Ecotoxicological and chemical assessment of contaminated sediments

I.Czerniawska-Kusza, T. Ciesielczuk, G. Kusza
Department of Land Protection, University of Opole
Izabela.Kusza@uni.opole.pl

Bioassays provide useful tools for ecological risk assessment of contaminated sediments. In contrast to chemical analyses, which mainly focus on the qualitative and quantitative determination of contaminants, biological tests detect combined effects of different pollutants, their mobility and bioavailability.

The objective of the present study was to: (1) evaluate the extent of environmental contamination of sediments using combined chemical analyses and toxicity bioassay techniques; (2) estimate the potential of the recently developed Phytotoxkit microbiotest as an adequate tool for hazard assessment of river sediments; (3) assess the influence of other factors than contaminant concentrations on phytotoxic effects.

Materials and methods

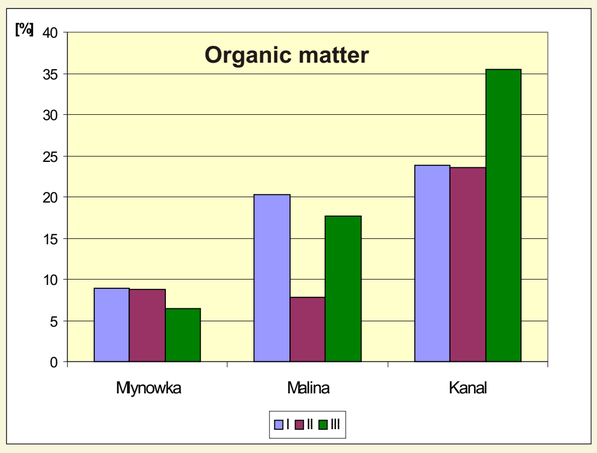
Sediments (27 in total) were collected with an Ekman Bottom grab from three watercourses in Opole region - Malina, Młynówka and Kanał. For general classification scenery of pollution, following physical-chemical parameters were analyzed with standard methods: granulometric composition of sediments, pH, organic matter content, concentration of oil derivatives, polycyclic aromatic hydrocarbons (PAHs) and heavy metals (Cd, Cr, Cu, Zn, Ni, Pb, and Hg).

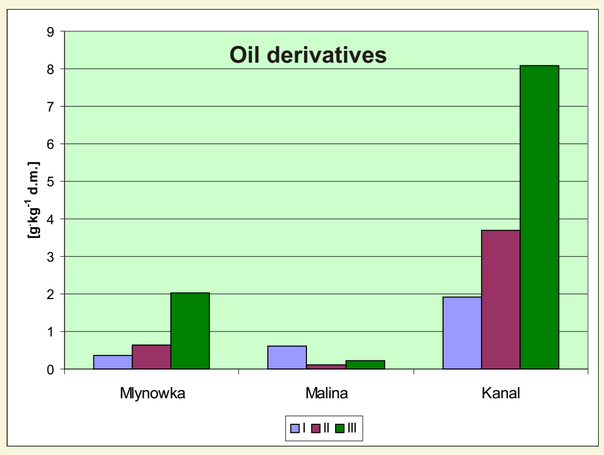
The toxicity of pore water and whole sediments was determined with two microbiotests:
Algaltoxkit F with *Selenastrum capricornutum*

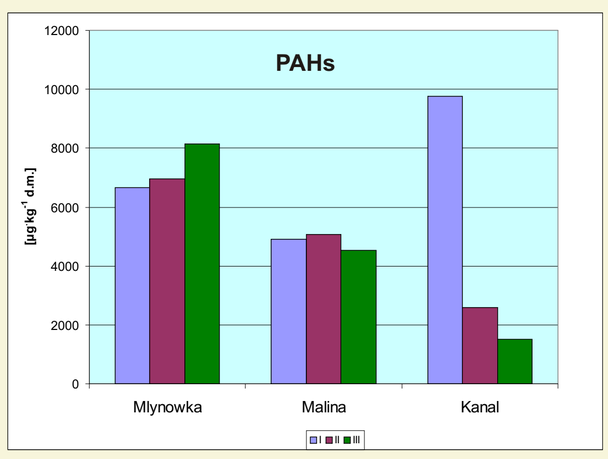
The effect data (72h Ec50) of the sediment pore waters were transformed in Toxic Units (TU) according to the equation:TU = 1/EC50x100

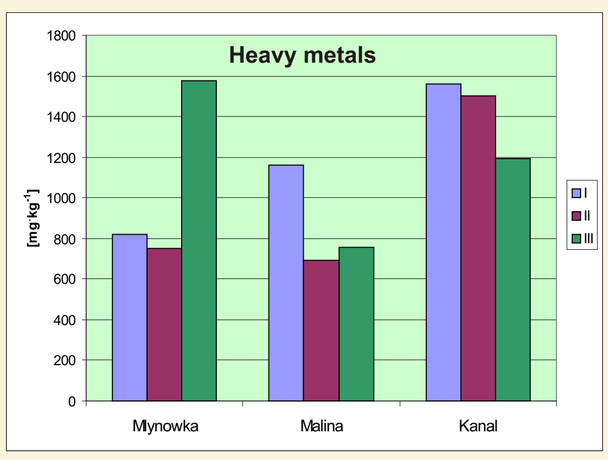
Phytotoxkit with higher plants *Lepidium sativum*, *Sinapia alba* and *Sorghum saccharatum*

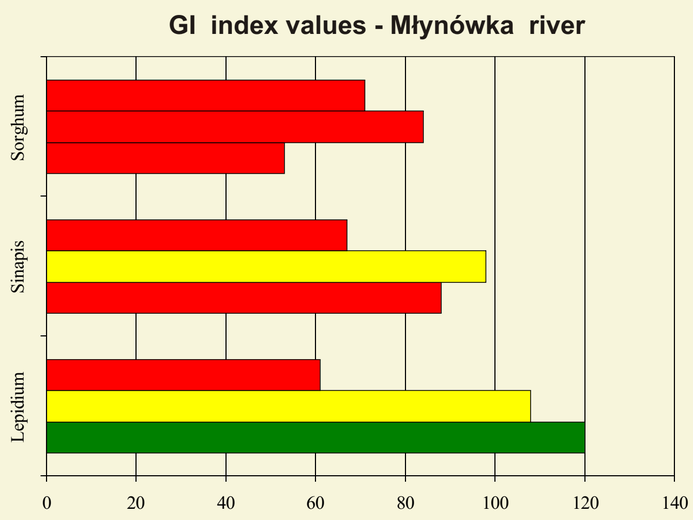
The seed germination and root elongation data were combined into the germination index (GI) using the formula: GI = (GsLs)/(GcLc) where Gs and Ls are seed germination (%) and root elongation (mm) for the sample, while Gc and Lc the corresponding control values.

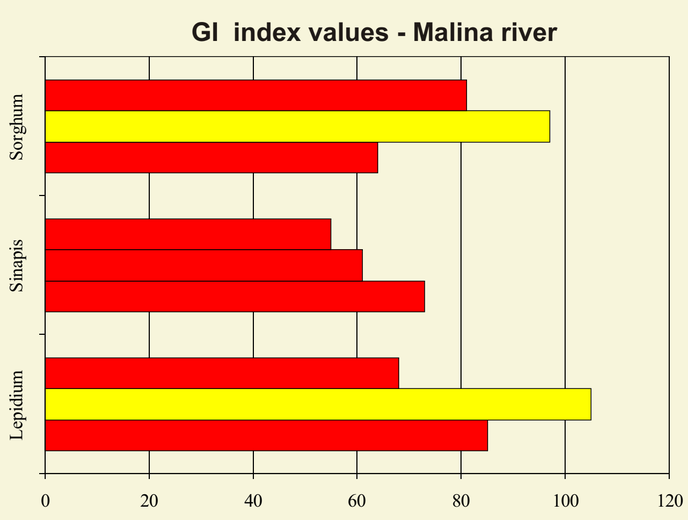


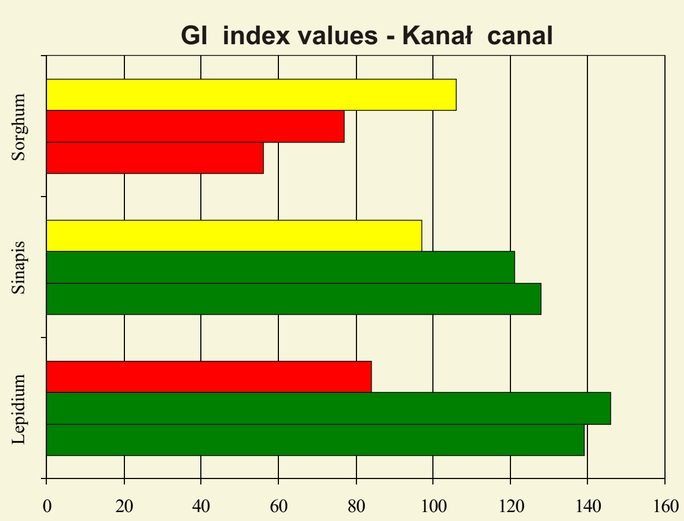




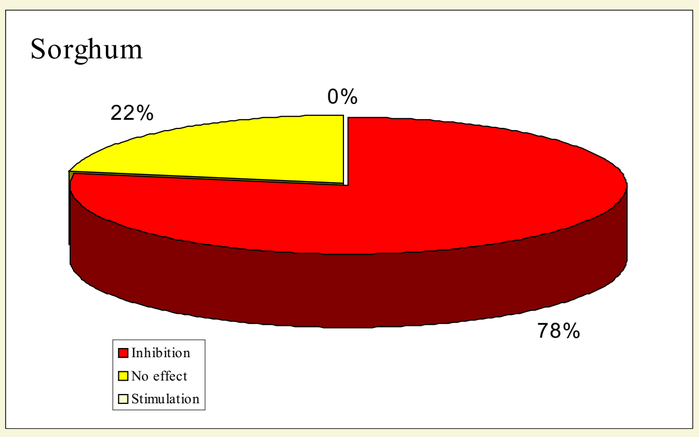


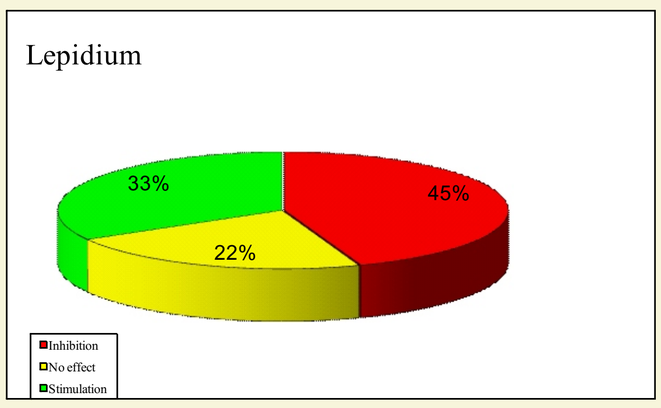


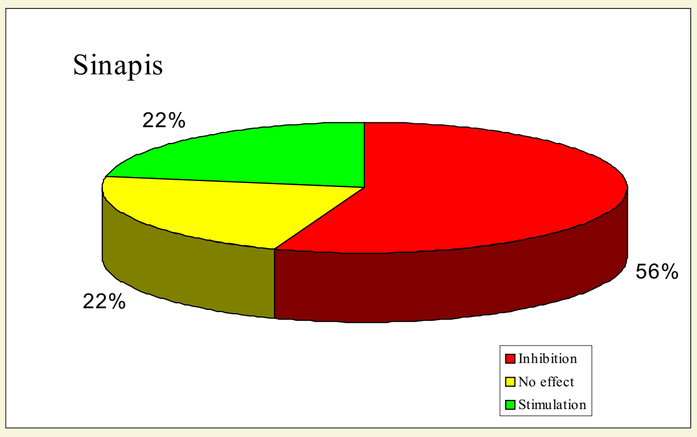




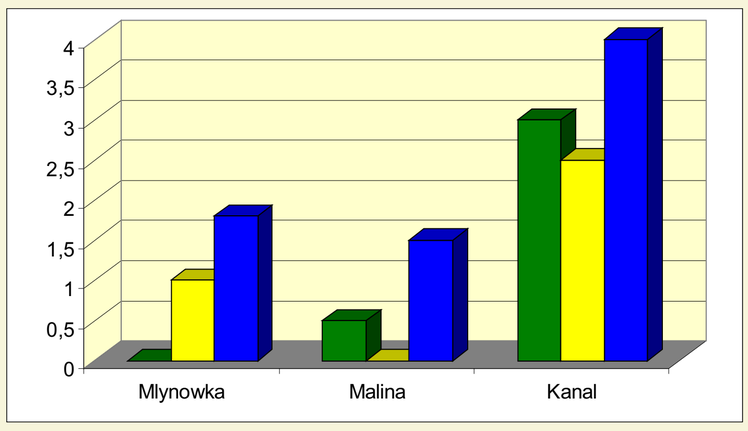
Higher plant response to contaminated sediments







Mean toxicity (in TU) of sediment pore waters performed with the Algaltoxkit F



Summary

1.The level of sediment contamination varied significantly among particular sampling sites.

2. The Phytotoxkit microbiotest was effective in identifying toxic sediments, but the three plant species responded differently in the magnitude of the effects. The order of increasing plant sensitivity to contaminated sediments was *L. sativum* < *S. alba* < *S. saccharatum*.

3. Absence of pore water toxicity was not always consistent with the results of the sediment toxicity test performed with higher plants. The sequence of increasing:
   - pore water toxicity: Malina<Młynowka<Kanał,
   - sediment toxicity: Kanał<Młynówka<Malina.

4. Phytotoxic effects were modified by organic matter content and grain size composition.