

Abstract

The main goal of the presented doctoral dissertation was to determine the most important mechanisms responsible for the distribution and migration of selected radioactive isotopes in lake sediments of anthropogenic reservoirs in Poland. The research area consists of two dam lakes – Lakes Turawskie and Koronowskie and one post-mining lake – Lake ŁK-61 affected by acid mine drainage (AMD). The variability in the distribution of particular radioisotopes in the sediments demonstrated in the study was used to characterize sedimentation processes and changes in environmental conditions that occurred in the ecosystems of the studied lakes in the past.

The spatial and vertical distributions of cesium ^{137}Cs activity concentrations in the sediments of dam lakes were determined. In the post-mining lake, the vertical distribution of ^{137}Cs and polonium ^{210}Po content was analyzed. Moreover, due to the specificity of Lake ŁK-61, the distribution of heavy metals (Cu, Ni, Pb, Zn, etc.) content in the water column and in the sediment core was also examined. In order to better characterize the factors and processes responsible for the distribution of radionuclides, the vertical distributions of the concentration of selected ions and dissolved organic carbon (DOC) in the water column were also studied. Additionally, analyses of subfossil diatoms, particle-size distribution, mineralogical composition, and the content of potassium ^{40}K , total organic carbon (TOC) and nitrogen (TN) in selected sediment samples were also conducted.

The obtained results showed that the most important factors responsible for the spatial distribution of ^{137}Cs activity concentrations in the bottom sediments of dam lakes are the type and characteristics (grain size distribution and mineralogical composition) of the deposited sediments, the physical and limnological characteristics of the lakes (e.g., hydro-morphological parameters) and the processes responsible for erosion and sediment transport. Cesium ^{137}Cs accumulates in reservoirs mainly in fine-grained sediments (<0.063 cm), which are deposited in the profundal zone of these lakes, especially near the dam. In the case of a post-mining lake, the dominant processes responsible for the distribution of ^{137}Cs and ^{210}Po in the lake sediments are the dissolution and precipitation of minerals, as well as sorption processes with autogenic and allogenic minerals. However, these processes may be disturbed by depositional events, such as floods. In all anthropogenic reservoirs, the distribution of selected radionuclides is also significantly influenced by the supply of contaminated particles from the catchments of the studied lakes.

Keywords: radionuclides, anthropogenic reservoirs, post-mining lake, dam reservoirs, heavy metals, lake sediments, radioisotope migration, sediment transport