Karolina Szymańska - doctoral thesis abstract

„Selected natural radioactive isotopes in edible mushrooms collected in Northern Poland”

Contamination of the natural environment with radioactive elements is mainly related to the use of radioactive isotopes and compounds for economic and industrial, medical and military purposes. A certain amount of radioactive elements is released into the natural environment as a result of mining mineral deposits, burning lignite and hard coal, as well as storing industrial waste. Due to origin of radionuclides on the Earth they were divided into two main groups: natural radioactive elements and anthropogenic radioactive isotopes. Among naturally occurring radionuclides in the environment, the alpha particle emitters have a significant role in the determination of radioactive contamination of the natural environment, as well as the assessment of radiological effects related to their accumulation in fauna and flora.

Research presented in the these thesis contributed to deeper knowledge about the occurrence and accumulation of polonium ^{210}Pb, lead ^{210}Pb, uranium (^{234}U, ^{235}U, ^{238}U) and thorium (^{230}Th, ^{232}Th) in environmental samples of selected edible mushrooms species and soil collected from Northern Poland. Collected mushrooms, the subject of the study, were the fruiting bodies of forest fungi of the family *Boletaceae* of the genus *Leccinum* (orange oak bolete, slate bolete, red-capped scaber, hazel bolete, foxy bolete), which were chosen due to their popularity among the consumers and common occurrence in the nature. Moreover, 4 morphologically different mushrooms species samples were collected: brown bay bolete, slippery jack bolete, common earthball and fairy ring mushroom, to analyze the distribution of ^{210}Po and ^{210}Pb isotopes in their fruiting bodies and estimate the influence of the atmospheric fallout on their distribution in the mushroom fruiting bodies (skin, cap, stem).

The main aim of the research was to: determine the content of polonium ^{210}Po, radiolead ^{210}Pb, uranium (^{234}U, ^{235}U, ^{238}U) and thorium (^{230}Th, ^{232}Th) in collected samples of mushrooms and soil, evaluate the radionuclides distribution in the morphological parts of fruiting bodies, and calculate the effective doses coming from ^{210}Po, ^{210}Pb, ^{234}U, ^{235}U, ^{238}U, ^{230Th} and ^{232}Th ingested with mushrooms. The determination of the level of occurrence of radioisotopes in the natural environment is important for both scientific and social purposes and it is helpful to protect human health.

The radiochemical methods used for the determination of radioactive elements were the mineralization of the mushroom samples and soil substrate in concentration acid (hydrochloric and nitric) and then radiochemical process of ^{210}Po autodeposition on silver disc. In the case of uranium ^{234}U, ^{235}U, ^{238}U and thorium ^{230}Th, ^{232}Th, they were separated and purified using columns with exchange ions resins. Next the electrolysis process on steel discs was done and the activities of analyzed radionuclides was done using an alpha spectrometer Alpha Analyst S470 (Canberra-Packard, USA). Radiolead ^{210}Pb was determined using indirectly method by measuring the equilibrium amount of ^{210}Po.

This study allowed to determine the activity and degree of radionuclides accumulation such as ^{210}Po polonium, ^{210}Pb lead, ^{234}U, ^{235}U, ^{238}U uranium and thorium ^{230}Th and ^{232}Th in forest edible fungi of the genus *Leccinum*: orange oak bolete *(L. quercinum*) foxy bolete *(L. vulpinum*), slate bolete (*L. duriusculum*), red-capped scaber (*L. aurantiacum*) and hazel bolete (*L. pseudoscabrum*) as well as soil. The research allowed to determine the radionuclides distribution in selected parts of fruiting bodies and let to estimate possible effective radiation doses due to consumption of the analyzed mushrooms. Also the impact of the atmospheric fallout containing ^{210}Po and ^{210}Pb in fruiting bodies was estimated. Obtained results indicated that, in the case of ^{210}Po in the caps of analyzed fungi, in the skin it comes directly from the atmospheric fallout.

The final conclusions of the research are:

- ^{210}Po, ^{210}Pb, ^{234}U, ^{235}U, ^{238}U, ^{230}Th and ^{232}Th accumulation in analyzed mushrooms depended on the natural radiation background, the mushroom species and soil type,
- atmospheric fallout containing of ^{210}Po and ^{210}Pb had a significant effect on their content in mushrooms,
- values of BCF were below 1, what meant that mushrooms accumulated small amounts of ^{210}Po, ^{210}Pb, ^{234}U, ^{235}U, ^{238}U, ^{230}Th and ^{232}Th,
- tested mushrooms have not been bioindicators in the environment,
- consumption of forest edible mushrooms containing ^{210}Po, ^{210}Pb, ^{234}U, ^{235}U, ^{238}U, ^{230}Th and ^{232}Th gave a small contribution to the total annual effective dose and these mushrooms were safe from the radiological protection point of view.