

ALLOCATION AND TRANSFORMATIONS OF SELECTED POLLUTANTS IN DAM RESERVOIRS OF THE HYDRO-JUNCTION OF THE KŁODNICA AND GLIWICE CANAL

Summary

The allocation of heavy metals, polycyclic aromatic hydrocarbons (PAHs), and radioisotopes in bottom sediments of three lowland dam reservoirs: Pławniowice, Dzierżno Małe, and Dzierżno Duże – functioning in circumstances of strong anthropo-pressure and constituting together with the Gliwice Canal so called “Kłodnica Hydro-Junction” – has been investigated. On the basis of the pollutant balances, the role played by the reservoirs in the processes affecting quality of water resources has been determined.

The allocation of the pollutants in an ecosystem is a resultant of various environmental factors. The sedimentation of suspensions is the most noticeable component of the self-purification process in the investigated reservoirs. The grain composition of allochthonic suspensions is reflected in the sedimentation rate and causes spatial stratification of the pollutants.

The content of heavy metals in suspensions is related to the grain composition of the suspensions. With decreasing size of particles, the concentrations of heavy metals (such as lead, cadmium, chromium, manganese, copper) increase in the allochthonic suspensions. But due to an unimportant contribution of the finest fractions to the total load of suspensions, higher loads of metals do not correspond to higher concentrations of the metals in these fractions. As far as the total content of heavy metals in bottom sediments is concerned, it has been shown how important two following issues are: how much of this total amount is bio-available and what part of it may be released from the sediments to water. Also the probability of occurrence of the conditions enabling these processes in the reservoirs has been determined.

The content of heavy metals in bottom sediments also corresponds to the grain composition of the sediments. The strongest dependence occurs for fractions of grain sizes between 5 and 10 μm . PAHs in bottom sediments of the reservoir Dzierżno Duże are the compounds heavily polluting the ecosystem. Their concentrations are similar to these of anthropogenic PAHs contaminating soils. A new classification method using the anthropo-accumulation index IA-WWA, the index defined here for PAHs as an analogue to the geo-accumulation index Igeo, has been created to assess the degree of contamination of bottom sediments with PAHs. According to this new classification, basing on the index IA-WWA, the contamination of these sediments is of the highest degree.

The soluble forms of heavy metals, precipitating while moving through the reservoir, are responsible for the transportation of these metals within the reservoirs; whereas easily depositing suspensions are responsible for the internal transportation of PAHs. These two ways of the pollutant transportation yield two characteristic modes of allocation of the pollutants along the reservoir axis: PAHs are high and metals low at the reservoir entrance and, gradually changing, the situation becomes an opposite of the previous: one at the outlet PAHs are low and metals high.

The strong interdependence between the concentrations of heavy metals and radioisotopes in bottom sediments of the investigated ecosystems suggests the same transportation ways for these two groups of metals. Moreover, from this dependence, it may be concluded that the radioisotopes and heavy metals – due to their specific physical and chemical properties – are similar in their behavior in the aqueous ecosystem.

By proper formation of the morphometry elements the self-purification processes in dam reservoirs may be intensified.

Application of the notion of loads of contaminants and balancing of pollutants should be considered as a proper method for evaluation of the role of the reservoir in the process of formation of water resources quality.