SEDIMENTARY RECORD OF OIL POLLUTANT SATURATED BIOMARKERS IN ALLUVIAL SEDIMENTS OF THE SAVA RIVER

Tatjana Šolević Knudsen[1,*], Sandra Bulatović[2], Srdjan Miletić[1], Mila Ilić[1]

[1]University of Belgrade, Institute of Chemistry, Technology and Metallurgy – Department of Chemistry, Njegoševa 12, 11000 Belgrade, Serbia
[2]University of Belgrade, Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia
(* tsolevic@chem.bg.ac.rs)

INTRODUCTION

One of the largest heating plants in the Balkan is located in Belgrade (the capital of Serbia), close to the Sava River (Figure 1). Due to the potential risk of contamination, this site has been a subject of detailed environmental monitoring for several years. Our previous research was focused on the pedologic analysis of the sedimentary profile, and on the analyses of *n*-alkanes and isoprenoids in the alluvial sediments in this area [1].

According to the pedologic analysis, the lithologic profile at this location is represented by alternating layers of sand and clay, and by low content of organic matter. Because of that, a reduced adsorption capacity and a reduced retention of oil pollutants can be expected at this locality.

The aim of our present research was to investigate the presence, composition and distribution of oil pollutant saturated biomarkers (n-alkanes and sterane and terpane polycyclic alkanes) in alluvial sediments of the Sava River in the vicinity of the heating plant in New Belgrade, Serbia.

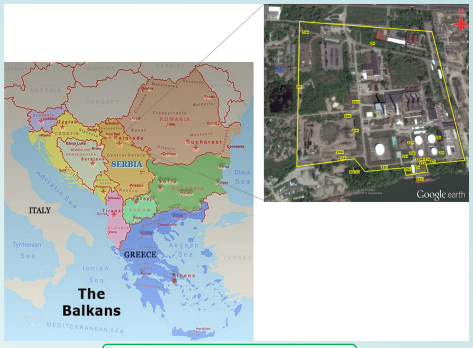

Figure 1. The investigated location.

EXPERIMENTAL

Surface soil and sediment samples were collected at three microlocations from this locality. The sediment samples were collected at regular depth intervals, down to the depth of 15 m. From these samples extractable organic matter was isolated with dichloromethane using a Soxhlet apparatus. Saturated hydrocarbons were isolated from the extracts using a column chromatography and analyzed by GC-MS. The analytical procedure employed was described in our previous papers [2].

RESULTS

The distribution of the *n*-alkanes in the *m/z* = 71 GC-MS chromatograms revealed that most of the samples contained a mixture of an oil pollutant and a native organic matter. Their ratio varied depending on the distance from the heating plant, which was the only suspected source of oil pollution in this area (Figures 2-3).

The analyses of steranes (*m/z* = 217) and terpanes (*m/z* = 191) showed that, at some locations, different oil pollutants were present (Figure 5). These results suggested that multiple discharges of the oil pollutants to the surrounding soil occurred over the years.

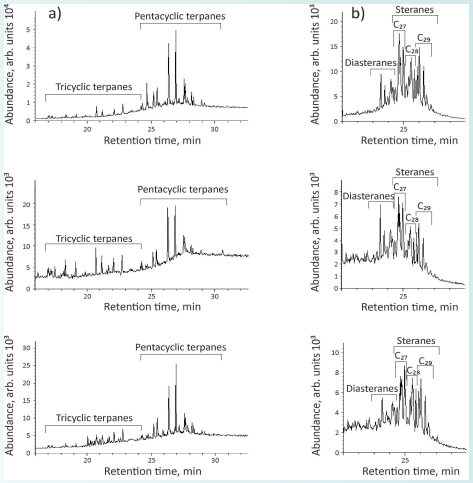

Figure 5. Examples of biomarker terpane (a) and sterane (b) compounds isolated from the samples investigated.

CONCLUSIONS

The results of GC-MS analyses of the saturated fractions indicated that the surface soil samples at the investigated location contained a mixture of a diesel fuel and a native organic substance.

GC-MS analyses of the saturated fractions isolated from the subsurface samples revealed that these samples contained mixtures of a diesel fuel and a heavy oil fuel. Presence of different oil pollutants in the investigated samples was confirmed by some differences in distribution of terpane and sterane biomarkers isolated from different samples.

According to all these results it can be concluded that the oil pollutant's saturated hydrocarbons at the investigated location originate from multiple discharges of diesel and/or a heavy oil fuel. At some microlocations, these pollutants leaked through the sediment profile almost unaltered, most probably due to the low adsorption capacity of the surrounding sediments.

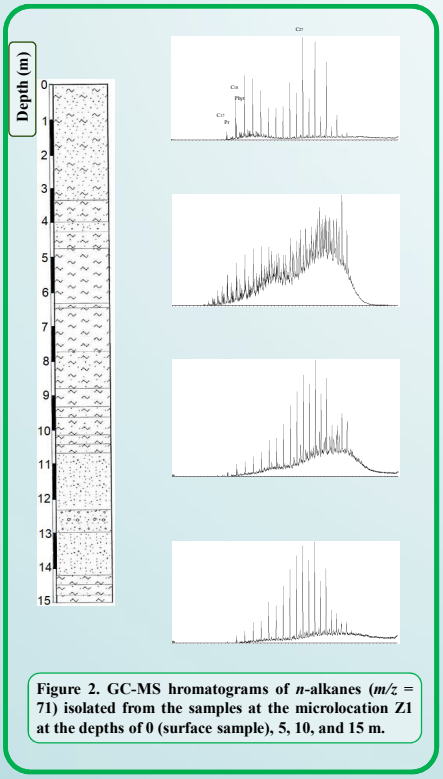

Figure 2. GC-MS hromatograms of *n*-alkanes (*m/z* = 71) isolated from the samples at the microlocation Z1 at the depths of 0 (surface sample), 5, 10, and 15 m.

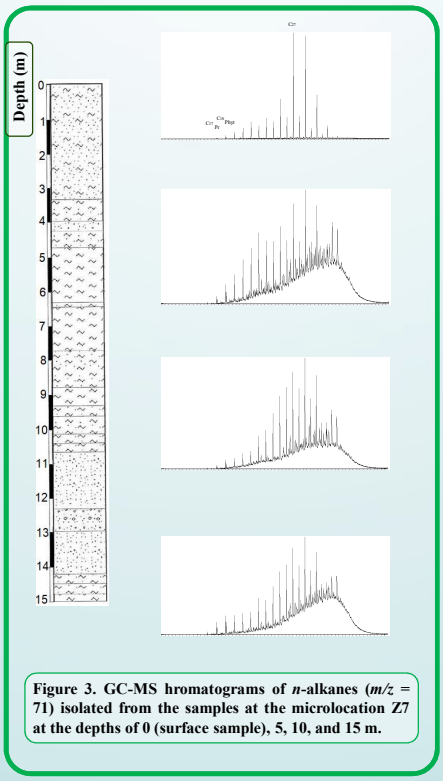

Figure 3. GC-MS hromatograms of *n*-alkanes (*m/z* = 71) isolated from the samples at the microlocation Z7 at the depths of 0 (surface sample), 5, 10, and 15 m.

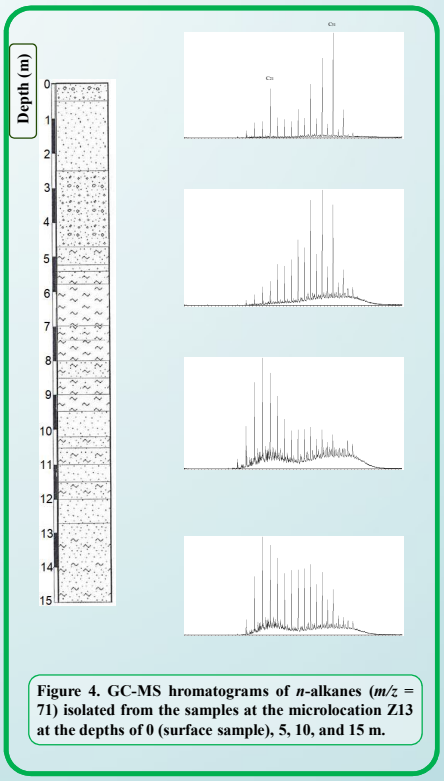

Figure 4. GC-MS hromatograms of *n*-alkanes (*m/z* = 71) isolated from the samples at the microlocation Z13 at the depths of 0 (surface sample), 5, 10, and 15 m.

REFERENCES:
[1] S. Bulatović, T. Šolević Knudsen, M. Ilić, S. Miletić, 19 European Meeting on Environmental Chemistry, EMEC19, Clermont-Ferrand, France, 2018.
[2] B. Jovančićević, M. Antić, T. Šolević, M.M. Vrvić, A. Kronimus, J. Schwarzbauer, Environmental Science and Pollution Research, 12 (2005) 205.

Acknowledgements
We thank the Ministry of Education, Science and Technological Development of the Republic of Serbia (Projects 176006 and III 43004) for supporting this research..