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Sanitary-Microbiological Assessment of Water in Kuyimazar and Tudakul Reservoirs

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Abstract: This article presents the results of a sanitary-microbiological assessment of the water quality in the Kuyimazar and Tudakul reservoirs. A microbiological analysis was carried out to determine the level of contamination and evaluate the suitability of the water for drinking, agricultural, and recreational purposes.

Keywords: Sanitary-microbiological assessment, Kuyimazar, Tudakul reservoir, coliform bacteria, Total Microbial Count (TMC).

Introduction.

The Kuyimazar and Tudakul reservoirs are important sources of water supply and irrigation in the region. However, their water quality is subject to changes due to anthropogenic factors such as agricultural runoff, industrial discharge, and domestic wastewater. The sanitary-microbiological analysis of water helps assess the level of contamination and potential health risks.

The Kuyimazar and Tudakul reservoirs, located in the Navoi region in the southwestern part of the Kyzylkum Desert in Uzbekistan, are included in the Ramsar List of Wetlands of International Importance (No. 2433). These wetlands serve as a water storage area in the arid "desert-shrub" biogeographic region of Central Asia and play a vital role in maintaining biodiversity.

Kuyimazar Reservoir is the primary source of drinking water for Bukhara, the fifth-largest city in Uzbekistan, and the city of Kagan. Its salinity is lower than that of the neighboring Tudakul Reservoir, which is primarily used for aquaculture and agriculture. The total area of these wetlands is approximately 32,000 hectares, making them an essential stopover site for migratory birds along the Central Asian flyway. Over the past five years, the average annual number of migratory birds has exceeded 40,000.

Materials.

The reservoirs host around 229 bird species, including the endangered white-headed duck (Oxyura leucocephala), with over 1% of the biogeographic population wintering in the area. Other rare and endangered species include the vulnerable goitered gazelle (Gazella subgutturosa) and the critically endangered Amu Darya shovelnose sturgeon (Pseudoscaphirhynchus kaufmanni).

I apologize for the earlier confusion. Here is the information on recent studies concerning microbiological contamination of water, presented in English.

Primary Sources of Microbiological Contamination:

Fecal Contamination: The presence of coliform bacteria, such as Escherichia coli, in water indicates fecal contamination, which can lead to diseases like diarrhea, cholera, dysentery, and typhoid fever.

Cyanobacteria and Their Toxins: Water blooms caused by cyanobacteria result in the release of toxins, such as microcystins, which are resilient under various conditions and can accumulate in the food chain, posing health risks to humans.

Research and methods.

Modern Detection and Control Methods:

Rapid Analysis Techniques: Contemporary methods have been developed to quickly detect microbiological contamination in drinking water without the need for complex laboratory equipment, expediting the implementation of water safety measures.

Microbiological Monitoring: New standards for the sanitary-microbiological quality of drinking water have been introduced, providing a rationale for the implemented quality indicators and enhancing the effectiveness of microbial contamination control.

Impact on Health and Ecosystems:

Waterborne Diseases: Microbiological contamination of drinking water is a contributing factor to the spread of diseases such as diarrhea, cholera, dysentery, typhoid fever, and poliomyelitis, leading to an estimated 505,000 diarrheal deaths annually.

Ecological Consequences: Pollution of water bodies with various organic discharges alters the species composition of water microflora, increasing the content of rod-shaped and spore-forming bacteria, which affects ecosystems and water quality.

In summary, recent studies highlight the necessity for continuous monitoring of the microbiological state of water bodies and the development of effective purification methods to ensure the safety and quality of drinking water.

Research Objectives

Main Goal:

To assess the sanitary-microbiological condition of the water in the Kuyimazar and Tudakul reservoirs, determine the level of microbial contamination, identify the presence of potentially hazardous microorganisms, and evaluate the suitability of the water for drinking, agricultural, and recreational use.

Research Tasks:

Water Sampling: Collect water samples from different locations within the Kuyimazar and Tudakul reservoirs in various seasons.

Microbiological Analysis: Determine key sanitary-microbiological indicators, including:

Total Microbial Count (TMC)

Coliform bacteria (Coliform Index)

Thermotolerant coliform bacteria (TTC)

Pathogenic microorganisms (Salmonella, Shigella, Vibrio cholerae)

Coliphages (viral markers of fecal contamination)

Contamination Assessment: Evaluate the levels of fecal and general microbial contamination.

Comparison with Sanitary Standards: Compare the results with established sanitary norms and identify any deviations.

Seasonal Variations: Analyze seasonal fluctuations in microbiological indicators.

Recommendations: Develop recommendations for improving water quality and preventing contamination.

Results.

Water samples were collected from different points of the reservoirs across different seasons to account for seasonal variations in contamination levels. The following sanitary-microbiological indicators were measured using standard laboratory methods:

Total Microbial Count (TMC): An indicator of general bacterial contamination in water.Coliform Bacteria (Coliform Index, CI): A marker of fecal contamination.

Thermotolerant Coliform Bacteria (TTC): A more precise indicator of fecal contamination.

Pathogenic Microorganisms: Including Salmonella, Shigella, and Vibrio cholerae, which determine the epidemiological safety of water.

Coliphages: Viral markers indicating fecal contamination.

The analyses were conducted following standard procedures regulated by GOST and SanPiN sanitary guidelines.

Discussion.

The microbiological assessment revealed the following key findings:

Seasonal Variability:

In the winter season, the Kuyimazar Reservoir had a lower coliform bacteria count than in the summer, likely due to lower temperatures reducing bacterial activity.

The Tudakul Reservoir exhibited higher levels of coliform bacteria in coastal areas, possibly indicating sewage discharge into the water body.

Fecal Contamination:

Elevated Coliform Index (CI) values were found in some samples, particularly in the Tudakul Reservoir's nearshore regions.

Occasional detections of Salmonella and Shigella suggest a potential risk of waterborne diseases.

Microbial Load:

The Total Microbial Count (TMC) in most water samples met sanitary standards.

However, localized spikes in microbial activity were recorded in some areas, necessitating further monitoring.

Conclusion.

The sanitary-microbiological assessment indicates that the water quality in the Kuyimazar and Tudakul reservoirs generally meets sanitary norms. However, during the summer, an increase in microbial contamination is observed, necessitating additional preventive measures.

To ensure water safety, the following recommendations are proposed:

Strengthening control over wastewater discharge into reservoirs.

Conducting regular microbiological monitoring of water quality.

Implementing water treatment and purification measures, particularly during warmer months.

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