Abstract

The doctoral dissertation focuses on the analysis of concentrations of isotopes ^{210}Po and ^{210}Pb in fish and mollusk products and fresh fish available in the Polish food market. The research aims to understand the risk associated with the bioaccumulation of these isotopes in food products and determine the effective doses of ionizing radiation resulting from their consumption. Isotopes ^{210}Po and ^{210}Pb are natural radioactive isotopes that occur in the natural environment, but their concentrations can be altered due to human economic activities, including uranium ore mining and processing, phosphate gypsum enrichment, and combustion of fossil fuels. By-products of these activities often end up in coastal waters, and subsequently in open seas and oceans.

As part of the research, an analysis of the concentrations of isotopes ^{210}Po and ^{210}Pb was conducted in processed fish products purchased in stores, as well as in fresh fish obtained from fishermen. The highest concentrations of ^{210}Po and ^{210}Pb were measured in processed fish preserves, particularly in the case of sardines and octopus, while lower values were observed in fresh fish such as lake salmon and mackerel. Radiochemical analysis performed for the purposes of the dissertation showed that some species of vertebrates and invertebrates were characterized by significant concentrations of ^{210}Po (mollusks, squid, mussels, octopus, two-zone fish and tuna) and ^{210}Pb (mainly in processed fish such as mackerel, herring and Atlantic herring). Statistical analysis was used to examine the influence of food preservation methods, fish packaging types, marinades, and their origins on the concentrations of the analyzed radioactive radionuclides. The research also estimated potential effective doses resulting from the consumption of fish and fish products for different age groups, such as children, adolescents, and adults. Average annual dose values were determined, amounting to 0,600 µSv/year and 0,032 µSv/year for the 1-2-year-old children group, 0,353 µSv/year and 0,034 µSv/year for the 7-12-year-old children group, and 0,353 µSv/year and 0,068 µSv/year for adults, for isotopes ^{210}Po and ^{210}Pb, respectively.

Analysis of variance of the studied material for the ^{210}Po isotope confirmed the hypothesis of no significant statistical differences between the groups, considering the sample origin, as the concentrations of ^{210}Po for wild and farmed fish did not differ significantly from each other but differed statistically from the other samples of canned fish. Vacuum-packed fish

also differed significantly from fish stored in cans, while no statistically significant differences characterized species stored in cans with different marinades (or no marinade). On the other hand, analysis of variance for the ^{210}Pb isotope in the tested samples confirmed the hypothesis of no significant statistical differences between the groups, considering the sample origin and the type of marinade in which fish products were placed, while statistically significant differences were obtained when considering the criterion of fish species. The obtained research results also indicate that discrepancies in the concentrations of ^{210}Po and ^{210}Pb isotopes primarily result from differences in the diet of the studied fish and various methods of storing and processing fish products.

Thoroughly conducted studies on the concentrations of ^{210}Po and ^{210}Pb isotopes in fish products and fish available in the Polish food market indicate the importance of informing consumers about the risks associated with consuming fish and fish products, which can significantly contribute to increasing the awareness of potential consumers and help them make informed decisions regarding their food choices.