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IMPROVING THE DESIGN AND DEVELOPMENT OF WATER INTAKE STRUCTURES AND WATER TREATMENT TECHNOLOGIES IN OPEN-CHANNEL IRRIGATION SYSTEMS BY UTILIZING WATER PURIFICATION METHODS.

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ANNOTATION.This article extensively studies issues related to the design of water intake structures for the use of surface water resources for drinking and technical purposes, as well as the application of water treatment methods and the improvement of water treatment technologies. The ecological and sanitary conditions of surface waters were analyzed, and factors affecting water quality were considered. The article describes mechanical, chemical, and biological water treatment methods, membrane technologies, ultraviolet disinfection, and the importance of automated control systems. In addition, scientific and methodological recommendations are provided for energy saving, environmental safety, and rational management of water resources in water supply systems.

KEYWORDS. Surface water, water treatment, water preparation technologies, water intake structures, filtration, coagulation, disinfection, membrane technology, reverse osmosis, ecology, automation, water resources, sanitation, hydraulic structures.

INTRODUCTION.Globally, the demand for water resources is increasing year by year. Population growth, urbanization processes, and the development of industry and agriculture are significantly raising the need for drinking water. At the same time, the pollution of surface water sources, climate change, and the limited nature of water resources require the improvement of water supply systems.

Surface water sources are mostly:

• rivers;
• lakes;
• canal waters;
• reservoirs.

These water sources are polluted by agricultural waste, industrial discharges, domestic wastewater, and microorganisms. Therefore, before using water for drinking purposes, it must be treated using special methods.

Modern water treatment systems are not limited only to purification; they also include such directions as:

• energy saving;
• environmental safety;
• automated control;
• implementation of innovative technologies.

DESCRIPTION OF SURFACE WATER SOURCES Surface waters are formed as a result of the natural water cycle process. They are continuously replenished by atmospheric precipitation, glacial meltwater, and groundwater.

Main characteristics of surface waters:

Surface waters are characterized by the following features:

Physical properties:

• turbidity;
• color;
• temperature;
• odor and taste.

Chemical properties:

• pH level;
• mineral content;
• iron and manganese concentration;
• organic compounds.

Biological properties:

• bacteria;
• viruses;
• aquatic plants;
• plankton.

WATER QUALITY AND DESIGN OF WATER INTAKE STRUCTURES.

Poor water quality poses a threat to human health and leads to sanitary-epidemiological problems.

DESIGN OF WATER INTAKE STRUCTURES

Water intake structures perform the function of collecting water from sources and delivering it to treatment plants.

Main design objectives:

• continuous water supply;
• ensuring sanitary safety;
• technical reliability;
• ease of operation;
• economic efficiency.

Water treatment consists of several technological stages.

Mechanical treatment:

This process removes large particles from water.

• metal screens;
• sand traps;
• settling basins.

Mechanical treatment improves the efficiency of subsequent processes.

Coagulation and flocculation:

Reagents are added to combine fine dispersed particles into larger flocs.
Commonly used chemicals:

• aluminum sulfate;
• iron chloride;
• polyacrylamide.

This process significantly reduces water turbidity.

Filtration process:

Water is passed through special filter materials.

Types of filters:

• sand filters;
• activated carbon filters;
• membrane filters.

Filtration reduces:

• color;
• odor;
• organic compounds in water.

ESEARCH METHODOLOGY

In this scientific study, the following methods were used:

Analytical method:
The physical and chemical parameters of surface water were analyzed.

Comparative analysis:
Traditional and modern water treatment technologies were compared.

Laboratory studies:
Water samples were tested for:
• turbidity;
• pH;
• bacterial indicators.

Statistical method:
The obtained results on water quality were processed using mathematical and statistical analysis methods.

RECOMMENDED MEASURES (English translation):

To protect surface water sources and improve water treatment systems, it is advisable to implement the following measures:

1. Establishment of sanitary protection zones
Sanitary control around water sources should be strengthened.

2. Introduction of modern technologies
• membrane filters;
• UV disinfection;
• ozonation systems.

3. Wastewater treatment and reuse
Recycling technologies help reduce the problem of water scarcity.

4. Installation of automated monitoring systems
Online monitoring systems ensure continuous analysis of water quality.

5. Use of energy-efficient equipment
Energy-saving motors should be used in pumping stations.

6. Strengthening environmental control
Strict control over industrial wastewater discharge is necessary.

CONCLUSION The rational and efficient use of surface water resources, as well as their protection from pollution, is currently one of the most important environmental, economic, and social issues in the world. Since water is the fundamental source of life, maintaining its quality and ensuring its sufficient supply must be an integral part of sustainable development strategies of all countries. Population growth, industrial expansion, climate change, and anthropogenic factors are placing increasing pressure on water resources, making their protection a top priority.

The water treatment technologies discussed in this article—membrane filtration, ozonation, ultraviolet (UV) disinfection, and automated control systems—significantly improve the quality of water treatment processes. These technologies effectively remove microbiological pathogens, harmful chemical substances, and mechanical impurities, ensuring the supply of safe drinking water to the population. In addition, the introduction of energy-saving technologies, automation of water supply infrastructure, and the use of intelligent monitoring systems elevate water resource management to a new level. These approaches not only improve water quality but also reduce economic costs, enable rapid detection of technical issues, and increase the operational stability of the system. Environmental safety is also one of the most important aspects of this process. The use of environmentally friendly technologies in water treatment processes helps protect natural ecosystems and preserve biodiversity by minimizing harmful impacts and waste discharge. In the future, the widespread use of smart water management systems, digital technologies, IoT-based monitoring, artificial intelligence elements, and water recycling systems

will become key factors in the sustainable use of water resources. These developments will reduce water scarcity problems and represent an important step toward ensuring global water security. In conclusion, the implementation of modern technologies in water supply systems, their continuous improvement, and compliance with environmental standards play a crucial role in improving human living standards and preserving clean water resources for future generations.

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