COMPOSITION AND DISTRIBUTION OF SATURATED HYDROCARBONS IN THE VICINITY OF A HEATING PLANT IN NEW BELGRADE - ALLUVIAL SEDIMENTS OF THE SAVA RIVER, SERBIA

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INTRODUCTION

The heating plant in New Belgrade is one of the largest heating plants in Belgrade, the capital of Serbia. During the months of May and June 2015 a detailed investigation of the pollution of the soil and sediments in the vicinity of this heating plant was conducted.

The aim of our present research was to investigate the composition and distribution of saturated hydrocarbons in alluvial sediments of the Sava River in the vicinity of a heating plant in New Belgrade, Serbia.

EXPERIMENTAL

In spring 2015, an extensive analysis of the soils and sediments within the area of the heating plant in New Belgrade was conducted. The soil and sediments were sampled from 20 micro locations. 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; Moreover, three new wells were drilled down to the depth of 15 m. From these three new wells the samples were taken from the lowere depths as well: 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 might result 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 saturated fractions were analyzed by gas chromatography – mass spectrometry (GC-MS) techniques. A detailed analysis comprised n-alkanes (m/z = 71), isoprenoids (m/z = 183), steranes (m/z = 217) and terpanes (m/z = 191).

Figure 1. The investigated location.

RESULTS

The results showed that in most of the extracts isolated polar compounds (Fraction III) were most abundant while saturated hydrocarbons (Fraction I) were least represented. This ratio between the fractions remained almost unaltered in different soil profiles in this area and at different depts.

Saturated hydrocarbons were analyzed by gas chromatography – mass spectrometry (GC-MS) techniques.

The analyses of n-alkanes (m/z = 71) and isoprenoids (m/z = 183) revealed presence of oil pollutant in almost all of the samples analyzed (Figures 2-4).

GC-MS analysis indicated that the soil/sediment samples investigated contained diesel and/or a heavy oil fuel which have been used for decades in this heating plant.

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

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.

CONCLUSIONS

According to all of these results it can be concluded that the saturated hydrocarbons in the soil and the sediments at the investigated location represent a mixture of an oil pollutant and a native organic matter.

The oil pollutant's saturated hydrocarbons 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.

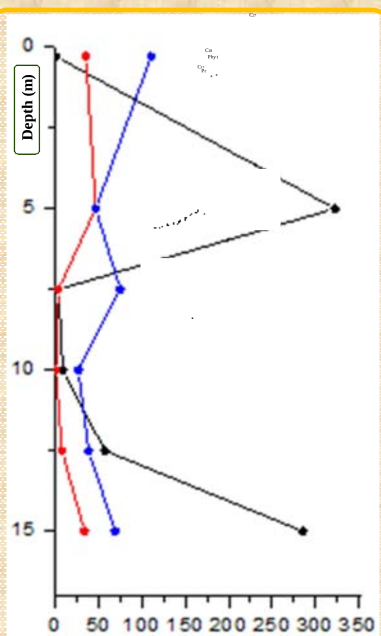

Figure 2. Concentration profiles of saturated (I), aromatic (II) and polar fractions (III; mg/kg) in the borehole Z1. GC-MS hromatograms of *n*-alkanes (m/z = 71) are included as well.

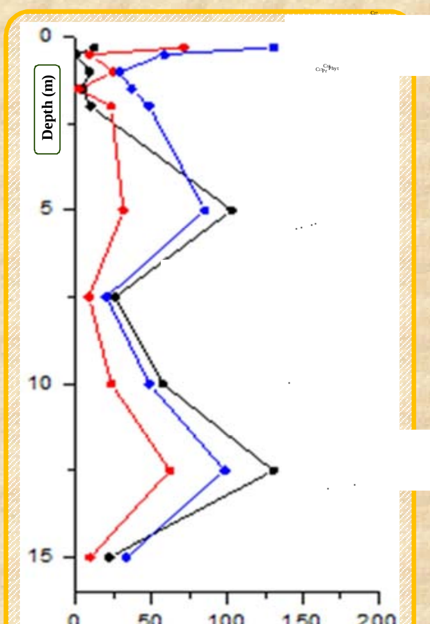

Figure 3. Concentration profiles of saturated (I), aromatic (II) and polar fractions (III; mg/kg) in the borehole Z7. GC-MS hromatograms of *n*-alkanes (m/z = 71) are included as well.

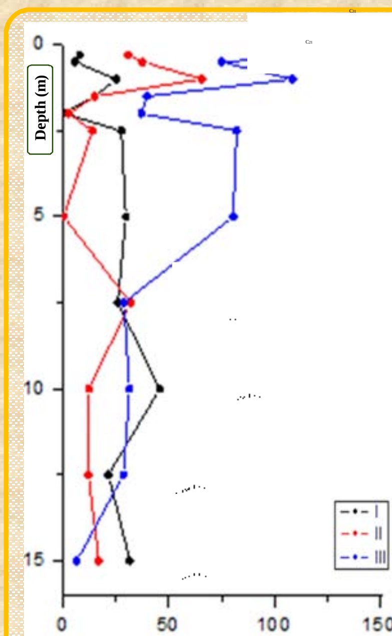

Figure 4. Concentration profiles of saturated (I), aromatic (II) and polar fractions (III; mg/kg) in the borehole Z13. GC-MS hromatograms of *n*-alkanes (m/z = 71) are included as well.

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