INTERNATIONAL JOURNAL OF RECENTLY SCIENTIFIC RESEARCHER'S THEORY

USE OF AN OXYGEN CONE FOR THE INTENSIFICATION OF WATER SUPPLY IN FISH FARMS

[1]Kholikov A.M., [2]Akmalkhonov T. Sh., [2]Usmonova R.A., [2]Zhumaeva O.A., [2]Kadirkulov A.A.
[1]Fish Farming Research Institute,
[2]Tashkent State Agrarian University

Annotation. In article describes an improved technology for the device of an oxygen cone (oxygenator) to increase the concentration of oxygen in artificial reservoirs using the laws of hydrodynamics.

Key words: photosynthesis, concentration, nozzle, diffusion, aeration, oxygenator, Segner wheel, hydrodynamic flow exciter.

Introduction. We know that oxygen is present in dissolved form in any reservoir. Depending on the environmental parameters, the oxygen concentration in the reservoir may vary. For example, when atmospheric pressure decreases, the equilibrium concentration of dissolved oxygen also decreases. Temperature and the degree of mineralization also affect this concentration, but in a different way. With a decrease in both the temperature and the degree of mineralization of the reservoir, the amount of dissolved oxygen also decreases.

The main sources of oxygen in the reservoir are oxygen from the air (enters the water by the mechanism of absorption on the surface), precipitation water (it is more saturated with oxygen), biological activity (photosynthesis) of aquatic plants. It is also worth mentioning that wastewater often has a fairly high degree of oxygen saturation due to the high efficiency of oxygenation processes used by humans. Thus, one of the sources of oxygen in the reservoir is purified and prepared wastewater.

The content of dissolved oxygen in water has a decisive influence on the life cycle of aquatic fauna and flora, because at a low level of its content, the living conditions of the reservoir become unsuitable for its inhabitants. Note that oxygen is involved in the decomposition of biological compounds. Thus, the content of dissolved oxygen in a reservoir is an important indicative factor of the well-being, ecological and sanitary condition of reservoirs.

A sharp decrease in the concentration of dissolved oxygen in the reservoir may indicate its contamination with easily oxidizing (most often organic) impurities. Note that the biochemical and biological processes occurring in the reservoir depend on the concentration of RC and therefore its sharp decrease leads to negative consequences. They include: eutrophication (by anaerobic bacteria, photosynthetic bacteria and algae), the extinction of aerobic organisms (fish, shellfish, plankton, etc.), an avalanche-like increase in the concentration of easily oxidizable organic impurities.

The content of dissolved oxygen depends on the temperature, atmospheric pressure, degree of water turbulization, amount of precipitation, mineralization of water, etc. At each temperature, there is an equilibrium oxygen concentration, which can be determined from special reference tables compiled for normal atmospheric pressure. The degree of saturation of water with oxygen corresponding to the equilibrium concentration is taken equal to 100%. The solubility of oxygen increases with a decrease in temperature and mineralization and with an increase in atmospheric pressure.

The content of dissolved oxygen in surface waters can range from 0 to 14 mg/l and is subject to significant seasonal and daily fluctuations. Significant oxygen deficiency can occur in eutrophied and highly contaminated water bodies. A decrease in the concentration of dissolved oxygen to 2 mg/l causes mass death of fish and other hydrobionts.

The content of dissolved oxygen in water has a decisive influence on the life cycle of aquatic fauna and flora, because at a low level of its content, the living conditions of the reservoir become unsuitable for its inhabitants. Note that oxygen is involved in the decomposition of biological compounds. Thus, the content of dissolved oxygen in a reservoir is an important indicative factor of the well-being, ecological and sanitary condition of reservoirs.

A sharp decrease in the concentration of dissolved oxygen in the reservoir may indicate its contamination with easily oxidizing (most often organic) impurities. Note that the biochemical and biological processes occurring in the reservoir depend on the concentration of RC and therefore its sharp decrease leads to negative consequences. They include: eutrophication (by anaerobic bacteria, photosynthetic bacteria and algae), the extinction of aerobic organisms (fish, shellfish, plankton, etc.), an avalanche-like increase in the concentration of easily oxidizable organic impurities. Dissolved oxygen is a very unstable component of the chemical composition of waters. When determining it, sampling should be carried out especially carefully: it is necessary to avoid contact of water with air until oxygen is fixed (binding it into an insoluble compound).

The control of oxygen content in water is an extremely important problem, in which almost all sectors of the national economy are interested in solving, including ferrous and non–ferrous metallurgy, chemical industry, agriculture, medicine, biology, fish and food industry, environmental protection services. The dissolved oxygen content is determined both in uncontaminated natural waters and in wastewater after treatment. Wastewater treatment processes are always accompanied by oxygen content control. The determination of dissolved oxygen is part of the analysis in determining another important indicator of water quality – biochemical oxygen consumption (BOD). In natural uncontaminated reservoirs, fluctuations in the level of dissolved oxygen are quite noticeable. Most reservoirs are characterized by annual, monthly and even daily fluctuations in the concentration of dissolved oxygen, but its level should not fall below certain values (the threshold average value of 4 mg / l is most often mentioned, since a decrease in concentration below this value can lead to mass death of the fauna of the reservoir).

Methods and methods for research. Oxygen enrichment of water, especially wastewater, is one of the most important stages of water treatment and preparation of wastewater for discharge into reservoirs. Various methods are used to carry out this process. Their choice is determined by the requirements for a particular process.

For example, primary oxygen saturation of wastewater (aeration) is often carried out by spraying water in the air through nozzles. The smallest drops of water, in contact with the oxygen of the air, are saturated with it in the process of diffusion. This method is very simple and effective, but requires relatively high energy consumption and large areas. A further development of this method is the nozzle spraying of water in tanks at elevated pressure. Due to the high partial pressure of oxygen in such tanks, the diffusion process occurs more quickly, and water can be saturated with oxygen to a greater extent, however, this method is even more energy-consuming, since it requires constant maintenance of high pressures of both water and gas.

One relatively popular method of oxygenating water is simply passing air through a mass of water. This method is called pneumatic oxygenation. Because of its simplicity, it is often used to saturate aquariums with oxygen in stores and when transporting live fish, however, you should know that the efficiency for such systems is relatively low, so they can hardly be called effective.

It is possible to increase the efficiency of this method by applying mechanical methods of mixing water with gas, for example, paddle agitators in combination with oxygen sprayers. This significantly increases the efficiency of the process, so such systems can be used for the oxygenation of wastewater.

Separately, it is worth noting the methods that use the laws of hydrodynamics to enrich water with oxygen. These include the jet method and the method using oxygenation cones.

The essence of the jet method is the use of a hydrodynamic effect that leads to an increase in the flow rate at the points of narrowing of the pipeline. Thus, the oxygen source installed before the narrowing supplies gas to the water, which then accelerates, often with the transition of the flow from laminar to turbulent mode. In this regard, both the saturation of the water mass with oxygen and the crushing of gas bubbles occur when the water layers are shifted, which, in general, noticeably accelerates and facilitates the whole process. Nevertheless, this method is very energy-consuming, since it requires the use of a large number of powerful pumps to ensure sufficient fluid pressure, and the pipelines used for it quickly wear out due to cavitation phenomena and the aggressive action of oxygen on the wall material.

Further development of the jet method are oxygenation cones. These devices are cone-shaped pipelines installed with the wide side down. Oxygen is supplied inside the device, but the gas pressure and, as a result, the rate of bubble ascent are selected in such a way that the speed of water movement in the narrow part of the cone is higher, which leads to the establishment of a kind of equilibrium in the system. Thus, the cone acts as a trap for oxygen bubbles, which is constantly in contact with the mass of water, which leads to a full diffusion of gas and a high degree of oxygen saturation of water. This method is one of the most energy efficient and is often used in fisheries enterprises.

For all the above methods, an oxygen source is required. As such, both liquefied gas cylinders and oxygen generators can serve. From the point of view of the economic feasibility of the process, generators are the preferred option because they are more energy efficient. The oxygen generator performance directly depends on the power consumed by the device, and PSA and VPSA generators have a fairly high efficiency. The principle of their operation consists in sequential processes of sorption and desorption of air oxygen by zeolites under pressure created by the compressor. The second stage, desorption, differs for PSA and

VPSA generators only by the pressure of the chamber: if a desorption chamber is used for the PSA generator, operating only at low rarefaction or at atmospheric pressure, then more efficient VPSA generators desorption oxygen in vacuum, which increases the oxygen yield from one sorption cycle-desorption.

Despite a number of difficulties arising in the process of oxygenation, it is almost always economically feasible, since oxygen saturation of water is an important and relatively simple way to clean wastewater from pollutants of various nature, and also has a positive impact on the ecology of the reservoir where the treated and prepared wastewater is discharged[].

In natural uncontaminated reservoirs, fluctuations in the level of dissolved oxygen are quite noticeable. Most reservoirs are characterized by annual, monthly and even daily fluctuations in the concentration of dissolved oxygen, but its level should not fall below certain values (the threshold value of 4 mg / l is most often mentioned, since a decrease in concentration below this value can lead to mass death of the fauna of the reservoir).

Dissolved oxygen is beneficial to humans in many ways. Reservoirs saturated with this gas are best suited, for example, for fish breeding. Also a high degree of saturation of the reservoir water with oxygen leads to an intensification of oxidation processes. That is why wastewater aeration is carried out.

Aeration is one of the main methods of wastewater treatment. This method is suitable for water with any composition of impurities, since in this process many organic compounds pass into their oxidized form, which poses less threat than the reduced one.

Norms and MPC in surface and wastewater differ in different ways. Depending on the type of water, different norms of dissolved oxygen content are established, for example:

• For fishery reservoirs – 6 mg/l for valuable fish species, 4 mg/l for the rest;

• For water of surface reservoirs, when measured before 12 o'clock in the afternoon, the concentration of dissolved oxygen should be at least 4 mg/l;

• When the oxygen concentration decreases below 2 mg/l, mass death of the fauna of the reservoir is observed, therefore, this concentration is set as the minimum standard for wastewater.

Nevertheless, modern control measures practically exclude such possibilities.

Dissolved oxygen is found in natural water in the form of O2 molecules. Its content in water is influenced by two groups of oppositely directed processes: some increase the concentration of oxygen, others decrease it. Among the first are the absorption of oxygen from the atmosphere, the release of oxygen by aquatic vegetation during photosynthesis and the entry into reservoirs with rain and snow waters, which are usually supersaturated with oxygen. In artesian waters, all these factors practically do not work and therefore there is no oxygen in such waters. In surface waters, the oxygen content is less than theoretically possible due to the processes that reduce its concentration, namely: oxygen consumption by various organisms, fermentation, putrefaction of organic residues, oxidation reactions, etc.

The relative oxygen content in water, expressed as a percentage of its normal content, is called the degree of oxygen saturation. This parameter depends on the water temperature, atmospheric pressure and the level of mineralization. Calculated by the formula

:

$$M = (a*101308*100)/N*P,$$

where M- is the degree of oxygen saturation of water, %;

a -is the oxygen concentration, mg/dm3;

P- is the atmospheric pressure in the area, MP.

N- is the normal oxygen concentration at a given temperature and total pressure of 0.101308 MP.

In fish farming, pneumatic oxygenation of water is used, in which pneumatic oxygenation of water is used, in which gaseous oxygen is milked through a fine spray. The disadvantage of this method is low efficiency.

A more effective method is mechanical oxygenation, the essence of which consists in mechanical mixing of oxygen with water. They are installed, as a rule, directly in the fish-breeding pool or feeding channels. Spray and jet oxygenation are also highly effective, but they are energy-consuming and have not found wide distribution. Oxygenation with the use of oxygenation cones is widely used in fish farms.

The experience of operating such oxygen oxygenators has shown that the supplied gaseous oxygen is poorly mixed with the enriched water and is not fully saturated with it, which lowers the efficiency of the installation.

The task of the proposed experiment is to intensify the process of hydrodynamic mixing of oxygen with water and increase the specific oxygen content in water mg /l.

The problem is solved by the fact that in a well-known oxygen oxygenator containing a working cone, inlet and inlet valves for the treated water, a pressure gauge, a control tube and a valve for supplying gaseous oxygen, a hydrodynamic flow exciter is installed inside the working cone, made in the form of a coaxially located central axis of a ferrojet wheel consisting of at least four-shaped outlets communicating with the oxygen gas distribution pipeline, while a narrowing flap is installed at the outlet end of the outlets.

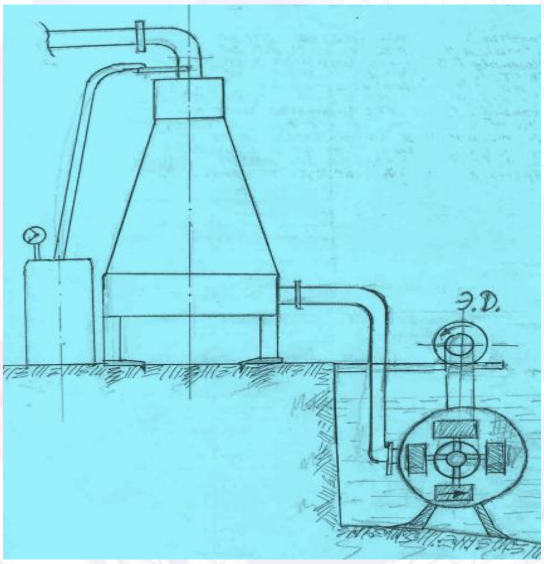

Fig. 2. Oxygen cone.

The working cone of the oxygenator (Fig.1) contains a cone-shaped closed container consisting of a boiled cone-shaped bell, sealed by means of annular bandages with a delicate cone-shaped container.

The upper pillar is closed from above by the bottom, on which there is a feeding valve for supplying the treated water. A control pressure gauge is installed at the entrance to the bell to measure the pressure in the apparatus,

and inside the coaxially central axis, a hydrodynamic flow exciter is installed on the upper bearing support and the lower support, made in the form of at least four L-shaped bends mounted on the central tube With narrowing flaps

fixed at the outlet end, the central tube is connected through a branch pipe, an adjustable valve with a compressed oxygen gas supply pipeline. The cone-shaped container rests on the bottom and a stand and is equipped with an outlet valve for the discharge of treated water.

Results. The oxygenator for the closed water supply system of fish farms works in a monitoring manner. During the transition of many fish farms to an intensive method of fish breeding, it is necessary to use oxygenation of the return water, i.e. saturation of it with oxygen.

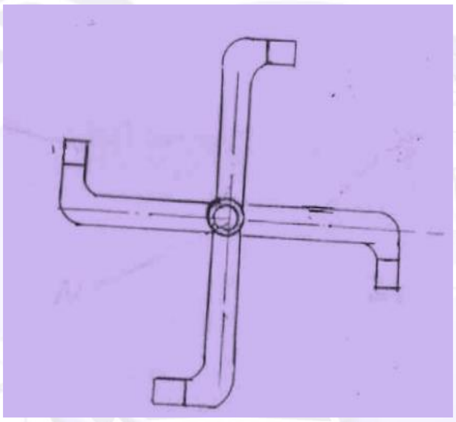

Fig.3. Flow exciter.

To do this, depending on the throughput capacity of the oxygenator (from 15 to 150 m3 / hour), it is fed through the supply valve from the main line of the inlet water for processing. At the same time, an oxygen-water mixture falls through the pipeline, an adjustable valve and a branch pipe into the central tube. The incoming mixture, at the exit of the L-shaped outlet and the narrowing flap, creates a reactive force directed in the opposite direction, due to which the formed Segner wheel will begin to rotate around the vertical axis, creating circular movement of water layers and thereby mixing of the liquid in the apparatus. At the same time, the efficiency of oxygen dissolution in water can reach up to 95% or 25 mg/l. The oxygen-enriched water is removed through the outlet valve into the fish-breeding feeding pool.

Thus, the proposed oxygenator allows you to maintain the vital activity of fish at a high planting density. such equipment, as demonstrated by experimental operation in fish farming systems, plays an important role in the intensive method of water supply of fish farms.

Literature

1. Glushankov, K.V. Basic information on fish farming / K.V. Glushankov, S.M. Solovyov. - L.: AgroGiz, 1988. - 104 p.
2. Grishchenko, L.I. Diseases of fish with the basics of fish farming / L.I. Grishchenko, M.Sh. Akbaev. - M.: Kolos S, 2013. - 480 p.
3. Journal "Fish farming and fishing". Annual filing for 1958. - M .: Publishing house of the Ministry of Agriculture of the RSFSR, 1994. - 384 p.
4. Ilyin, M.N. Aquarium fish farming / M.N. Ilyin. - M.: Publishing house of Moscow State University, 1980. - 400 p.
5. Kalaida, M. L. Biological bases of fish farming. Brief theory and practice. Textbook / M.L. Kalaida. - M.: Sciene St, 2014. - 224 p.
6. Kochetov, A.M. Ornamental fish farming / A.M. Kochetov. - M.: Enlightenment, 1991. - 384 p.
7. Mukhachev, I.S. Lake commercial fish farming / I.S. Mukhachev. - M.: Lan, 2013. - 991 p.
8. Ponomarev, S.V. Industrial fish farming / S.V. Ponomarev. - M.: Lan, 2013. - 995 p.
9. Ryzhkov, L.P. Lake commercial fish farming / L.P. Ryzhkov. - M.: Agropromizdat, 1987. - 336 p.
10. Ryzhkov, L.P. Fundamentals of fish farming / L.P. Ryzhkov, T.Yu. Kuchko, I.M. Dzyubuk. - M.: Lan, 2011. - 560 p.
11. Ryzhkov, Leonid Pavlovich Fundamentals of fish farming. Textbook. Vulture UMO MO RF / Ryzhkov Leonid Pavlovich. - M.: Lan, 2011. - 899 p.
12. Grinevsky E. V. et al. Design of fish-breeding enterprises. Agropromizdat. 1990.-223p..