

PCBs contamination in bottom sediments from three dam reservoirs: catchment characteristics and pollution sources

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Introduction: Anthropogenic activity has introduced a significant amount of substances exerting the toxicological effects into the aquatic environment. One of them are polychlorinated biphenyls (PCBs) - a man-made chemicals, which have been produced and used since 1929. Because of their high affinities to solid phases they can end up in the sediments and thus affect environmental quality.

This investigation paid attention to variations in the PCB levels in samples collected from three different types of dam reservoirs: Wloclawski Reservoir (WR), Jeziorsko Reservoir (JR) and Sulejowski Reservoir (SR) for a possible source of contamination and influence of catchment characteristics.

Methods: PCBs extractions, clean-up and analysis were performed according to US EPA 1668 Method and PN/EN 1948: 3 2002 Norm. The dried sediments were spiked with ¹³C-labelled PCB and extracted by ASE (Automatic System Extraction) 200 Dionex. Removal of interferences from extracts was conducted with use of a silica multilayer column. Identification and quantification of 12 dioxin-like PCB congeners was performed using HRGC/HRMS (HP6890, Hewlett Packard/Autospec Ultima, Micromass) fitted with DB-5MS columns (60m x 0.25 mm i.d., film thickness 0.25 µm). Samples were quantified with an isotope dilution method.

Results and conclusions: The concentrations of PCB were characterized by the elevated levels at the locations in the down section of each reservoir. The highest total average PCBs concentration occurred in WR (592.28 ng/kg d.w.), lowest in SR (23.48 ng/kg d.w.) and medium value of 220.06 ng/kg d.w. in JR. Despite above results, the highest total equivalent (TEQ) concentration, ranging from 0.25 to 0.66 ng TEQ/kg d.w., was noted in the reservoir of medium PCBs pollution (JR) being influenced by contaminants from highly contaminated Ner River received pollutants from the Lodz agglomeration. In the samples collected from the largest reservoir of the highest water flow and no retention time (WR), the TEQ values ranged from 0.10 to 0.53 ng TEQ/kg d.w. Whereas samples collected from SR characterized by high retention time and low catchment transformation had much less toxicity varied from 0.02 to 0.11 ng TEQ/kg d.w.

The results showed the concentration of PCBs were higher in the samples from WR and JR – and indicated the effect of urban and industrial land use on the pollutants distribution patterns. Additionally, the physical parameters such as water flow, water retention time and sediment types can be important factors controlling the PCB levels within examined reservoirs

References

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