

## Abstract

### “Accumulation of $^{210}\text{Po}$ and $^{210}\text{Pb}$ isotopes in medicinal plants”

Aleksandra Moniakowska, MSc

The beneficial role of medicinal plants from various botanical species, such as birch, St. John's wort, horsetail, elderberry, yarrow, nettle and many others, consists in their positive impact on human well-being, while not disturbing the natural functioning of the body. Nevertheless, plants can accumulate chemical substances, and as a consequence, raw materials used in the production of herbal preparations may contain toxic elements and radioisotopes, reflecting the region in which they grew. The growing pollution of the natural environment leads to toxic flora contamination with pesticides, heavy metals and radioactivity. The greatest influence on the plant's radionuclides content is precipitation and the soil substrate's geochemistry. Hence, assessing the content of toxic elements, both stable and radioactive, in medicinal plants is extremely important to ensure the safety of their consumers. Among the radionuclides present in the environment, alpha emitters are the most harmful to human health, strongly ionizing tissues, which is particularly important in the case of food products, and herbs in many cultures, especially in developing countries, are treated as the main source of medicines.

The research carried out as part of this work contributes to the development of knowledge about the occurrence and accumulation of naturally occurring radioisotopes of polonium  $^{210}\text{Po}$  and lead  $^{210}\text{Pb}$  in selected, commonly used, wild species of medicinal herbs collected from three distant regions of Poland: Gdańsk (Pomeranian Voivodeship), Kętrzyn (Warmian-Masurian Voivodeship) and Ryki (Lubelskie Voivodeship). In addition, it was planned to determine the accumulation of  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  isotopes in the plant and to estimate the impact of atmospheric precipitation on the share of these isotopes in specific parts of the plant (root, stem, leaves) from 4 commonly used herbs, i.e. basil (*Ocimum basilicum*), lemon balm (*Melissa officinalis*), peppermint (*Mentha piperita*) and sage (*Salvia officinalis*) grown in soil and in water using the hydroponic method.

The main objectives of the research carried out as part of the doctoral thesis were to determine the activity concentrations of the analyzed radionuclides of polonium  $^{210}\text{Po}$  and lead  $^{210}\text{Pb}$  in wild medicinal plants from distant regions of Poland, estimation of radiological safety and risk factors for cancer for people who are not professionally connected with ionizing radiation as a result of ingesting of the analyzed wild herbs, assessment of the degree of accumulation and distribution of polonium  $^{210}\text{Po}$  and lead

$^{210}\text{Pb}$  in herbs grown under different cultivation conditions, and determination of the influence of precipitation on the content of  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  in herbs.

The research methodology included the following stages and activities: mineralization of samples of herbal raw materials and anatomical parts of 4 plant species, soil substrate and tap water used for hydroponic cultivation, using concentrated acids, electroless deposition of polonium  $^{210}\text{Po}$  on a silver plate, measurement of isotope activity in the alpha spectrometer Alpha Analyst S470 (Canberra, USA). Lead  $^{210}\text{Pb}$  was determined using an indirect method by measuring equilibrium  $^{210}\text{Po}$ .

The research carried out as part of this work allowed us to determine the activity and the degree of accumulation of polonium  $^{210}\text{Po}$  and lead  $^{210}\text{Pb}$  radionuclides in wild-growing medicinal herbs. The conducted research made it possible to determine the accumulation of radionuclides in individual parts of the plant and to estimate the effective doses obtained due to the consumption of the analyzed plant species and the cancer risk factors. In addition, as part of the planned research, the impact of precipitation on the content of the tested radionuclides in plants was estimated.