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Evaluation of microplastics abundance in a peri–urban river

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INTRODUCTION & AIM

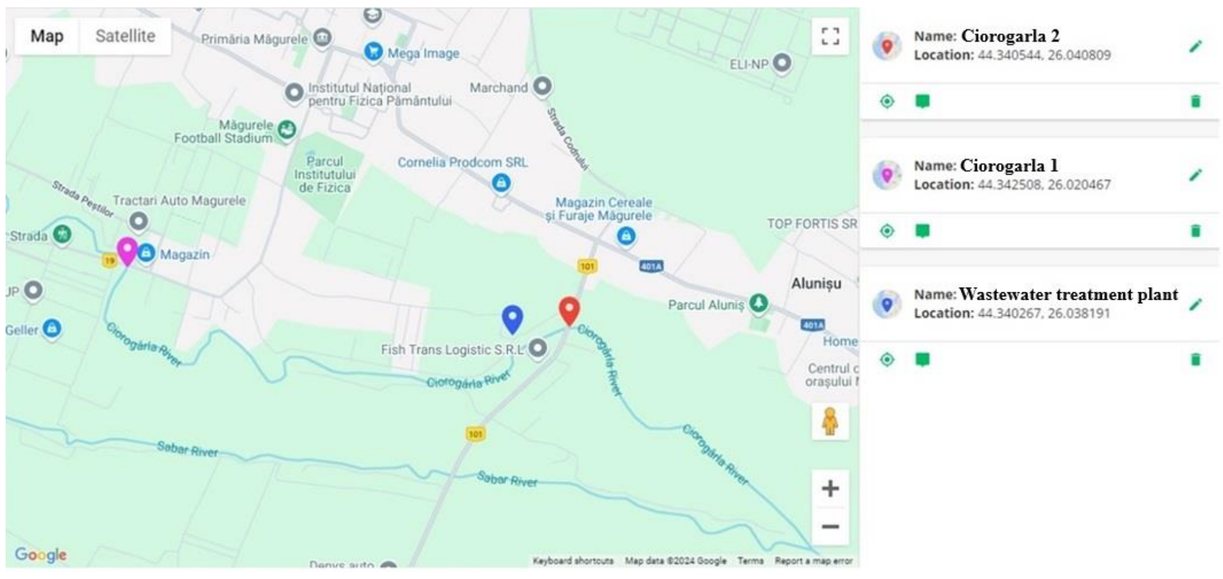
The presence of microplastics (MPs) in the aquatic environment has been intensely studied in recent years, due to their potential threat to living organisms. The toxic potential of microparticles is determined by their physicochemical properties: particle size, shape, specific surface area, surface charge distribution, chemical composition and state of aggregation. On the other hand, the transformation processes of the physical, chemical and biological environments, mediated primarily by pH, electrolyte concentration and dissolved organic matter, modify the behavior of micro and nanoparticles, thus changing their degree of toxicity. Due to their small size and relatively large surface area, MPs can act as carriers of other particles, adsorbing and transporting various pollutants such as heavy metal ions, organic micropollutants and pathogenic organisms.

Microplastics can be found in the form of fragments, spheres or pellets, fibers or films. Depending on their composition and the monomers that were used to obtain them, the most common types of MP are: high-density polyethylene (HDPE), low-density polyethylene (LDPE), polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET), polystyrene (PS) and polyamide (PA).

This study aimed to determine the abundance and characteristics of MPs in a peri−urban river that receives wastewater effluents.

METHOD

Samples were collected from upstream (Ciorogarla 1) and downstream (Ciorogarla 2) of the wastewater treatment plant. Particles isolated from the river were examined using an optical microscope (OLYMPUS BX 51 M, Olympus Corporation, Tokyo, Japan), operated with Olympus Stream Essential 1.9.3 software, using X100 magnification.



CONCLUSION

The total number of MPs varied between 15 and 45 for upstream samples and between 16 and 26 for downstream samples. In both cases, most particles were detected in samples taken in winter, and the lowest abundance of particles was recorded in spring and summer, in the case of upstream samples and in summer in the case of downstream samples. Microscopic analysis revealed a prevalence of fibers (88.39% for upstream and 85.71% for downstream). Lower quantities were observed for the other types of MPs: 8.04% fragments and 3.57% films – upstream, and 4.4% fragments and 9.89% films – downstream. Moreover, an increased abundance of fibers was noted during autumn and winter for both sampling sources. The seasonal variations in MPs concentrations detected at both sampling points suggest that there is a direct influence given by anthropogenic activity in the area. Moreover, the abundance of fibers highlights that one of the main sources of MPs is represented by water discharged from washing machines.

FUNDING

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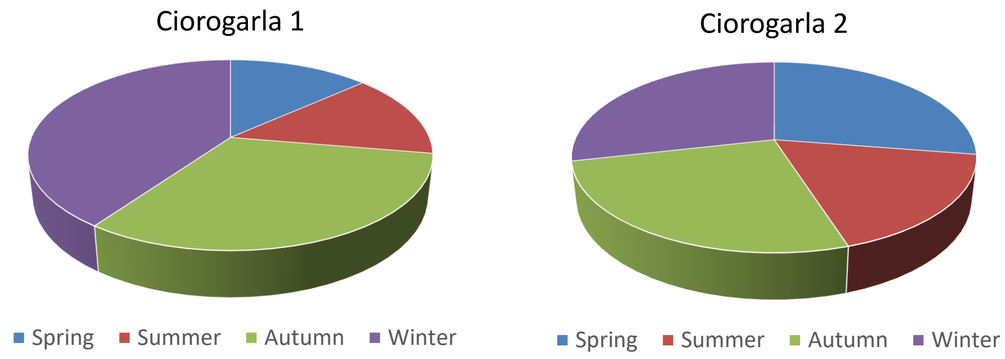
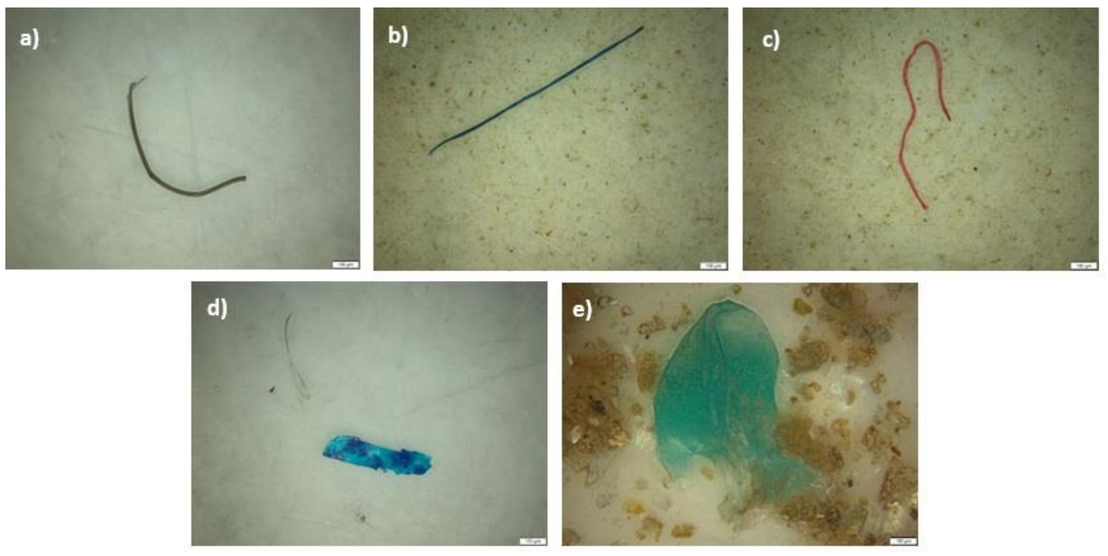
RESULTS & DISCUSSION

The total number of anthropogenic particles in the form of microplastics investigated by optical microscopy varied between 15 and 45 for samples taken from Ciorogarla 1 point and between 16 and 26 for samples taken from Ciorogarla 2 point. In both cases, it was observed that most particles were detected in samples taken in winter, and the lowest abundance of particles was recorded in spring and summer, in the case of Ciorogarla 1 samples and in summer in the case of Ciorogarla 2 samples.



Regarding the shape of the identified particles, they are divided into fibers, fragments and films.



Examples of types of fragments found in the Ciorogarla 1 and Ciorogarla 2 samples in the form of a) black fiber, b) blue fiber, c) red fiber, d) blue fragment and e) blue foil

It has been observed that three dominant colors are distinguished in terms of frequency of occurrence: black, blue and red. Black color predominated, closely followed by blue. Given that no significant differences were observed between the Ciorogarla 1 and Ciorogarla 2 points, it can be concluded that the treatment processes within the wastewater treatment plants do not radically change the color of microplastics.