

DOI: <http://doi.org/10.21698/simi.2022.ab18>

WASTEWATER TREATMENT PLANT EFFICIENCY ON ANTIBIORESISTANCE PROFILE OF POTENTIALLY PATHOGENIC BACTERIA

Monica Vaideanu^{1,2}, Cristina Iftode¹, Alina Roxana Banciu¹, Irina Eugenia Lucaciu¹, Catalina Stoica¹, Daniela Ionica¹, Stefania Gheorghe¹, Mihai Nita-Lazar¹, Laura Novac¹

¹National Research and Development Institute for Industrial Ecology- ECOIND Bucharest, 57-73 Drumul Podu Dambovitei Street, 060652, Bucharest, monica.vaideanu@ecoind.ro, Romania

²University of Bucharest, Faculty of Biology, 91-95 Splaiul Independentei, R-050095, Bucharest, Romania

Keywords: *antibioresistance, pathogenic bacteria, WWTP*

Urban wastewater treatment plants (WWTP) represent an interface regarding the respective city, having at the same time the role of controlling and preventing the elimination of pollutants, be they chemical or biological, in natural aquatic bodies.

Treatments applied at the station often lead to a reduction in the bacterial load, but at the level of biological treatment with activated sludge stress factors can occur for transient strains. The strains can become resistant to chemicals of major importance for human health, such as antibiotics. The major problem with these treatment plants is that they cannot completely remove these bacterial strains, eventually ending up in the environment with possible new resistance.

The purpose of this paper was to evaluate the changes in the antibiotic resistance profile at the exit from the station, compared to what the influent brings.

Materials and methods

In 2022, the influent and the effluent of the urban WWTP Glina (Bucharest, Romania) water samples were quarterly collected in order to isolate, identify and determine the antibiotic resistance profile of the present strains.

The first step consisted in pre-enrichment, by mixing the wastewater sample with the same volume of Peptone Water and incubated at $36 \text{ }^{\circ}\text{C} \pm 2 \text{ }^{\circ}\text{C}$ for 22 ± 2 h.

The strains were isolated on culture media: eosin methylene blue agar and Soybean Casein digest agar. Isolated bacteria were identified using the Omnilog automated system (Biolog, USA). The potentially pathogenic strains were subjected to the determination of antibiotic resistance, especially with antibiotics used in clinical settings of Romania. The antibiotics used were: piperacillin (100 μg), ampicillin (10 μg), amoxicillin with clavulanic acid (30 μg), cefepime (30 μg) and imipenem (10 μg), provided by Oxoid. The diameters of the resistance zones were recorded using Scan 500 in mm, and interpreted according to CLSI 2019.

Results and conclusions

Within the 2 samples, at the level of the influent of the WWTP, 24 strains with pathogenic potential were determined and analyzed using the Kirby Bauer method. The strains were: *Escherichia coli*, *E. coli O157:H7*, *Klebsiella aerogenes*, *K. variicola*, *K. pneumoniae*, *K. oxytoca*, *Citrobacter freundii* and *Enterobacter cloacae*. In the case of the effluent, 20 strains were found to be pathogenic bacteria, including: *E. coli*, *E. coli O157:H7*, *Salmonella enterica ST typhi*, *C. freundii*, *K. aerogenes*, *K. variicola*, *K. pneumoniae*.

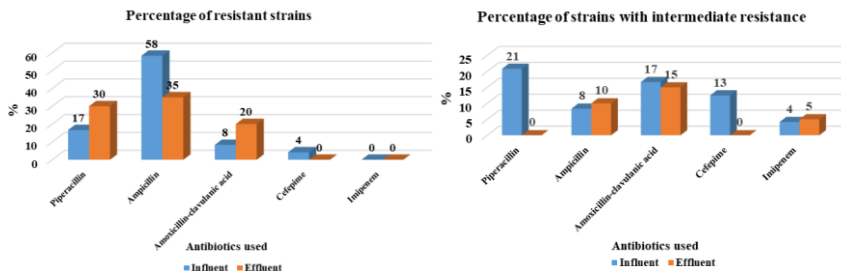


Fig. 1 a). Comparison between the percentage of resistant bacterial strains identified at the influent and effluent of WWTP

Fig. 1 b). Comparison between the percentage of intermediate resistance bacterial strains identified at the influent and effluent of WWTP

It was observed in the case of piperacillin and amoxicillin-clavulanic acid that the resistance to these antibiotics increases after the treatment (Figure 1a), but the treatment also decreases the share of strains with intermediate resistance in the effluent, compared to the influent (Figure 1b).

In contrast, the percentage of resistant strains to ampicillin decreases after the treatment but the percentage of strains with intermediate resistance increases.

For cefepime, there is a decrease in the share of strains with antibiotic resistance, as well as for intermediate resistance, but, the treatment causes an increase in the proportion of strains with the intermediate resistance.

In conclusion, the preliminary data show that the treatment applied at the level of the WWTP, determines the appearance of new resistances to antibiotics tested.

Acknowledgement. This work was financially supported by Ministry of Research, Innovation and Digitalization of Romania through Programme Nucleu, contract no. 20N/2019, Project PN 19-04 02 01.