



**ФАН ВА ТЕХНОЛОГИЯЛАР
ТАРАҚҚИЁТИ**
**РАЗВИТИЕ НАУКИ И
ТЕХНОЛОГИЙ**



1
2025

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ИЛМИЙ – ТЕХНИКАВИЙ ЖУРНАЛ

РАЗВИТИЕ НАУКИ И ТЕХНОЛОГИЙ

НАУЧНО – ТЕХНИЧЕСКИЙ ЖУРНАЛ

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Муассис:

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INCREASING THE ENERGY EFFICIENCY OF BIOLOGICAL TREATMENT PLANTS BY AUTOMATING MEASUREMENTS OF MAIN TECHNOLOGICAL PARAMETERS.

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Annotation. This study work discusses instruments and devices for measuring technological parameters of wastewater treatment to automate treatment processes in order to achieve energy-efficient indicators of consumed energy resources, in particular electricity. The main object of study is an aeration tank in which the aeration process is carried out, which is the most energy-intensive process in the implementation of biological wastewater treatment.

Key words: aeration, aeration tank, compressor, dissolved oxygen concentration, frequency converter, measuring device.

ПОВЫШЕНИЕ ЭНЕРГОЭФФЕКТИВНОСТИ БИООЧИСТНЫХ УСТАНОВОК ПУТЕМ АВТОМАТИЗАЦИИ ИЗМЕРЕНИЙ ОСНОВНЫХ ТЕХНОЛОГИЧЕСКИХ ПАРАМЕТРОВ

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Аннотация. В этой научной работе рассмотрены приборы и устройства измерения технологических параметров очистки сточных вод для автоматизации процессов очистки в целях достижения энергоэффективных показателей расходуемых энергетических ресурсов, в частности электроэнергии. В качестве основного объекта исследования рассмотрен аэротенк в котором осуществляется процесс аэрации, которая является самым энергоемким ходом осуществления биологической очистки сточных вод.

Ключевые слова: аэрация, аэротенк, компрессор, концентрация растворенного кислорода, частотный преобразователь, измерительный прибор.

ASOSIY TEXNOLOGIK PARAMETRLARNING O'CHISHLARINI AVTOMATLASHTIRISH YO'LI BIOLOGIK TOZALASH QUVVATLARINING ENERGIYA SAMARALIGINI OSHIRISH

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Annotatsiya. Ushbu ilmiy ishda iste'mol qilinadigan energiya resurslari, xususan, elektr energiyasining energiya tejankor ko'rsatkichlariga erishish uchun oqava suvlarni avtomatik tozalash jarayonlariga tozalashning texnologik parametrlarini o'lchash asboblari va boshqa asboblarni muhokama qilinadi. Asosiy tadqiqot obyekti - aeratsiya jarayoni amalga oshiriladigan aeratsiya tanki, bu oqava suvlarni biologik tozalashni amalga oshirishda eng ko'p energiya talab qiladigan jarayondir.

Kalit so'zlar: aeratsiya, aerotenk, kompressor, erigan kislorod konsentratsiyasi, chastota o'zgartgichi, o'lchash asbobi.

Reducing electricity consumption, improving the quality of water and wastewater treatment, as well as reducing water losses in water supply networks are the three main problems solved by the majority of Russian water utilities as part of programs to improve energy efficiency and requirements for the quality of water and wastewater treatment.

Reducing electricity consumption, improving the quality of water and wastewater treatment, as well as reducing water losses in water supply networks are the three main problems solved by the majority of Russian water utilities as part of programs to improve energy efficiency and requirements for the quality of water and wastewater treatment. The first and main cost item in wastewater treatment technology is electricity.

Today, an effective tool for reducing energy consumption at wastewater disposal facilities is the use of blowers with variable frequency drives, with which it is possible to reduce energy consumption by adjusting the power of the blower depending on the actual load of treatment facilities.

However, using compressors with variable frequency drives alone, it is impossible to reduce energy consumption without losing the quality of wastewater treatment, since the automation of air supply to the aeration tank should be carried out while maintaining the optimal concentration of dissolved oxygen in the aeration tank.

Operational monitoring of the content of dissolved oxygen in the aeration tank by the chemical laboratory of the water utility, unfortunately, is impossible, since it can be carried out no more than 1-2 times a day, while the oxygen concentration depends on many parameters and is constantly changing.

Thus, to control the air supply to the aeration tank based on the content of dissolved oxygen, it is necessary to use stationary in-line oxygen sensors. Using these sensors, it is possible not only to continuously monitor the dissolved oxygen content in aeration tanks, but also to automate the process of regulating the blower using controllers. Energy savings when implementing this solution can reach 30%.

Direct implementation of the solution described above is usually not possible in practice. Typically, at treatment plants, several compressors pump air into one line, which then diverges into several aeration tanks. In this case, the air supply to each aeration tank is regulated by automatic valves on the supply air ducts based on the readings of dissolved oxygen sensors, and the performance of the blowers is controlled by changes in pressure in the common air duct.

When carrying out comprehensive automation of biological treatment facilities, it is also necessary to provide a system for recording air flow rates at each aeration tank. This allows you to monitor the throughput of the aeration system, a change in which leads to disruption of the technological process and an unjustified increase in energy consumption.

Selection of instrumentation. The selection of control and measuring instruments for solving these problems should be carried out taking into account the specifics of the technological process of biological treatment facilities. When selecting dissolved oxygen sensors, it is primarily the level of wastewater contamination in the aeration tank at which the sensors must provide reliable measurements with a minimum of maintenance.

The most common types of dissolved oxygen sensors are amperometric and optical. Amperometric sensors are attractive in price, but when used in water utilities they have a serious drawback - the need for regular and labor-intensive maintenance.

Optical oxygen sensors are somewhat more expensive and allow not only to increase the reliability and accuracy of measurements, but also to eliminate consumables and minimize maintenance.



Fig.1. In-line dissolved oxygen sensor, installation on the side of an aeration tank

For the determination of dissolved oxygen in aeration systems, Endress+Hauser offers the Oxymax COS61D optical sensor in conjunction with the Liquiline CM44x secondary converter. Up to eight oxygen sensors can be connected to one Liquiline CM44x transmitter simultaneously, reducing the cost of automating multiple measurement points.

It is necessary to specifically note the Russian-language menu of the device, as well as the possibility of archiving data onto a flash card and the compatibility of the system's output signal formats with all common modern automation systems.

Selecting the optimal devices for monitoring air flow in aeration pipes is an equally important task. Air flow rates in an aeration system often vary over a wide range, making an orifice plate equipped with a differential pressure sensor ineffective for this task. At high air flow rates, it creates a large pressure loss, which requires additional energy to overcome, and at low flow rates it "goes blind".

The requirements of the aeration process are most accurately met by flow meters of the thermal-mass operating principle, which determine the flow rate by the cooling effect of the heated electrode by the oncoming gas flow. Such flow meters have a flow rate range of up to 100:1 and practically do not create additional losses in the aeration system.



Fig.2. Thermal mass flow meter on the supply pipeline

To monitor the air flow in aeration pipes, Endress+Hauser offers thermal mass flow meters from the t- mass series . Installation and dismantling of these submersible devices can be carried out without stopping the technological process. In addition, a spill-free verification technique has been developed and approved for t- mass , thanks to which it is possible to reduce the costs of their operation.

In addition to the tasks described above, Endress+Hauser also offers measuring instruments for solving many other tasks for automating water treatment and wastewater technology in water utilities. For example, analyzers for automatically determining the content of aluminum and iron in drinking water, ammonium and nitrates in aeration tanks, phosphates and nitrites; instruments for measuring the level of sand in sand traps, specialized instruments for continuous measurement of the level of sediment in primary and secondary settling tanks, samplers.

Products specifically developed by Endress+Hauser for water and wastewater systems include electromagnetic flowmeters for measuring potable, waste and process water with a diameter of up to 2400 mm. A spill-free verification method has been developed for these flowmeters without dismantling them from the pipeline, making the use of these flowmeters with a diameter of more than 300 mm in Russia becoming fundamentally possible.

In addition to measuring instruments, Endress+Hauser offers comprehensive solutions for the automation of drinking water quality monitoring and turnkey wastewater treatment, services for the maintenance of sensors and complex measuring systems. In partnership with Endress+Hauser , it is therefore possible to solve various measurement automation tasks in water supply and wastewater systems, from standard to the most ambitious.

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UO'K 621.314

REAKTIV QUVVAT MANBALARI YORDAMIDA ELEKTR ENERGIYASINING SIFAT KO'RSATKICHLARINI BOSQICHMA-BOSQICH OSHIRISHDA TIZIMLI TAHLIL OLIB BORISH

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Annotatsiya. Maqolada elektr energiyasining sifat ko'rsatkichlari hamda sifat ko'rsatkichlarining asosini tashkil etuvchi asosiy elementlar hamda kattaliklar, reaktiv, aktiv hamda to'la quvvatning elektr tarmoqlaridagi asosiy roli, muhimlik darajasi, reaktiv quvvat manbalari, statik kondensatorlar, kommutatsiya o'chirgichli reaktorlar, to'yinadigan reaktorlar va kombinatsiyalangan reaktorlarning elektr energiyasi sifatini oshirishga bog'liqlik darajasi inobatga olinib tahlil qilindi.

Kalit so'zlar: elektr ta'minoti tizimining asosiy elementlari, kondensator batareyalariga asoslangan statik tiristorli kompensatorlar, kondensator batareyalari, kommutatsiya o'chirgichli reaktorlar, to'yinadigan reaktorlar, elektr uzatish liniyalari reaktiv quvvat manbasi sifatidagi o'rni, kombinatsiyalangan reaktiv quvvat manbalari.