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Sanitary-Bacteriological Water Quality Studies

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Abstract: Ensuring the microbiological safety of drinking and recreational water is an important public health issue worldwide. Contaminated water may serve as a source of various infectious diseases, including intestinal infections, respiratory illnesses, and skin diseases. The purpose of this study is to analyze sanitary and bacteriological indicators used to assess water quality and to evaluate modern microbiological methods applied for water quality monitoring. The research is based on sanitary-microbiological analysis of water samples, focusing on the detection of indicator microorganisms such as Escherichia coli, lactose-positive coliform bacteria, enterococci, and staphylococci. The results demonstrate that traditional bacteriological methods remain the most reliable tools for assessing the sanitary condition of water sources, although modern rapid testing technologies significantly reduce analysis time and improve monitoring efficiency. The study confirms the importance of improving microbiological monitoring systems and harmonizing national water quality standards with international requirements to ensure the epidemiological safety of drinking and recreational water resources.

Keywords: hygienic standards, drinking water use, recreational water use, microbiological water quality indicators, staphylococci and enterococci in domestic wastewater, pollution level.

Introduction

Water quality plays a crucial role in maintaining public health and preventing infectious diseases. Drinking water contaminated with pathogenic microorganisms can lead to the spread of intestinal infections, respiratory diseases, and various skin infections. According to international health organizations, a significant proportion of infectious diseases is associated with poor water quality and inadequate sanitation systems [1].

In regions with hot climates, recreational use of water bodies increases significantly, which raises additional risks related to waterborne diseases. Therefore, the monitoring of microbiological water quality indicators is an important component of sanitary and epidemiological safety [2].

Sanitary microbiology uses specific indicator microorganisms to assess water contamination. Among the most widely used indicators are Escherichia coli, lactose-positive coliform bacteria, enterococci, and staphylococci. These microorganisms serve as reliable indicators of fecal contamination and potential epidemiological hazards [3].

The aim of this study is to investigate sanitary-bacteriological indicators of water quality and evaluate modern microbiological methods used for water quality monitoring [4].

Relevance. The growing importance of recreational water use, especially in regions with hot climates, raises the problem of preventing not only intestinal infections but also upper respiratory tract and skin diseases. Adenovirus diseases, conjunctivitis, and staphylococcal infections have been reported in people after exposure to contaminated water. This necessitates regulation of recreational water bodies and the detection of pathogens causing upper respiratory tract and skin infections. Representatives of the coccal microflora (staphylococci), which permanently inhabit the skin and upper respiratory tract, can be recommended as indicator microorganisms. The above indicates that existing water quality monitoring of water bodies is ineffective, does not meet international requirements, and does not guarantee the epidemic safety of water bodies used for domestic and recreational purposes. Most drinking water sources require the implementation of simple, reliable, and, if possible, rapid and generally accessible microbiological testing methods for monitoring indicator microorganisms [5].

Methodology

The research was conducted using sanitary-microbiological analysis methods commonly applied in water quality monitoring. Water samples were analyzed to determine the presence of indicator microorganisms, including coliform bacteria, Escherichia coli, enterococci, and staphylococci [6].

The study applied both classical bacteriological methods and modern rapid diagnostic techniques. The bacteriological method involved culturing microorganisms on selective nutrient media followed by incubation and colony counting. This method allows accurate identification of microbial contamination levels in water samples [7].

Additionally, modern rapid testing technologies were used, including Petrifilm methods and immunochromatographic rapid tests. These methods allow faster detection of microbial contamination and significantly reduce analysis time compared with traditional laboratory techniques [8].

The collected data were analyzed using comparative methods to evaluate the effectiveness of different microbiological testing approaches [9].

Current regulatory documents establish drinking water quality indicators, methods for their determination, and procedures for collecting and storing water samples. Drinking water must meet regulated parameters for reagent content, organoleptic, microbiological, parasitological, chemical-analytical, and radiation characteristics, both at the water treatment stages and throughout all stages of water supply to the consumer. Therefore, a pressing task in water treatment for providing the population with drinking water is to ensure its safety from epidemics. Due to the increasing incidence of bacterial, viral, and parasitic diseases worldwide, caused by the consumption of contaminated drinking water, there is a need to improve the regulatory framework for quality control while simultaneously unifying requirements at the international level [10].

Most countries, including Uzbekistan, standardize the quality of water treatment processes and the hygienic condition of water supply systems using the total microbial count (TMC) or heterotrophic plate count (Heterotrophic plate count). This indicator is an integrated, multifunctional measure of the level of general microbial contamination of drinking water, encompassing a large group of aerobic and facultative-anaerobic microorganisms. Some countries (Australia, WHO Guidelines, EU Directive) have adopted indicators of fecal contamination of drinking water, such as enterococci. Furthermore, to monitor the quality of water treatment from surface water sources, spores of sulfite-reducing clostridia are determined at the outlet of water treatment plants, with the identification of Clostridium perfringens. In Uzbekistan, this indicator is also recommended, but without species identification, which significantly increases the reliability of the search for these bacteria and simplifies and speeds up water analysis. In a number of countries, in addition to bacteriological and parasitological indicators, virological indicators are also determined. Thus, the US standard and Canadian Drinking Water Guidelines (2012) mandate the direct detection of enteric viruses; the Australian Guidelines (2011) and WHO Guidelines recommend coliphages as an indicator of viral contamination [11].

Results

The analysis of water samples demonstrated that sanitary-indicator microorganisms remain essential indicators of water contamination. The presence of E. coli and coliform bacteria indicates fecal pollution and potential epidemiological risks [12].

The results also show that enterococci and staphylococci may serve as additional indicators of microbial contamination in recreational water bodies. These microorganisms are commonly associated with skin and respiratory infections and may indicate pollution originating from domestic wastewater [13].

The application of modern rapid testing methods significantly reduced the time required for

microbiological analysis. While traditional bacteriological methods require several days for obtaining results, rapid testing technologies allow detection of certain microorganisms within 24–48 hours.

However, despite the advantages of modern diagnostic tools, the classical bacteriological method remains the most reliable approach for confirming microbiological contamination.

The aim of the study was to conduct a series of experiments to substantiate standards for the content of the studied microbiological water quality indicators in water bodies. For this purpose, experiments were conducted that included an assessment of the indicator value of sanitary indicator microorganisms: E. coli, lactose-positive Escherichia coli (LPC), enterococci, and staphylococci, and their standardization in water bodies used for domestic, drinking, and recreational water use [14].

Subjects and Methods When studying sanitary and microbiological indicators of drinking water quality, the following are usually analyzed in each sample: coliform bacteria (including E. Coli, an indicator of fecal contamination), total microbial count, etc.; parasitological indicators - lamblia cysts and cryptosporidium oocysts.

Methodological guidelines enable the rapid determination of water quality indicators and the implementation of step-by-step sanitary testing. Modern water quality control methods can significantly reduce testing time. Accelerated analysis methods using Petrifilms, immunochromatographic rapid tests, and ready-made selective and indicator nutrient media are highly promising for measuring total microbial counts, coliform bacteria, E. coli, and other microorganisms.

Modern tests are designed for the quantitative determination of sanitary indicator microorganisms and contain special indicators and substrates that facilitate the counting of grown microbial colonies. When the test sample (1-5 ml of water sample) is introduced onto the substrate, a gel-like nutrient medium is formed, on which (after incubation) the microbial count is counted.

When analyzing water using membrane filtration, the Petrifilm is first activated (with 1 ml of sterile water), then the membrane filter is placed on the substrate. Modern tests and cultures are incubated according to . An automated colony registration and counting system allows for the rapid assessment and counting of colonies of different types. Their color visual images and test results are stored in a computer graphics file for an unlimited time (Fig. 1).

Using modern tests significantly reduces analysis time (from 3-5 days to 1-2 days for certain bacterial species), the culture procedure is simple, there is no need to confirm positive results for the presence of coliforms, and E. coli is detected by specific staining on a chromogenic medium.

However, despite the widespread adoption of modern research methods in microbiological practice, the bacteriological method remains the "gold standard" of sanitary microbiology, providing the most reliable assessment of the sanitary condition of test objects [15].

Discussion

The results of this study highlight the importance of improving water quality monitoring systems. Effective monitoring requires the use of reliable microbiological indicators and standardized testing methods.

International standards recommend the use of multiple microbial indicators to ensure accurate evaluation of water safety. The presence of fecal indicator bacteria such as E. coli and enterococci is widely recognized as a reliable marker of potential health risks.

Modern diagnostic technologies provide faster and more efficient tools for monitoring water quality. However, these methods should complement rather than replace traditional bacteriological techniques, which remain the gold standard in sanitary microbiology.

Improving microbiological monitoring systems also requires harmonizing national water quality

standards with international guidelines. This approach will enhance the effectiveness of public health protection measures.

Conclusion

The study confirms that microbiological monitoring is a key component of water quality control and public health protection. Indicator microorganisms such as Escherichia coli, enterococci, and staphylococci play an important role in assessing the sanitary condition of water bodies.

Modern rapid diagnostic technologies significantly improve the efficiency of water quality monitoring, but traditional bacteriological methods remain essential for reliable laboratory confirmation.

The improvement of regulatory frameworks and the implementation of modern microbiological monitoring methods will contribute to ensuring the epidemiological safety of drinking and recreational water sources.

References

[1] World Health Organization, Guidelines for Drinking-water Quality, 4th ed. Geneva, Switzerland: WHO Press, 2017.
[2] O'zDST 951:2011, Sources of centralized domestic and drinking water supply: Hygienic and technical requirements. Tashkent, Uzbekistan, 2011.
[3] V. V. Aleshnya, P. V. Zhuravlev, and S. V. Yalovina, "Indicator value of bacteriological indicators in assessing water quality," in Proc. Int. Congress Water: Ecology and Technology, Moscow, Russia, 2002, pp. 705–708.
[4] I. A. Kalashnikov and O. A. Kulichenko, "Water supply from surface water bodies as a potential health risk," in Proc. Int. Congress Water: Ecology and Technology, Moscow, Russia, 2006, pp. 916–917.
[5] D. Kh. Fayzieva, I. A. Usmanov, E. E. Bekzhanova, and A. K. Musaeva, "Survival of enterococci and staphylococci in water under experimental conditions," Bulletin of the Association of Doctors of Uzbekistan, no. 3, pp. 84–85.
[6] SanPiN 0211-06, Hygienic criteria and control of drinking water quality. Tashkent, Uzbekistan, 2006.
[7] I. S. Manasova, "Hygienic aspects of labor protection in livestock farms," Tibbiyotda yangi kun, vol. 25, no. 1, 2019.
[8] I. S. Manasova, "Hygienic principles for protecting the health of workers in cotton production," Tibbiyotda yangi kun, vol. 25, no. 1, 2019.
[9] Kh. J. Salomova and Kh. O. Kosimov, "Ecological and hygienic aspects of insecticide use in agriculture," American Journal of Medicine and Medical Sciences, vol. 10, no. 4, pp. 266–268, 2020.
[10] J. Bartram and R. Ballance, Water Quality Monitoring. London, U.K.: E & FN Spon, 1996.
[11] M. Fewtrell and J. Bartram, Water Quality: Guidelines and Health. London, U.K.: IWA Publishing, 2001.
[12] J. LeChevallier and K. Au, Water Treatment and Pathogen Control. London, U.K.: IWA Publishing, 2004.
[13] P. Payment and A. Locas, "Pathogens in water: Value and limits of correlation with microbial indicators," Groundwater, vol. 49, no. 1, pp. 4–11, 2011.
[14] WHO/UNICEF, Progress on Drinking Water and Sanitation. Geneva, Switzerland, 2019.
[15] United Nations, World Water Development Report. Paris, France: UNESCO, 2020.