

# MIGRATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN VERTICAL PROFILE OF ALLUVIAL SEDIMENTS OF THE SAVA RIVER, SERBIA

Tatjana Šolević Knudsen<sup>1,\*</sup>, Mila Ilić<sup>1</sup>, Sandra Bulatović<sup>2</sup>, Gordana Dević<sup>1</sup>, Jelena Milić<sup>1</sup>, Srdjan Miletić<sup>1</sup>, Miroslav M. Vrvic<sup>2</sup>

<sup>1</sup>University of Belgrade, Institute of Chemistry, Technology and Metallurgy – Department of Chemistry, Njegoševa 12, 11000 Belgrade, Serbia

<sup>2</sup>University of Belgrade, Faculty of Chemistry, Studentski trg 12-16, 11000 Belgrade, Serbia  
(\* tsolevic@chem.bg.ac.rs)

## INTRODUCTION

The plants for district heating in Belgrade (Capital of Serbia) have been using petroleum products as fuel for decades. The heating plant in New Belgrade is one of the largest heating plants in Balcan. Due to its location in New Belgrade-alluvial plains of the Sava River, this heating plant represents potential source of the oil pollution for the whole alluvial area.

Our previous research confirmed presence of different oil pollutants in these sediments (Miletić et al, 2015). The aim of our present research was to investigate the extent of vertical migration of polycyclic aromatic hydrocarbons in vertical profile of alluvial sediments of the Sava River at this locality.

## EXPERIMENTAL

In spring 2015, during an extensive analysis of the ground waters from the existing system of 10 piezometers, within the area of the heating plant in New Belgrade, three new wells were drilled down to the depth of 15 m. From these three new boreholes the soil and sediment samples were taken from several depths: 0-0.30 m; 0.50 m; 1.00 m; 1.50; 2.00 m; 5.00 m; 7.00 m, 10.00 m 12.5 m and 15.00 m. Pedologic analysis revealed that lithologic profile was represented by alternating layers of sand and clay. Moreover, most of the layers in the soil profile were characterized by low content of organic matter which results in a reduced adsorption capacity and reduced retention of oil pollutants (Delle Site, 2001).

The soil and sediment samples were extracted for petroleum hydrocarbons with dichloromethane in a Soxhlet apparatus. The extracts were fractionated using column chromatography into fractions of: saturated hydrocarbons (Fraction I), aromatic hydrocarbons (Fraction II), and polar compounds (alcohols and keto compounds - Fraction III; Jovančićević et al, 2005.).

The aromatic fractions were analyzed by gas chromatography – mass spectrometry (GC-MS) techniques. A detailed analysis comprised 2-, 3-, and 4-ring polycyclic aromatic compounds (PAHs), and their methylated homologues, typical for crude oils and their derivatives.

## RESULTS

The results showed that low amounts of petroleum PAHs investigated were present in the whole profile investigated, down to the depth of 15 m.

## CONCLUSIONS

It can be concluded that in these alluvial sediments PAHs can migrate down to the depth of 15 m. Considering characteristics of the surrounding soil profile with low adsorption capacity and reduced retention of oil pollutants, it is necessary to raise awareness that these environmental pollutants can easily be remobilized and migrate to the surrounding soil, sediments and, probably ground water.

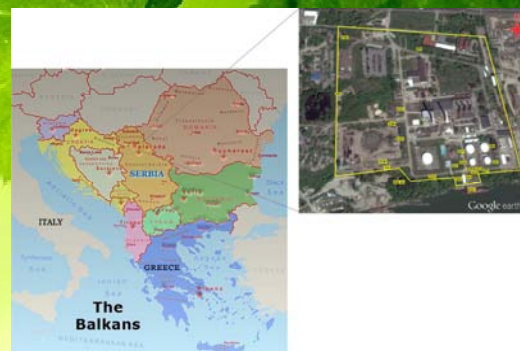


Figure 1. The investigated location.

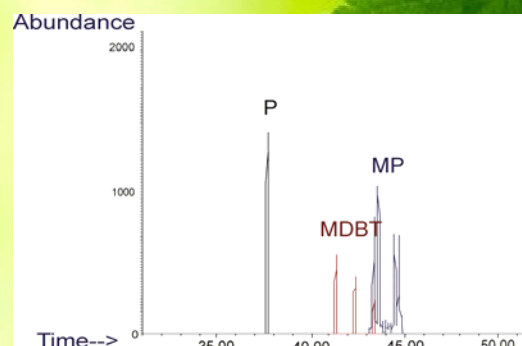


Figure 2. Reconstructed ion chromatogram of  $m/z = 178$  (phenanthrene; P),  $m/z = 192$  (methylphenanthrenes; MP) and  $m/z = 198$  (methyl dibenzothiophenes; MDBT) identified in the borehole Z13 at the depth of 10 m, but also typical for most of the samples investigated.

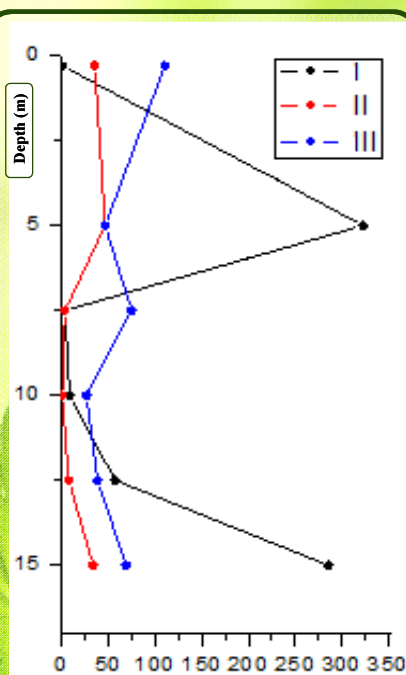


Figure 3. Concentration profiles of saturated (I), aromatic (II) and polar fractions (III; mg/kg) in the borehole Z1.

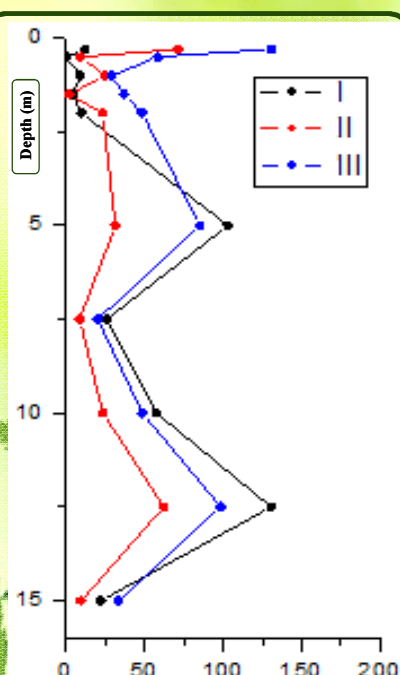


Figure 4. Concentration profiles of saturated (I), aromatic (II) and polar fractions (III; mg/kg) in the borehole Z7.

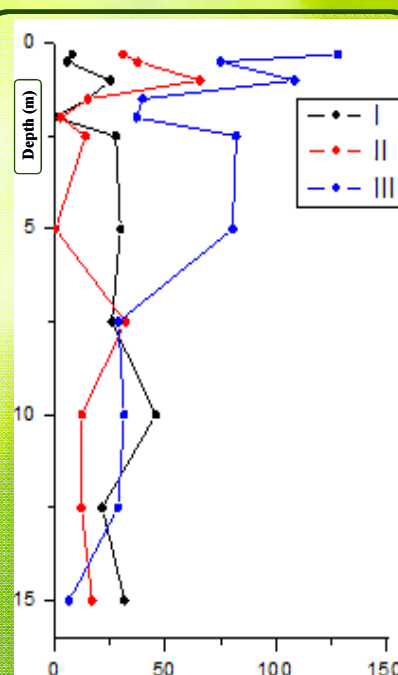


Figure 5. Concentration profiles of saturated (I), aromatic (II) and polar fractions (III; mg/kg) in the borehole Z13.

## REFERENCES:

- Delle Site A. 2001. Factors Affecting Sorption of Organic Compounds in Natural Sorbent/Water Systems and Sorption Coefficients for Selected Pollutants. A Review. Journal of Physical and Chemical Reference Data, 30, 187-439.
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- Miletić S., Ilić M., Avaldović J., Šolević Knudsen T., Bešković Y.P., Branimir Jovančićević B., Vrvic M.M. (2015) Oil pollution in the vicinity of a heating plant in New Belgrade (Serbia) – influence on the quality of the surrounding soil and sediments. 16th European Meeting on Environmental Chemistry, EMEC16, Book of Abstracts, November 30 – December 03, 2015, Torino, Italy.