

Trace elements, radionuclides and persistent organic pollutants in Sulejów reservoir bottom sediments (Poland)

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Introduction: The Sulejów reservoir was created in years 1969 -1974. It is formed by a dam constructed on the middle course of Pilica river (342 km long left-side tributary of Vistula river) on 138,9 km of the river course near Smardzewice village. Its surface area is about 25 km², its length is about 15 km, its width is 3,5 km, and the maximum depth equals 15 m. Pilica river brings 82,1% of water volume on average, while Luciąża river – 16,6%. It is a typical lowland, low-volume reservoir with large area and major fluctuations of water level. The whole catchment area is afforested and agricultural arable lands account for about 64% of the catchment area, forests – about 31% and only 5,1% remains for other types.

Methods: 51 drilling cores were collected from the reservoir. The cores were divided into 131 samples. Concentrations of Ag, As, Ba, Cd, Cr, Co, Cu, Hg, Pb, Se, Sr, Sb, Sn, Tl, V, and Zn were analyzed with AAS, ICP-MS and TMA methods and U (eU), Th (eTh), ⁴⁰K and ¹³⁷Cs were analyzed using spectrometric methods with applying germanium detector. PAHs, PCBs and chlorinated pesticides loads were detected with GC-MSD and GC-ECD methods.



Fig. 1: Thickness of silt in the Sulejów reservoir.

Results: Silt sediments do not create a continuous layer on the reservoir bottom. They accumulate in the widest part of the reservoir, where water velocity is

the lowest, and near the dam (figure 1). The concentrations of the most trace elements in the sediments accumulated at the bottom of the Sulejów reservoir are potentially toxic. Trace elements slightly elevated concentration compared to geochemical background values. The silt sediments were characterized by higher contents of trace elements than sand sediments, which have very low concentrations of these elements similar to that type of sediments. Mean trace element concentrations in the silt sediments are closed to geochemical background values [2]. Only concentrations of chromium and barium are higher than their geochemical background values. Maximum concentrations of antimony was equal to 0,6 mg/kg, arsenic – 12 mg/kg, barium – 163 mg/kg, cadmium – 1,2 mg/kg, chromium – 24 mg/kg, cobalt – 7 mg/kg, copper – 20 mg/kg, mercury – 0,12 mg/kg, nickel – 14 mg/kg, lead – 40 mg/kg, selenium – 1,4 mg/kg silver – 0,58 mg/kg, strontium – 138 mg/kg, thallium – 0,21 mg/kg, tin 1,4 mg/kg, vanadium – 32 mg/kg and zinc – 137 mg/kg in sediments. Radionuclides occur in the Sulejów reservoir in concentrations similar to characteristic values for that type of sediments. In lower parts of reservoir there is a small cesium positive anomaly (120 Bq/kg). Maximum PAHs concentration was 3,46 mg/kg. PCBs were detected in values closed to detected limits with a few exceptions only. only compounds of DDT group were detected among chlorinated pesticides..

Discussion: The accumulated sediments in the Sulejów reservoir are not potentially toxic for water organisms. The estimated volume of silts accumulated in reservoir was 3400000 m³ and their tonnage - 5880000 t. It was calculated that these silt sediments contain about 1,1 t of antimony, 15 t of arsenic, 76 t of chromium, 3,3 t of tin, 220 t of zinc, 1,4 t of cadmium, 31 t of copper, 42 t of nickel, 65 t of lead and 0,3 t of mercury.

References: [1] Galicka W. (1996) Limnologiczna charakterystyka nizinnego zbiornika zaporowego na Pilicy. UŁ. [2] LIS J., PASIECZNA A. (1995) — Geochemical maps of Poland in scale 1:2 500 000 PGI. Warsaw.