

# 第24回 環境化学討論会

24<sup>th</sup> Symposium on Environmental Chemistry  
Program and Abstracts

## 環境化学の新たな展開 — 環境毒性学の視点を加えて —

要 旨 集

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Graduate School of Veterinary Medicine, Hokkaido University

[主催] 一般社団法人日本環境化学会

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## **Congener specific analysis of PCBs after bioremediation of contaminated river sediment**

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### **[Introduction]**

Persistent Organic Pollutants, (POPs) are chemical substances that persist in the environment, bioaccumulate through the food chain and cause adverse effects on human health and the environment [1, 2]. They include the group of Polychlorinated Biphenyls, (PCBs), industrial chemicals which may be substituted with 1 - 10 chlorine atoms [3-6]. Due to their chemical inertness, heat resistance and low dielectric constants PCBs were used as insulations in transformers and large capacitors, as heat exchangers and color additives in the production of plastics [3-6]. We have studied the biodegradation of PCBs in sediment samples collected from rivers in the territory of Belgrade, Serbia. The aim of our study was to analyze the potential of allochthonous and autochthonous microorganisms in the process of biodegradation of PCBs from sediments of the river to protect the environment and future potential treatment of these sites.

### **[Methods]**

For the study of bioremediation PCBs, sediment composite samples from the four depths in the ratio 1: 2: 3: 4 (w/w) were made. In Bushnell - Haas medium (modified, chloride-free) sand and composite samples, 1: 1 (w / w) were added. The experiment lasted 70 days with alternating anaerobic - aerobic cycles and inoculation on 21st and 56th day. Inoculation was performed by a consortium of the genera *Pseudomonas* (sp. NS009 and CHNSH-17), *Rhodococcus* (sp. RNP05 and CHP-NR31) and *Achromobacter* (sp. NS014). These allochthonous microorganisms were isolated from sites contaminated by petroleum products and after microbiological and biochemical characterization their 16S rRNA sequences were deposited in GenBank. In parallel, activity of autochthonous microorganisms on PCB transformation were followed. As abiotic control sterilized sample were used. Biodegradation processes are interrupted by sterilization. Then extraction was carried out with a mixture of acetone: hexane, 1: 1 (V / V). The PCB content was analyzed congener specifically in obtained samples by GC-MS/MS method. Sample analysis was performed by HRGC/HRMS (JEOL JMS-800D) and GC-TQMS (450-GC/320-MS, Bruker). The congener assignment was confirmed using HT8-PCB capillary column (Kanto, 60m × 0.25mm).

### **[Results and discussion]**

The river sediment samples were collected from four locations in the territory of Belgrade: confluence of the Topčider river with Čukarički Rukavac (CR), Marina Dorćol (MD), Zemunski Kej (ZK) and the confluence of the river Sava and the Danube, Usce (U).

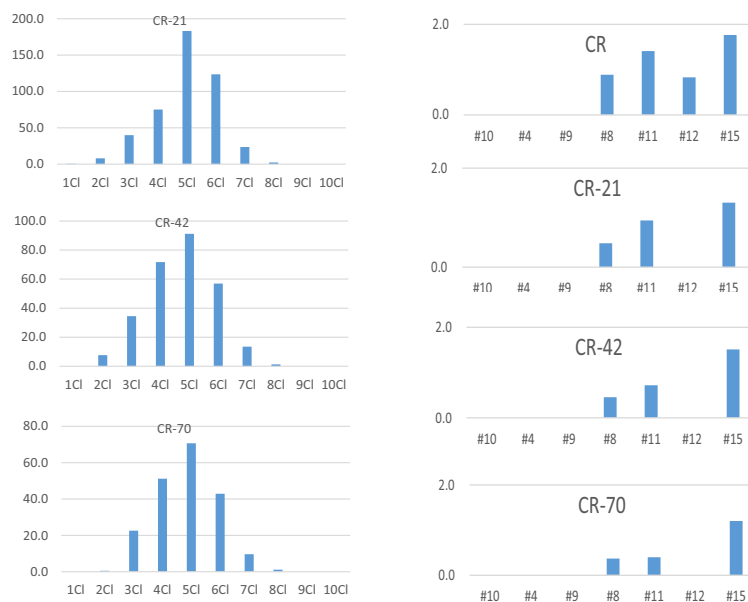


Figure 1. Homologue and isomer profile of PCB in sediment of Čukarički Rukavac (CR) (21, 42, 70 days)

Sediments were sampled from four depths in undisturbed condition as follows: 0-1, 1-3, 3-6 and 6-10 cm. The highest level of PCB in a sample is determined in CR sediment (169-305 ng/g) and MD (19.3-54.5 ng/g), while the sample concentration in ZK (6.2-7.1 ng/g) and U (2.1-5.3 ng/g) were relatively low.

#### [Conclusion]

In the samples inoculated with allochthonous consortium, as well as in the samples with autochthonous microorganisms reduction in the concentration of PCBs was observed. The concentration of PCB congeners in the sample CR decreased depending on the chemical structure of each PCB congeners during bioremediation process. The results indicate existence of bioremediation potential of microorganisms isolated from polluted environment for the treatment of sediment contaminated with PCBs using alternating anaerobic - aerobic cycles.

#### [References]

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