Presence of polycyclic aromatic hydrocarbons (PAHs) in surface waters of the Koprivnica-Križevci County area

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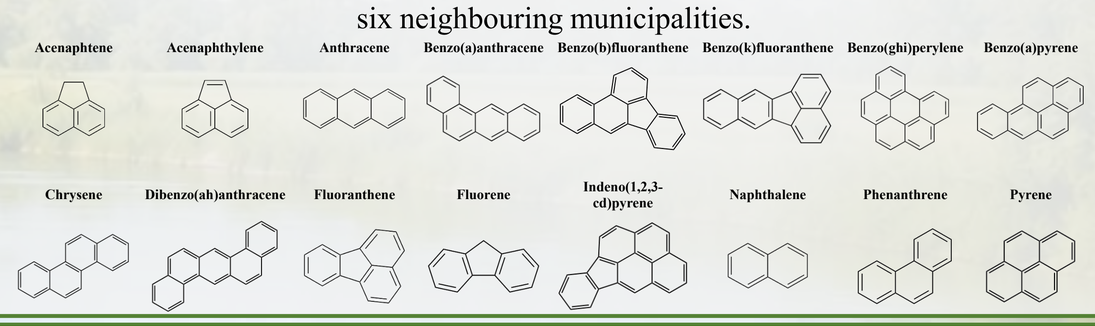
INTRODUCTION

Polycyclic aromatic hydrocarbons (PAHs) are widespread organic pollutants produced by the incomplete combustion of organic matter from both natural and anthropogenic sources. They consist of two or more aromatic rings arranged in linear, angular, or clustered configurations. PAHs enter aquatic systems primarily through atmospheric deposition and wastewater discharges. Owing to their persistence and toxicity, PAHs pose a potential risk to aquatic ecosystems and human health.[1] Because of their adverse effects on human health and marine organisms, the U.S. Environmental Protection Agency (USEPA) has classified 16 PAHs as priority pollutants requiring environmental monitoring.[2] Their concentrations in water are monitored in accordance with the Regulation on Water Quality Standards (NN 96/2019).

OBJECTIVE

The aim of this preliminary study was to determine the presence and concentrations of PAHs in surface waters of the Koprivnica – Križevci County area, sampled in the City of Križevci and six neighbouring municipalities.



MATERIALS AND METHODS

SAMPLING AND STUDY AREA

Sampling periods:
- June 2025 (n = 21)
- October 2025 (n = 21)

Sampling methods:
- EN ISO 5667-6 (river, stream)
- EN ISO 5667-4 (lake)

Sample storage:
- amber glass bottles
- store at 5 ± 3°C in accordance with EN ISO 5667-3

SAMPLE PREPARATION

Sample preparation followed the HRN EN 16691:2015.

1
- SPE filtration system assembly – the LabTech Extrapid – use 47 mm SDB-XC SPE disk
- washing and conditioning - dichloromethane, acetone, water
- sample loading
- elution – acetone, dichloromethane
- drying eluate over Na_2SO_4

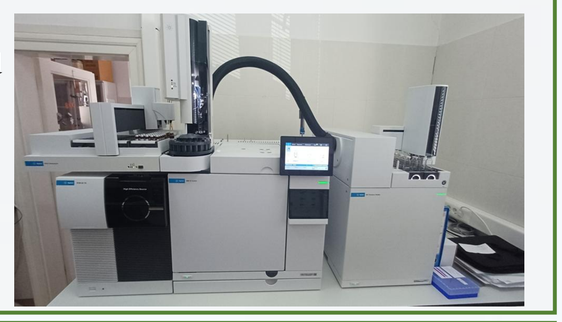
2
- adding isooctane and evaporating (rotavapor) at 45°C

3
- reconstitution in cyclohexane and transfer to vial for GC-MS/MS analysis

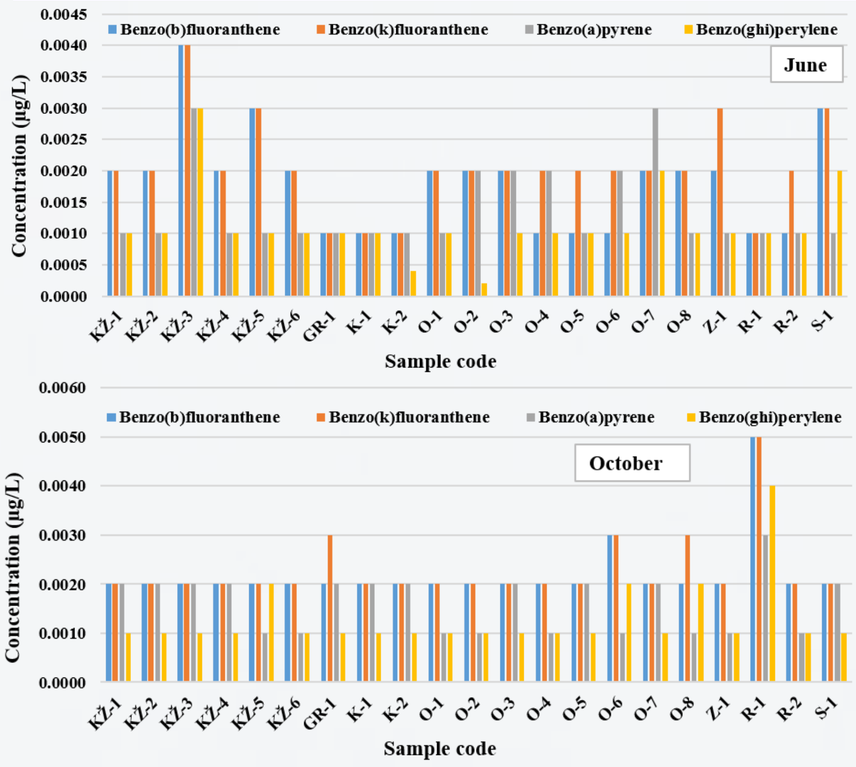
GC-MS/MS ANALYSIS

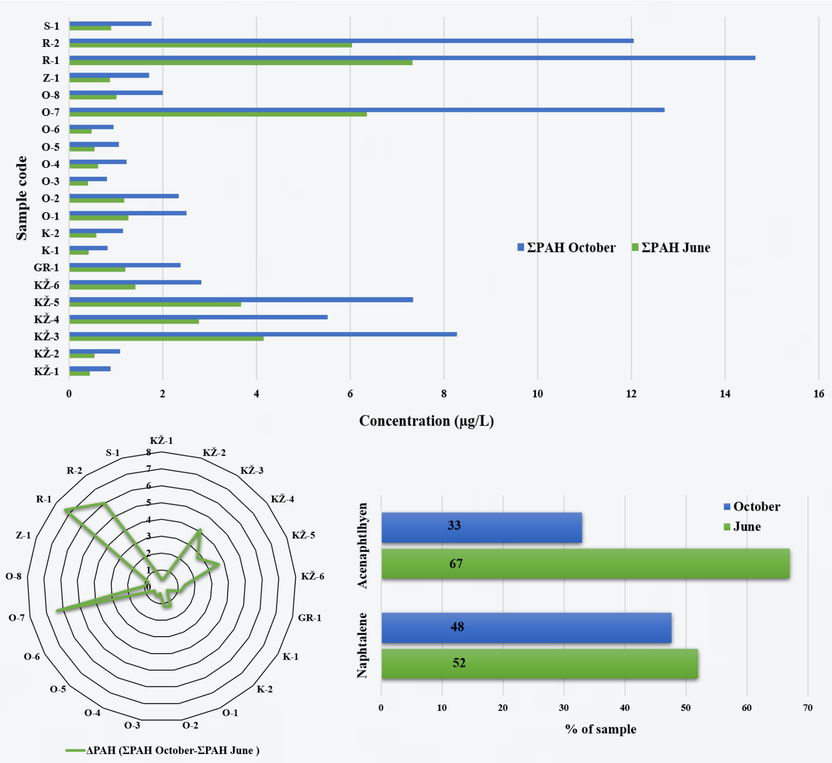
Agilent 8890 GC System coupled to a 7010B triple quadrupole mass spectrometer

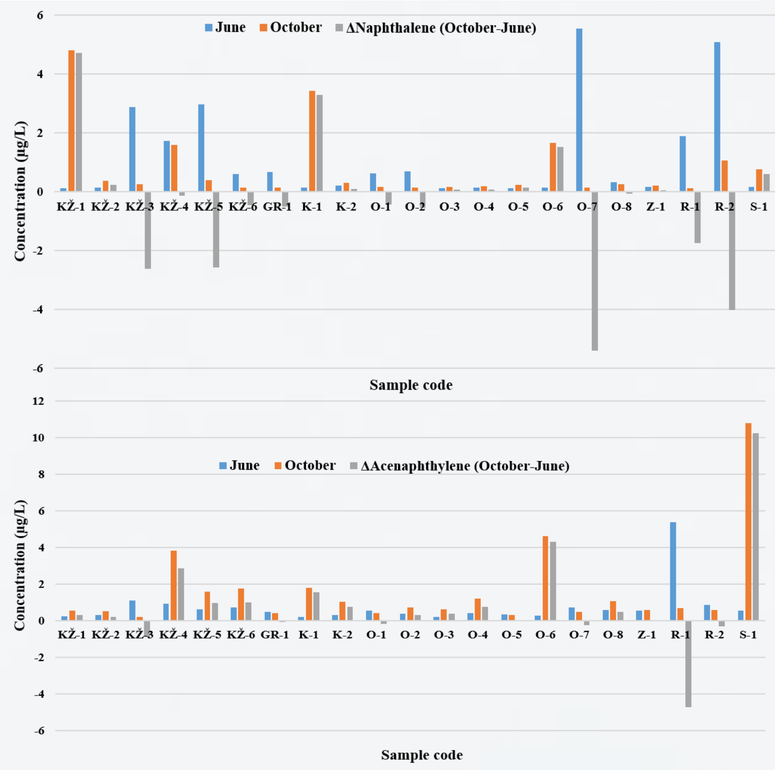
- split liner
- HP-5MS UI column (30 m × 0.25 mm i.d., 0.25 µm)
- run time: 31 min
- injection volume: 5 µL
- He flow rate: 1.2 mL/min



RESULTS







CONCLUSION

- Total PAH concentrations were higher in autumn at all sampling locations, with low-molecular-weight PAHs dominating the overall PAH profile.
- For naphthalene and acenaphthylene, higher concentrations were observed in June than in October in 52% and 67% of the samples, respectively.
- The largest differences in total PAH concentrations between the two sampling periods (ΔPAH = ΣPAH October − ΣPAH June) were observed at sampling locations R-1, R-2, and O-7.
- Concentrations of individual PAHs (benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(ghi)perylene) did not exceed the values prescribed by the Regulation on Water Quality Standards (NN 96/2019).
- Future research should include long-term seasonal monitoring and identification of potential PAH sources to improve understanding of their occurrence and distribution in surface waters.

ACKNOWLEDGEMENT

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