

Fish Farming in Indoor Water Supply Systems

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ABSTRACT: Breeding fish in RAS has a lot of advantages in comparison with its breeding in open water. But the installation itself is expensive and knowledge is needed to work with it. Therefore, before deciding to start a fish farming business in a RAS, you need to write a business plan with calculations and carefully analyze the idea. The following article is devoted to the practice of fish farming in indoor water supply systems.

KEY WORDS: indoor water supply system, breeding, fertilizer, purification, reservoir, fish waste, air installation, water treatment, filter.

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There are following advantages of breeding fish in RAS:

Ecologically clean fish comes out in the RAS.

You can grow exotic species of fish.

There is no season in the RAS and the fish are farmed all year round.

You can breed fish in any climatic conditions.

RAS can be placed in any available spacious room.

When grown in a RAS, there is a 3-fold saving on feed compared to growing in ponds.

Compared to rearing in artificial ponds, it is possible to control all fish breeding processes in RAS.

Obtaining by-products - fish produce droppings that can be used as fertilizer. Also, in a closed space, fish gives off carbon dioxide, which is used in the greenhouse business.

RAS is a closed water supply installation. The technology is used to grow fish, but it can be used to breed shrimp, mussels and other representatives of the seas, oceans, freshwater reservoirs. The technique has become relevant especially in recent years. Israeli and American scientists have tried to combine two technologies, RAS and hydroponics. Growing fish on RAS

Usually, artificial reservoirs are used for rearing fish. The fish is in a relatively limited space, receives a sufficient amount of food. This allows her to develop quickly. Recently, there has been a tendency to move away from this methodology and switch to new fish farming technologies.

This is due to the environmental situation, which is only getting worse every year, with changing climatic conditions in the world. Elevated temperatures adversely affect aquaculture, flora and fauna.

This problem exists both in open reservoirs and in artificially created ponds. Breeders began to switch to the technology of closed water supply. For fish, a volumetric pool is provided indoors. It maintains a certain temperature, acid-base balance. An artificial closed reservoir is constantly supplied with oxygen. Feeding pets is carried out according to the regimen. Feed is delivered according to certain standards.

The water in the pool is constantly updated. 5% of the liquid volume is removed from the pool, goes through the purification stage and is returned back to the pool. This ensures the cleaning of the "reservoir" and the flow, which brings the existence of aquatic life closer to the natural environment.

Fish waste is removed through filters to sedimentation tanks with anaerobic bacteria, where further purification of the liquid takes place. The sediment that remains is disposed of or used as organic fertilizer; taken to agricultural land.

The RAS scheme for fish breeding is as follows:

fish-breeding pool;

drum pre-filter for mechanical water purification; it provides a system for cleaning the filter itself; all dirt is discharged into the sewer or into septic tanks;

biofilter; organics are affected by heterotrophic bacteria that convert ammonia to nitrates; some units use the bacteria "pseudomonas"; they neutralize, convert nitrates to the level of atmospheric air;

degasser;

compressor for saturating water with oxygen;

equipment for disinfection; use ultraviolet;

swimming pool.

All installations are connected by pipes with a large diameter, so that pollution does not occur. RAS technology assumes constant circulation of water in the system. Breeders are constantly faced with the question of how to get rid of waste, where to dispose of suspensions. At the same time, the waste is a good organic fertilizer.

What we should have in mind about the basin farms is the direct-flow system of water use. This means that the water in the fish-breeding tanks where fish are grown is supplied from a water source, and then discharged from them into the water intake, either directly or through some kind of reservoir or tank that serves as a settling tank and purifies the discharged water. The water source and the water receiver can be the same river or canal. Only the water intake is carried out upstream, and the spillway - downstream. However, another scheme of water use is also possible. Water from the sump can not be discharged into the water intake immediately, but part of it, clarified after settling, can be sent back to the fish tanks. This method is called a recycling water supply system (WTS). It allows you to reduce water consumption by several times and use water resources more rationally. If the system is completely closed and water supplies are replenished only in the sump, which decrease due to evaporation, then such a water supply system is called closed. Recirculating water systems (RAS) differ from plants with a circulating water supply system (WTS) only in the proportion of daily make-up. In RAS it is less than 30% per day of the total volume of water in the system, in WDS - more than 30%. In modern RAS, no more than 3-5% of fresh water is added per day.

When operating plants with a closed water cycle, the process of water purification comes to the fore. The accumulation of toxic waste products of fish is the main threat, which is fought in various ways. All methods of water purification are divided into 4 groups: physical, chemical, physico-chemical and biological. Physico-chemical and chemical methods of water purification (adsorption of organic substances using activated carbon, skimmers (floaters), ultraviolet irradiation, ozonation, ion exchange, etc.) are most often used for caviar incubation. The most common method is ozonation. Ozone is a strong oxidizer of organic matter and a disinfectant. It should only be remembered that ozone, even in small concentrations, is detrimental to fish, especially juveniles, so ozonized water must be additionally defended.

The most widespread in industrial RAS are physical (also called mechanical) and biological methods of water treatment. For mechanical water purification, horizontal, vertical, shelf settling tanks are used, in which water settles and clarifies, freeing itself from most of the solid suspended particles, and coarse and fine filters (gravel, sand, and others), in which suspended particles are filtered and removed. Centrifuges and hydrocyclones are also used for this purpose. The use of settling tanks, as practice has shown, is ineffective due to the length of the settling process, the need for large volumes of containers for this, occupying large areas. In addition, there are heat losses in the settling tanks, which increases the consumption of electricity, and secondary water pollution is possible due to the decomposition of the accumulated sediment.

Biological water purification is a mandatory process in RAS, without which their efficient operation is impossible. It is based on the ability of microorganisms to decompose organic and inorganic substances that accumulate in water during fish farming, and is aimed at removing from recycled water primarily nitrogen and phosphorus compounds, which are the main sources of pollution. Biological treatment can take place in special devices - biofilters, aerotanks, as well as in biological ponds, where there is a special microflora or the so-called activated sludge. Activated sludge is a community of microorganisms - bacteria - capable of oxidizing organic matter.

Devices for biological water purification are divided into 3 types, each of which is currently used in industrial installations: aeration tanks, integrators, biofilters.

Aerotanks are containers filled with activated sludge and equipped with devices for aeration or oxygenation (saturation with liquid oxygen) of water. They can be without loading and with loading, which is gravel, expanded clay, ceramic or glass elements, polyethylene granules, and which allows to increase the concentration of bacteria and specific productivity. Aerotanks are relatively inexpensive and easy to maintain. However, they have a rather low performance, so there is a need for large volumes of cleaning blocks. The ratio of the volume of fish tanks to the volume of aeration tanks is 1:8-1:10. In addition, with aerotanks, it is usually not filters that are used for mechanical water purification, but settling tanks, since a large amount of suspended activated sludge makes it difficult for filters to work. All this makes it difficult to maintain the required temperature and increases the cost of electricity for heating water.

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