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Seasonal variability of fluorescence dissolved organic matter in peri-urban rivers

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INTRODUCTION & AIM

Rivers transport and transform dissolved organic matter, nutrients and pollutants along the system and beyond. Dissolved organic matter (DOM) is present in all natural aquatic systems and is composed of a complex mixture of compounds, such as amino acids, sugars, fulvic and humic acids. DOM has been shown to directly influence the presence of active microbial populations in sediments and aquatic food webs. Furthermore, DOM may facilitate the transport of a wide range of pollutants due to its ability to bind heavy metal ions and other persistent pollutants. This modifies the solubility, toxicity, bioavailability, mobility, and distribution of organic and inorganic pollutants in aquatic systems. There is limited knowledge on the temporal characteristics of DOM in rivers with pollution from agricultural and domestic wastewater.

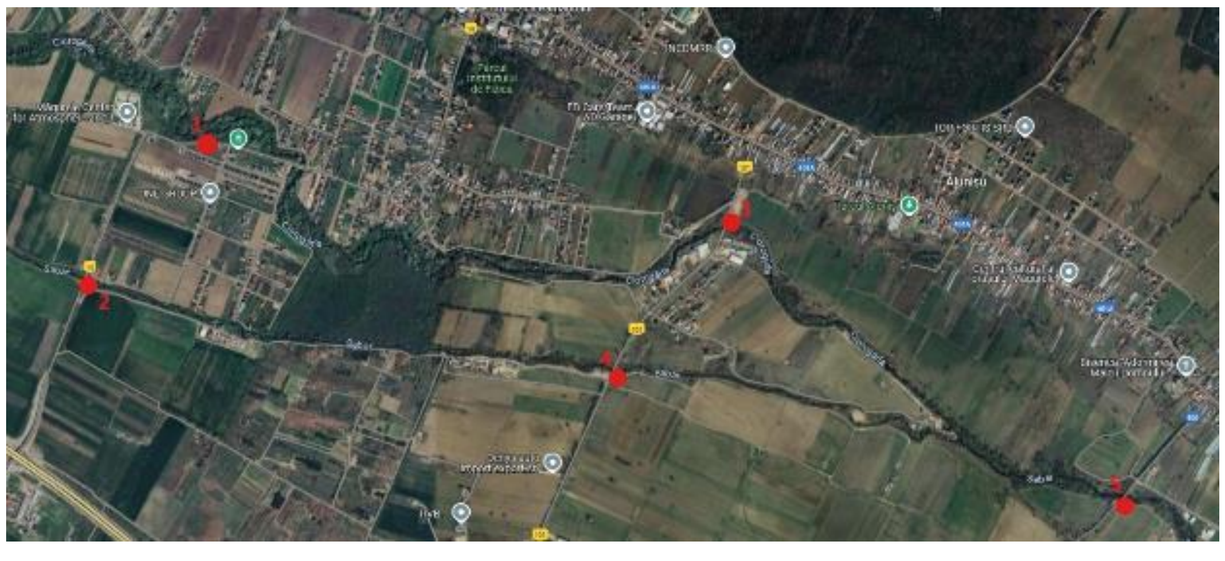
The aim of this study was to determine the seasonal characteristics of DOM in peri-urban rivers and the impact from precipitation and surface runoff. Samples were collected from 5 locations along Ciorogarla and Sabar rivers (Magurele, Romania), twice a month, for almost two years.

METHOD

Measurements were made using the Hanna Instruments HI 255 multimeter, the PF-12Plus photometer, Thermo Fisher Scientific Nanodrop OceC spectrophotometer and the Jasco FP8200 spectrofluorimeter.

Samples were collected from 5 locations located along the rivers Ciorogarla and Sabar, situated near Magurele City, Romania. Two sampling sites from each river were upstream of the confluence point (Ciorogarla MARS, Ciorogarla Alunis, Sabar MARS and Sabar Alunis), and one sampling site was chosen downstream of the confluence (Sabar Jilava), from the Sabar River.

Samples were collected twice a month between January 2023 and September 2024.



CONCLUSION

Results showed that the wastewater effluents have little impact on the concentration of DOM from Ciorogarla River, but changed the properties of DOM components. High concentrations of microbial and humic DOM were detected in Sabar River samples caused by the release of municipal and farm wastewater. Dry summer periods led to the accumulation of autochthonous and allochthonous DOM, while autumn precipitations led to a decrease of both fractions. The lowest quantities of DOM were observed in winter.

RESULTS & DISCUSSION

Seasonal evolution of fluorescence maxima associated with microbial activity depending on precipitation

In the case of the two urban rivers studied, precipitation did not significantly influence microbial proliferation, a more pronounced influence on microbial activity being atmospheric temperature. It was also noted that in the case of samples collected from the Sabar River (Sabar MARS and Sabar Alunis), the values obtained were always higher than in the case of samples collected from the Ciorogarla River (Ciorogarla MARS and Ciorogarla Alunis), these values decreasing after the confluence of the two rivers. This behavior suggests that a significant influence is exerted by human activities undertaken in the areas adjacent to the river courses, their contamination occurring even in the absence of precipitation.

The highest values of fluorescence intensity maxima associated with microbial activity in aquatic systems during the studied period were obtained between September and October 2023, this period being marked by a lack of precipitation. Microbial activity was also present in 2024, when in the period June-July, marked by a lack of precipitation in the collection area, the maximum values were high. However, in this case, the values were not extremely high, falling more within an average of the maximum intensity from the period May-September 2024.

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