DOI: http://doi.org/10.21698/simi.2022.ab19

ASSESSMENT OF THE POTENTIAL PATHOGENIC IMPACT OF SURFACE WATER ON THE GROUNDWATER TABLE

Dragos Mihai Rădulescu[1,2], Alina Roxana Banciu[1], Laura Novac[1], Luoana Florentina Pascu[1]

[1]National Research and Development Institute for Industrial Ecology – ECOIND, 57-73 Drumul Podu Dambovitei Street, 060652, Bucharest, ecoind@incdecoind.ro, Romania
[2]Ecological University of Bucharest, Faculty of Ecology and Environmental Protection, 1G Bd. Vasile Milea, Bucharest, contact@ueb.ro, Romania

Keywords*: antibiotic resistant bacteria, coliform bacteria, Danube Delta, groundwater table*

Introduction

With the accelerated industrialization and urbanization, the controlled or accidental discharge of wastewater has become an important source of contamination for surface water and indirectly for groundwater. The absence of treatment plants in the Sfantu Gheorghe branch area, included in the Danube Delta Biosphere Reserve, generates wastewater discharges directly into the natural emissary, influencing the quality of surface water and groundwater, both being used for drinking purposes. This project aimed to assess the potential impact of microbiological pollution of surface water in the Sfantu Gheorghe Branch on the natural aquatic ecosystem and groundwater contamination.

Materials and methods

The experimental study was conducted in two sampling campaigns, November 2021 and March 2022, in 3 control sections, Tulcea, Victoria and Uzlina, where samples of surface water, sediment and groundwater were taken for the quantitative and qualitative determination of fecal pollution indicators. The pure cultures of bacterial strains were subjected to antibiotic susceptibility testing by the disc-diffusion method, in accordance with CLSI recommendations.

Results and conclusions

The largest and most important pollution impact in the Sfantu Gheorghe Branch is produced by human settlements and various agricultural and zootechnical activities by discharging wastewater into the hydrographic network of the Delta and by household waste. Quantitative results of bacterial densities in surface water (Figure 1) and sediment (Figure 2) indicated a similar trend in the direction of water flow for total coliform bacteria and *Escherichia coli*. We can mention the phenomenon of bacteria sedimentation in order to adapt a nutrient substrate that allows survival and multiplication of poor environmental conditions. The density of polluting bacterial populations in drinking water (Figure 3) was higher in November 2021 depending on temperature and precipitation which were significantly higher in the previous period. Also, a difference in sedimentation of bacterial populations from one season to another was found, indicating their dependence on external environmental factors. What remained constant in both sampling campaigns was the presence of the same

bacterial strains with pathogenic potential, *Escherichia coli*, *Klebsiella sp*, *Citrobacter freundii*, which showed resistance, especially to the same beta-lactam antibiotics.

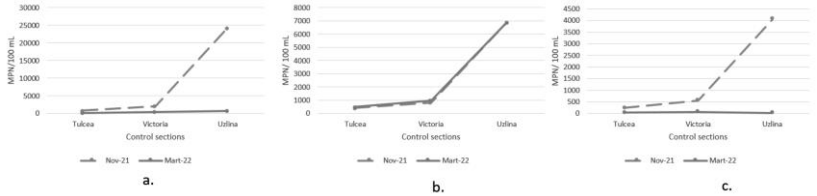

Fig. 1. Density of total coliform bacteria (a), faecal coliform bacteria (b) and *E. coli* (c) in surface water samples.

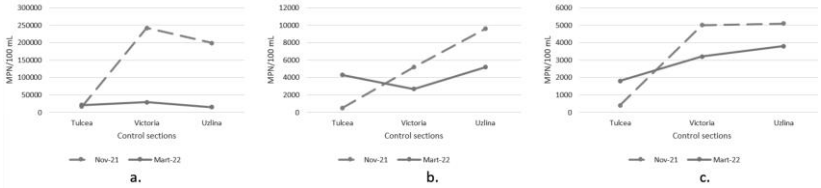

Fig.2. Density of total coliform bacteria (a), faecal coliform bacteria (b) and *E. coli* (c) in the sediment samples.

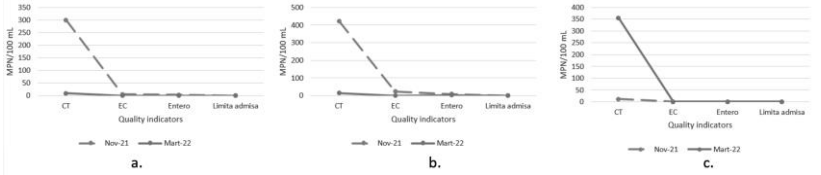

Fig.3. Density of total coliform bacteria (a), *E. coli* (b) and Enterococci (c) from groundwater samples.

Following the analyses, a species difference was found between surface water and groundwater, the sediment acting as a barrier between the two aquatic ecosystems. Despite a low risk of the transfer of potentially pathogenic bacteria from surface water to groundwater, the results indicated that there is a significant degree of pollution of aquatic ecosystems with antibiotic-resistant microorganisms, which turns them into resistance reservoirs. They can have a negative impact of materializing the transmission risk on the environment and bacterial communities and on human health.

Acknowledgement. This work was financially supported by Ministry of Research, Innovation and Digitalization of Romania through Programme Nucleu through contract 20N/2019, Project PN 19 04 02 01.