
The Natural Radionuclides and Trace Elements around Phosphogypsum Waste in Wiślinka, Northern Poland

A. Boryło, W. Nowicki, B. Skwarzec

University of Gdańsk, Faculty of Chemistry, Chair of Analytics and Environmental Radiochemistry, Sobieskiego 18/19, Gdańsk, Poland, aborylo@chem.univ.gda.pl

Abstract

The essence of radiotoxicity of phosphogypsum waste heap is not only gamma radiotoxicity, but very important are natural radioactive elements, which are in phosphogypsum and which as a result of the processes of emitting dust, leaching by rain, and bioaccumulation in plant and animal organisms reach the human organism. In longer time they can cause cancer. The treatment of phosphate rocks is a source of the natural increase of radiotoxicity. The radionuclides of uranium (^{234}U , ^{235}U , ^{238}U), thorium (^{232}Th) and existing in the equilibrium with radionuclides of radium (^{226}Ra , ^{228}Ra) polonium (^{210}Po) and lead (^{210}Pb) almost always exist in sedimentary phosphoric rocks.

The objective of this study was determination of uranium and polonium concentration in plants samples from area around the phosphogypsum waste dump in Wislinka. The results revealed that the concentrations of ^{210}Po , ^{234}U and ^{238}U in the analyzed plants were differentiated. The considerable amounts of polonium and uranium isotopes were found in common wheat (*Triticum aestivum*) samples. The comparability polonium and uranium content was confirmed in bedders, but higher accumulation was determined in ripe species than immature species of vegetables. The higher polonium and uranium concentration was noticed in green part of plant, the lower in root of plants. It is suggest that the transfer of the radionuclide via the root system is rather negligible. Therefore, the significant source of polonium and uranium in plants are wet and dry atmospheric falls gathering the soil and air dust from phosphogypsum waste dump. The atmospheric origin polonium content depends not only on falling velocity from the atmosphere, but also on the age of leaves and their surface area. Polonium and uranium concentration in cultivated plants samples wasn't species diverse.

Metals which play the role of microelements in living organisms, usually occur in trace amounts, strictly defined for specific species. Metals deficiency as well as excess can be harmful for living organisms.

The aim of this work was also to determine the amount of chosen heavy metals (Cd, Pb, Cu, Fe, Zn, Ni) and the examination of their accumulation process in the particular plant organs. The plants chosen for the research were already mentioned meadow plants, energy willow as well as cultivated plants (wheat, carrot, parsley, leek, beetroot, lettuce, onion). In the research we used the Atomic Absorption Spectrometry technique (AAS) and the Atomic Emission Spectrometry (ICP-AES).

The authors would like to thank the Ministry of Science and Higher Education for the financial support under grant DS/8460-4-0176-0.