

ІЕЕЕД
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**ІНСТИТУТ
ЕКОНОМІЧНИХ
ТА ЕКОЛОГО-
ЕНЕРГЕТИЧНИХ
ДОСЛІДЖЕНЬ**
ГРОМАДСЬКА ОРГАНІЗАЦІЯ

ГО «ІНСТИТУТ ЕКОНОМІЧНИХ ТА ЕКОЛОГО-ЕНЕРГЕТИЧНИХ ДОСЛІДЖЕНЬ»
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EASTERN EUROPEAN DEVELOPMENT AGENCY, (Словацька Республіка)
VYSOKÁ ŠKOLA DANUBIUS, (Словацька Республіка)
UNIVERSITY OF ECONOMY IN BYDGOSZCZ, (Республіка Польща)
UNIVERSITY OF MARYLAND, COLLEGE PARK, (USA)
WOJ'T OF GMINA GROMADSKA, (Республіка Польща)
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II МІЖНАРОДНА НАУКОВО-ПРАКТИЧНА КОНФЕРЕНЦІЯ

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НОРМАТИВНО-ПРАВОВОГО
ПОТЕНЦІАЛУ УКРАЇНИ
ТА ЇЇ РЕГІОНІВ**

Збірник тез

01 червня 2022 р.,
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Рецензенти:

Чорний Роман – доктор економічних наук, професор, директор Нововолинського навчально-наукового інституту економіки та менеджменту, Західноукраїнський національний університет.

Рейкін Віталій – доктор економічних наук, професор, доцент кафедри менеджменту та адміністрування, Волинський національний університет імені Лесі Українки.

Проблеми раціонального використання соціально-економічного, еколого-енергетичного, нормативно-правового потенціалу України та її регіонів: матеріали II Міжнародної науково-практичної конференції ГО «ІЕЕЕД», (01 червня 2022 року), м. Луцьк: СПД Галяк Жанна Володимирівна, друкарня "Волиньполіграф", 2021. 214 с.

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В даному виданні розміщено вибрані праці, що за змістом своїм розкривають наступну проблематику: соціально-економічний потенціал України в умовах воєнного стану; екологічний потенціал України в умовах воєнного стану; енергетичний потенціал України в умовах воєнного стану; підприємництво в Україні за умова воєнного стану; маркетингові процеси забезпечення стабілізації держави в умовах воєнного стану; фінансово-інвестиційна стабілізація держави в умовах воєнного стану; нормативно-правове забезпечення стабілізації держави в умовах воєнного стану; публічне управління, адміністрування в умовах воєнного стану.

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Gornostal S.

Candidate of Technical Sciences, Associate Professor,
Senior Lecturer of Department of Applied Mechanics
and Environmental Protection Technologies

**Gorban D.
Molchan A.**

2th year student, Faculty of Fire Safety
National University of Civil Defence of Ukraine,
gornostalsa@gmail.com

FEATURES OF THE WORK OF BIOLOGICAL WASTEWATER TREATMENT FACILITIES IN MARTIAL LAW

The conditions of martial law, in which Ukraine found itself in February 2022, made adjustments to the work of all spheres of economic activity. It is difficult to assess the negative consequences of shelling, explosions, lack of normal living conditions, recreation. In some regions, citizens do not have access to food, drinking water, medicine, and cannot get to work. All these problems have been fully experienced by public utilities, which provide drinking water, receive and treat wastewater from the public and businesses. It should be noted that as soon as there is a minimum opportunity to resume work, utilities try to provide citizens with drinking water, electricity, gas, drainage and wastewater. All this is happening even in spite of problems with personnel, material and technical resources.

A feature of biological wastewater treatment plants is their location outside the buildings. Aeration tanks, secondary settling tanks are reinforced concrete structures, the water level of which is approximately at ground level. Their service includes:

- constant inspection of the integrity of structures;
- periodic control of indicators characterizing the quality of cleaning, the state of activated sludge;
- adjustment of air supply, concentration of activated sludge.

To perform these actions, staff must walk around the area, take samples, transfer them to the laboratory. In order to reduce the environmental consequences of possible treatment of untreated or insufficiently treated wastewater in a state of war, it is necessary to organize the work of facilities in such a way as to minimize the presence of maintenance personnel in hazardous conditions. Therefore, the aim of the study is to propose measures that will ensure the effective operation of biological treatment facilities and compliance with environmental requirements for urban wastewater treatment, taking into account the peculiarities of martial law.

To achieve this goal there are several tasks:

- analyze the features of wastewater treatment;
- identify factors that affect the cleaning process;
- to propose measures for the effective operation of biological wastewater treatment facilities, taking into account the peculiarities of their work in martial law.

To treat a mixture of wastewater, which contains industrial and domestic effluents, use the following scheme:

- pre-lighting on mechanical treatment facilities;
- complete treatment at biological treatment facilities.

In mechanical treatment plants, the bulk of the largest and heaviest particles are removed from the wastewater. Then the clarified liquid enters the biological treatment, which provides for the removal of fine suspensions, colloidal and dissolved organic contaminants. After cleaning, the water is disinfected.

In different regions of Ukraine for wastewater treatment use equipment that differs in variety in shape, composition, size, technological features. Its choice is due to consumption, physical and chemical properties of wastewater entering treatment. One of the schemes that is actively used for biological wastewater treatment from small settlements or areas of large cities is the system «aeration tank-displacer - secondary settling tank». The peculiarities of the cleaning process in the aeration tank-displacer is that it does not completely mix a portion of wastewater and activated sludge. Due to the displacement effect, the load on the activated sludge and the oxidation rate at the beginning of the process increase, then these indicators gradually decrease. The increase in silt is not more than 5%. Features of the design and course of the process in the aeration tank-displacer led to its use in the indicator of biochemical oxygen demand in wastewater entering the treatment, not more than 500 mg/liter. The advantages of the design include more efficient separation of the sludge mixture from the treated water in the secondary settling tank. In fig. 1 shows a schematic diagram of the system «aeration tank-displacer - secondary settling tank".

Analysis of the features of the system «aeration tank-displacer - secondary settling tank» showed that the operation of facilities is significantly influenced by the concentration of activated sludge, the amount of air and the properties of the wastewater entering the treatment. Thus, the regulating ratios of «sewage activated sludge air» can affect the efficiency of biological treatment and ensure compliance with environmental requirements. This makes it possible to effectively protect the environment from pollution by insufficiently treated or untreated wastewater.

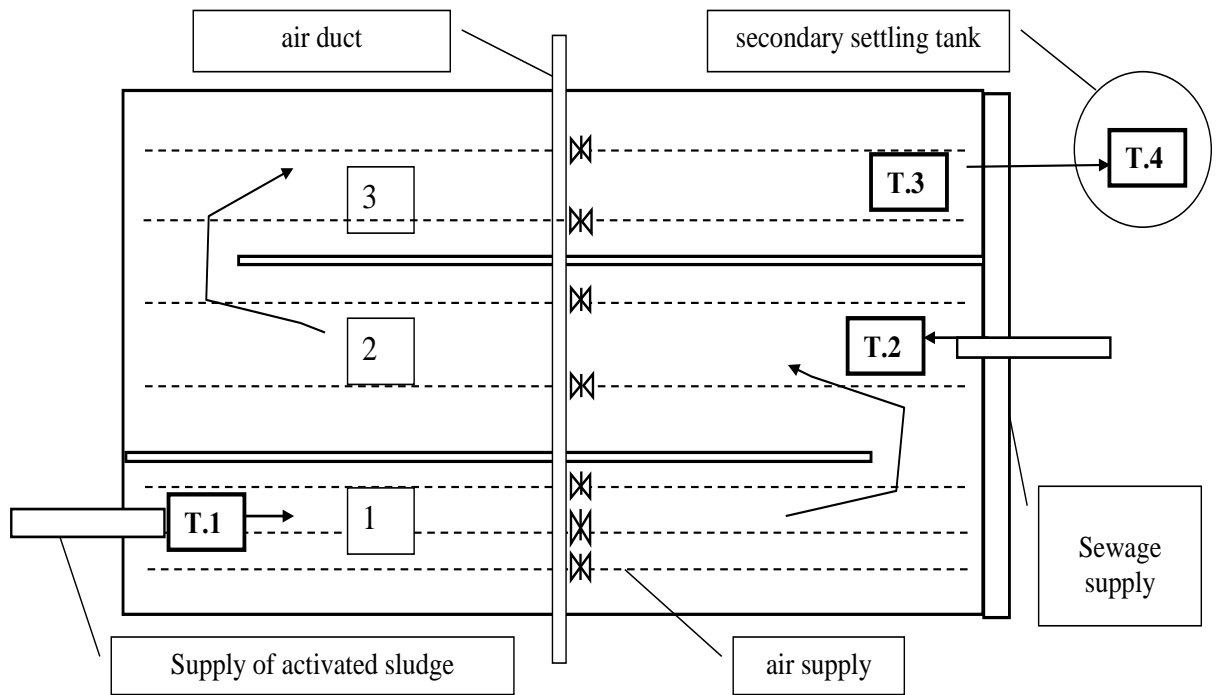


Fig 1. - Scheme of the system «aeration tank-displacer - secondary settling tank»: 1 - the first (regenerator), 2 - the second; 3 - the third corridor.

Mathematical modeling is used to study the cleaning process at different stages of its course and to determine the influence of individual factors. It allows you to take into account the complexity and features of the processes occurring in different parts of buildings. When developing mathematical models for the system "aeration tank-displacer - secondary settling tank" we have taken into account the following features of the purification process:

1. Activated sludge enters the first corridor of the aeration tank for regeneration.

2. Sewage mixed with activated sludge is concentrated in the second corridor. The mixture is then discharged to a secondary settling tank.

To describe these processes, it is necessary to make two models that take into account the peculiarities of their course in different parts of biological treatment plants. To build the models, the factors influencing the mode of operation of the system «aeration tank-displacer - secondary settling tank» are identified. Such factors include wastewater consumption, quantity and quality of activated sludge fed into the aeration tank, the saturation of the environment with oxygen. It is also taken into account that the air supply through the corridors of the aeration tank is carried out with different intensity. To control the course of the treatment process at different stages, such parameters as

the consumption and concentration of contaminants in the wastewater entering the treatment, the indicators of activated sludge, the intensity of aeration of the mixture in the aeration tank.

As a result of experimental research, data were obtained for compiling empirical dependencies [1, p. 73]. The obtained equations describe the change in the concentration of activated sludge at the outlet of the regenerator and the change in the concentration of contaminants in the treated water at the outlet of the treatment plant. The analysis of the adequacy of the obtained dependences according to Fisher's criterion is carried out. He showed that in the boundary conditions adopted during the experiment, the equations adequately describe the process of biological treatment in the system "aeration tank-displacer secondary settling tank".

The proposed dependences allow to investigate without additional experiments the processes occurring at different stages of purification in the aeration tank. In addition, the researcher has the opportunity to change the parameters of the treatment system, comparing different options for the supply of wastewater and activated sludge. It is also possible to change the characteristics of the wastewater, to vary the parameters of the air supply. This allows you to choose the mode of operation of facilities, taking into account the characteristics of the liquid coming for cleaning, and ensure compliance with environmental requirements.

For simple and convenient use of the models, a method of choosing the mode of operation of the aeration tank, which receives a mixture of industrial and domestic wastewater, is proposed [2, p. 204]. Its application allows you to quickly respond to changes in the quality of wastewater entering treatment, ensure compliance with environmental requirements and reduce the negative burden on the environment due to insufficient treatment of wastewater.

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