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INTERNATIONAL CONFERENCE ON RADIATION IN VARIOUS FIELDS OF RESEARCH

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BOOK OF ABSTRACTS

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Determination of radionuclide concentrations in soil and black walnut leaves and fruit using gamma-ray spectrometry

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The Juglandaceae are a plant family known as the walnut family and Juglans L. is one of the eight living genera in that family. It contains about 20 species and among them, Juglans regia L. is most commonly studied. Juglans nigra, the eastern American black walnut, is a species of deciduous tree in the walnut family, native to North America, but today it is spread all over the world. All walnut trees (Juglans species) produce edible seeds (known commonly as nuts), but those of black walnut are notoriously difficult to extract from their husks. It's well known all kind of walnuts due to the chemical composition has multiple biological significance. Some studies have shown that Juglans nigra nuts protect low-density lipoprotein against oxidation in vitro and there is relationship between nuts consumption and reduced risks for heart disease due to its effect on blood lipids. Tinctures of black nuts and leafs produced in the traditional way contain tannin and quinine, iodine, vitamin C in the form of ascorbic acid, alkaloids and minerals. Nowadays, as interest in functional food and herbal products is increasing tinctures of black nuts are used as primarily to cleanse the body of parasites, fungi and toxins.

Most research on black walnut is related to chemical research of its fruit or leaf, while there is no research related to the radiological characteristics of black walnut. In this research, a radiological analysis of the black walnut leaf and fruit, prepared tinctures, as well as nearby soil sample are presented. Concentrations of natural radionuclides (^{210}Pb, ^{235}U, ^{238}U, ^{228}Ac and ^{40}K), as well as concentrations of ^{137}Cs as an artificial radionuclide, were analysed in all samples. All samples were measured in close to detector geometry by means of two coaxial HPGe spectrometers: AMETEK-ORTEC GEM 30-70, with 37 % relative efficiency and 1.7 keV resolution for ^{60}Co at the 1332.5 keV, and Canberra GX5019, with 55 % relative efficiency and 1.9 keV resolution for ^{60}Co at the 1332.5 keV. Measured samples of soil and black walnut leaf and fruit were prepared by drying and crushing. All samples were packed in the appropriate cylindrical geometry equal to efficiency calibration standards.

For soil sample obtained radionuclides concentrations are:(69 ± 5) Bq/kg for^{210}Pb, (2.0 ± 0.4) Bq/kg for^{235}U, (41 ± 5) Bq/kg for^{238}U, (52 ± 3) Bq/kg for^{228}Ac, (532 ± 27) Bq/kg for^{40}K and (6.1 ± 0.4) Bq/kg for^{137}Cs.

For leaves sample obtained radionuclides concentrations are:(28 ± 3) Bq/kg for^{210}Pb, < 1.3 Bq/kg for^{235}U, < 35 Bq/kg for^{238}U, (2.0 ± 0.7) Bq/kg for^{228}Ac, (462 ± 25) Bq/kg for^{40}K and < 0.6 Bq/kg for^{137}Cs.

For fruit sample obtained radionuclides concentrations are:(7.5 ± 1.7) Bq/kg for^{210}Pb, (0.6 ± 0.1) Bq/kg for^{235}U, (24 ± 4) Bq/kg for^{238}U, (1.8 ± 0.3) Bq/kg for^{228}Ac, (808 ± 42) Bq/kg for^{40}K and < 0.5 Bq/kg for^{137}Cs.

For leaves tincture obtained radionuclides concentrations are: < 4 Bq/kg for^{210}Pb, (0.9 ± 0.2) Bq/kg for^{235}U, (25 ± 3)Bq/kg for^{238}U, (0.8 ± 0.1) Bq/kg for^{228}Ac, (53 ± 3) Bq/kg for^{40}K and < 0.3 Bq/kg for^{137}Cs.

For fruit tincture obtained radionuclides concentrations are: (29 ± 4) Bq/kg for^{210}Pb, (0.7 ± 0.2) Bq/kg for^{235}U, (10.7 ± 2.9) Bq/kg for^{238}U, < 1.6 Bq/kg for^{228}Ac, (45 ± 3) Bq/kg for^{40}K and< 0.3 Bq/kg for^{137}Cs.

This study showed that ^{137}Cs concentrations in black walnut leaf and fruit, as well as in tinctures were below the detection limits. Concentrations of other radionuclides are lower than their concentrations in the soil, except for concentration of ^{40}K in black walnut fruit, which objectively have more potassium due to the structure of the fruit. It indicates that the consumption of leaf and nut tinctureis absolutely safe, especially in relation to artificial radionuclides.