Battery of biotests as tools for toxicity assessment of bottom sediments

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Introduction: Bioassays are a useful tool whose application enables a fuller classification of risk resulting from the presence of chemical substances in sediments, their bioavailability, and interactions [1]. Many authors emphasize that bioassays are a good complement to chemical analyses in procedures of sediment quality assessment [2]. Due to the fact that organisms differ in sensitivity to various substances, it is essential to select appropriate test organisms. It is important for organisms to belong to different taxonomic groups and represent different links of the trophic chain [3]. The aims of this study were to use four bioassays (Phytotoxkit, Phytotestkit, Ostracodtoxkit F and Microtox®) to evaluate the toxicity of sediments, sediment elutriates and pore water. Moreover, a possible relationship between the observed toxicity and chemical composition of bottom sediments was studied. The obtained information may provide a better understanding of environmental risks of heavy metals in sediments.

Methods: The bottom sediments originated from 11 reservoirs situated in the southern Poland. The toxicity assessment was performed using the following tests: Phytotoxkit (sediment), Phytotestkit (pore water), Ostracodtoxkit F (sediment) and Microtox® (sediment elutriate, pore water) (Table 1).

Table 1. Battery of bioassays

Trophic level	Organisms	Test	Test reaction
Producers	*S. saccharatum*, *L. sativum*, *S. alba*	Phytotoxkit/ Phytototeskit	Germination and growth inhibition
Consumers	*H. incongruens*	Ostracodtoxkit	Mortality, growth inhibition
Decomposer	*V. fischeri*	Microtox®	Luminescence inhibiotion

Toxicity results were expressed as Percent Effect (PE%). In the first stage, screening tests were conducted on the sediment and pore water. After determining the percent effect for each bioassay, the sample was classified as one of five classes according to the highest toxicity indicated by at least one test.

Results: The assessment of results obtained from the battery of bioassays was based on the system of classification of hazards to surface waters [4] (Table 2). Toxicity of the studied samples can be put in the following order: solid phases > whole sediment > pore water. Among all the test organisms, the lowest sensitivity was observed in *H. incongruens* and the higest in the Microtox® test with *V. fischeri* bacteria.

Table 2. Sediments toxicity classification

Bottom sediments	Class		Hazard
Bagna Rzeszowskie	III	toxic	acute hazard
Besko	II	low toxic	low acute hazard
Brzóza Królewska	III (IV)	toxic	acute hazard/ high acute hazard
Brzóza Stadnicka	III	toxic	acute hazard
Cierpisz	II	low toxic	low acute hazard
Głuchów	II	low toxic	low acute hazard
Narożniki	II	low toxic	low acute hazard
Niedziwiadek	II	low toxic	low acute hazard
Ożanna	III	toxic	acute hazard
Rybnik	III (IV)	toxic	acute hazard/ high acute hazard
Rzeszów	II	low toxic	low acute hazard

In conclusion, in order to identify the degree of contamination of sediments, it is important to conduct, next to chemical analyses, an ecotoxicological classification of sediment quality using a battery of bioassays as biosensors for changes in the water ecosystem

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