activated sludge functioning in wastewater treatment plants is a living consortium, which has a complex structure. The biocenosis of activated sludge consists mainly of microorganisms associated with trophic and metabolic processes that result in wastewater treatment.

Managing mixed cultures of microorganisms under conditions of continuous processes of biochemical oxidation of organic pollutants is one of the promising ways to maximize the biological activity and oxidative capacity of activated sludge microorganisms. In this regard, studying the kinetics of growth, life activity and die-off of mixed microbial populations in the biomass of activated sludge is an urgent and important task. Proper selection of effective technological schemes of purification and optimization of compositions of activated sludge biocenoses are the main ways to achieve high purification rates and reduce excessive biomasses of activated sludge. Purposeful regulation of the vital activity of microbial populations contributes to reducing the content of pathogenic microflora in wastewater to sanitary norms and obtaining maximum efficiency of biochemical processes of oxidation of organic pollutants by microorganisms [2].

One of the main ways to intensify aerobic biological wastewater treatment is to increase the concentration of interacting components involved in the process, microorganisms and dissolved oxygen. To achieve these goals, facilities with higher doses of activated sludge, with the use of technical oxygen, with more efficient use of oxygen, with more productive aerators, etc. have been developed. However, even these possibilities were not unlimited, mainly due to the limited intensity of diffusion processes in aeration structures. As recent studies show, to overcome this shortcoming, it is necessary to provide a longer contact time of the treated medium with the oxygen source, to increase the surface of the "liquid-oxygen" phase interface and to implement a more rapid renewal of their boundaries. Implementation of these directions has led, on the one hand, to the creation of deep (mine) aeration tanks, and on the other hand, to the use of biological systems with attached (immobilized) microflora.

The attachment of microorganisms to the solid medium increases the duration of their stay in the reaction medium. The latter circumstance is of no small importance in view of the cost of disposal of large amounts of biomass of activated sludge. In biological layers formed on the solid surface of the carrier, at a steady mode of bioreactor an equilibrium between the processes of biofilm growth and leaching from the carrier layer is established. In this regard, there is no need for biomass recycling, fundamentally necessary for wastewater treatment in traditional aeration tanks, working on dispersed biomass. In addition, it should be noted a lower moisture content of biofilm compared to the activated sludge biomass of traditional aeration tanks, and thus a more effective separation of biofilm from treated water in the secondary settling tanks.

It is also important for aerobic biological immobilized systems that in a three-phase environment consisting of liquid, gas and solid carrier, the efficiency of oxygen use is increased. The dose of attached biomass of activated sludge developing on the surface of the solid carrier is 30 g/l or more in ash-free matter, which is completely unattainable for traditional aeration tanks with any method of thickening of activated sludge.

CONCLUSION

However, despite the above advantages, the method of immobilization of microorganisms on a solid carrier has not yet found wide application in the industry. This is explained by the fact that the available information on biological treatment with the use of biomass immobilization technique in scientific and technical literature is not systematized, often contradictory and, as a rule, inaccessible to a wide range of specialists in the field of industrial wastewater treatment.

The introduction of immobilization of microbial biomass into the practice of wastewater treatment is significantly complicated by the lack of a unified calculation methodology and recommendations for the hardware design of the treatment process in industrial conditions. The available literature data on the high efficiency of immobilization technique for biological removal of carbon-containing organics, nitrification and denitrification either contain fragmentary material or are totally unsuitable for practical use in designing sewage treatment plants. The development of industrial technology of biological wastewater treatment in immobilized beds requires extensive experimental and theoretical research of physical and biological processes both in the laboratory and under industrial conditions. Such studies, including the study of hydrodynamics and kinetics of biological processes of synthesis of biomass and assimilation of organic pollutants in wastewater, will ensure the creation of the most rational and efficient design schemes of aerobic biological treatment facilities.

REFERENCES

1. *Benefield L.D. 1990. Biological process design for wastewater treatment. P.56*
2. *Chinesa S.C., Irvine R.L. 1995. Growth and control of filamentous microbes in activated sludge: an integrated hypothesis. Water Research, vol. 19, N 4, p. 471-479.*
3. *Daigger G.T., Grady C.P. 1992. The dynamics of microbial growth on soluble subetrates. Water Research, vol. 16, p. 365-382.*
4. *GorchevH.G. Ozolins G. 1994. WHO guidelines for drinking-water quality. WHO chronicle. N 38, p. 103-108.*
5. *Logan B.E., Hunt J.R. 1998. Bioflocculation as a microbial response to substrate limitations. Biotechnology and Bioengineering, vol. 31, N 2, p. 91-101.*
6. *Wang L.K., Borgenthal T., Wang M.H. 1991. Kinetics and stoichimetry of respiration in biological treatment process. Jour, of Environmental Sciences, January/february, p. 39-43.*