

MICROBIOLOGICAL MONITORING OF POTENTIALLY PATHOGENIC MICROORGANISMS IN DIFFERENT TYPES OF WATER BODIES

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Surface water bodies are widely used by people as a resource for drinking and domestic water supply, as well as for recreational and landscape purposes. It is known that an increase in the activity of potentially pathogenic microorganisms has been observed in the last decade. This determines the relevance of the study of this group of microorganisms, including in natural hydroecosystems [1, p. 3657; 2, p. 95]. Water pollution is the cause of various diseases; therefore, attention is required to determine the sanitary and epidemiological threats and risks to minimize negative phenomena. According to The World Health Organization's, deaths from waterborne diseases exceed several million people a year [3]. The main source of pathogenic microorganisms in fresh and marine waters is the inflow of wastewater [4, p. 8; 5, p. 109]. Therefore, in our opinion, the study of the presence and number of potentially pathogenic microorganisms can be a mandatory and significant addition to the assessment of the ecological and sanitary condition of water bodies that are under anthropogenic influence.

The results of monitoring of biological sampling carried out in the summer-autumn seasons of 2019 and 2020 on lotic and lentic ecosystems within the territory of Ukraine are presented. The material was selected water from the Danube* (riverbed, arms), Yahorlyk*, Svicha and Hnyla Lypa (Dniester river basin) Rivers, two Lakes located in the urbanized area of Kyiv city – Verbne, Opechen Nyzhne. Water bodies are characterized by different hydrological regime, morphometric characteristics, nature of the shoreline, soil erosion in the catchment area, zonal development of the industrial and agricultural sector, the presence of domestic and industrial effluents, recreational and other forms of anthropogenic pressure.

DryFilter kits (Himedia, India) were used to analyze water from different types of water bodies for potentially pathogenic microorganisms. The selected material was inoculated on: Sabouraud dextrose medium, Bile esculin azide medium, Bismuth sulphite medium, Cetrimide medium, Chapman Stone medium, ECD medium and M-Endo medium. Incubated the inoculated nutrient under the conditions specified in the technical documentation for the

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kits. Interpret the results qualitatively by observing the presence or absence of growth and quantitatively by counting the number of colonies on the surface of the membrane filter and calculating cfu/100 ml.

The Danube was monitored on the arms (Ochakivsky, Bystry, Vostochny, Tsygansky, Starostambulsky) and riverbed above of the Reni city. The number of potentially pathogenic microorganisms in the studied areas ranged from 200 to 53600 cfu/100 ml. Their spatial dynamics depended on the localization of the sampling site, the type of bacteria and anthropogenic influence. For seasonal dynamics, there was an increase in the number of potentially pathogenic bacteria in summer compared to autumn. High values were recorded above of the Reni city in the summer of 2019, and low – in the arms of the Vostochny and Tsygansky in the fall of 2020. Top levels were recorded of yeast and fungi, fecal indicator bacteria and coliforms, *Salmonella spp.*, *Pseudomonas spp.* In accordance with Directive (Directive 2016/EC of 27 October 2016), implemented in Ukraine, the number of intestinal enterococci should not exceed 400 cfu/100 ml, the number of *Escherichia coli* – 1000 cfu/100 ml, *Salmonella spp.* – 0 cfu/100 ml for classification of bathing water quality on category «sufficient». Similar norms are established by the Law of Ukraine [6] and the State Sanitary Rules of the Ministry of Health of Ukraine [7, 8]. Comparing the obtained data with the requirements specified in these documents at all sampling areas recorded exceeding the relevant indicators by tens and hundreds of times. It is known that earlier scientists also noted a high number of coliforms and enterobacteria in the Ukrainian and Romanian parts of the Danube [9, p. 91].

Summer in the water of the Reservoir of the Yahorlyk River the number of potentially pathogenic microorganisms ranged from 4100 to 46300 cfu/100 ml. The location of the sampling areas, the type of bacteria and the temperature of water influenced their spatial distribution. High values were recorded for fecal coliforms, enterobacteria, salmonella and pseudomonads. Comparing the obtained data with the requirements specified in the normative documents for waters used for recreational and health purposes, the studied sampling areas recorded exceedances of hundreds of times.

Autumn in the Svicha River, research was conducted in three areas: the upper reaches of the River, above and below the dam near the Vygada village. The number of *E. coli* and coliforms, *Salmonella spp.* in water ranged from 100 to 500 cfu/100 ml; their dynamics in space depended on the sampling area and the type of microorganisms. The number of *Salmonella spp.* did not change from the three areas. Instead, the number of *E. coli* and coliforms decreased slightly in the direction of flow: possibly due to the elimination of introduced microflora within the natural park and the reorganization of the bacteriocenosis in accordance with the microzonality of physico-chemical

parameters of the river. Contamination by such potentially pathogenic bacteria can be carried out from sources that include human and animal feces, contributing to an increase in the number of microorganisms found in the wild. The monitoring of the Svicha River shows an excess of salmonella in the water, compared to those specified in the regulations, which in turn can lead to negative consequences.

The Hnyla Lypa River was monitored in autumn in two areas: above and below the dam of the Burshtyn Reservoir. The number of bacteria *Salmonella* spp., *E. coli* and coliforms in water was from 1600 to 78900 cfu/100 ml. For spatial dynamics, an increase in the number of bacteria in the flow direction was noted. The increased number of microorganisms may be due to the favorable temperature regime that has developed in the Reservoir due to heating from the thermal power plant, anthropogenic and recreational pressure. Comparing the obtained data with the requirements specified in the regulations at all sampling areas recorded the excess of the relevant indicators in the tens and hundreds of times, which can lead to the development of infection.

Study of potentially pathogenic microorganisms in stagnant Verbne Lake with an authorized beach and well-developed infrastructure for recreation was carried out in two areas: east and west. The number of bacteria in the water was from 100 to 34000 cfu/100 ml. Their spatial dynamics depended on the sampling areas, the type of microorganisms and the recreational pressure. For seasonal dynamics, the indicators were noted on average 3 times higher in summer than in autumn. The study showed that under conditions of active anthropogenic and recreational influence on the Lake, a significant content of potentially pathogenic bacteria was observed in the water, which exceeded the normative indicators established by law, and may indicate low water quality and high bacterial contamination. The greatest health risks for people who rest in this Lake are associated with swallowing contaminated water and skin infections.

Our data correspond to the data received by the organization on improvement of beaches of Kiev. Thus, in the summer of 2019 and 2020, it was forbidden for the population to use «Verbny Beach» for bathing according to the results of sanitary-microbiological and sanitary-chemical research of water that did not meet the requirements of the State Sanitary Rules of the Ministry of Health of Ukraine.

Research in the extreme Lake of the Opechen system (Opechen Nyzhne) was conducted in two areas: the upper and lower reaches of the Lake. The number of potentially pathogenic bacteria in the water ranged from 400 to 40500 cfu/100 ml. Their dynamics in space depended on the sampling area, the type of bacteria and man-made intervention in the lake system. For the

seasonal dynamics, higher indicators were observed in autumn for coliforms and salmonella than in summer. The study shows that the Lake located in an urban area in conditions of active anthropogenic and recreational pressure (unauthorized beach), contains in the water above the permissible norms of all studied of potentially pathogenic bacteria.

Therefore, studies on lotic and lentic ecosystems show that under conditions of active anthropogenic and recreational influence, a significant content of potentially pathogenic microorganisms in the water was observed, which indicates unsatisfactory water quality and a high degree of bacterial contamination, which can lead to negative consequences. According to the results of sanitary and microbiological studies of water, it can be concluded that these water bodies are unsuitable for use for health purposes and bathing, and the greatest risks to human health vacationers in these ecosystems are associated with swallowing contaminated water, indigestion and skin infections.

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