

Radioisotopes of the Uranium, Thorium, Plutonium and Americium in the mushrooms.

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ABSTRACT: The present work is devoted to an estimation of the data with radioactive contamination of natural grasses and different species of mushrooms with the aim of an analyzing of the influence of soil properties. Mushrooms have a high transfer factor showing a relatively high uptake of radionuclides from wood and soil from which they grow.

In the present investigation, radioactive plutonium, uranium, thorium and americium was assayed in the dried mushrooms collected in areas of East and West Slovakia in 1998 – 2002, and examined the effectiveness of this mushroom as a possible indicator of radioactive contamination of environment due to nuclear contamination of biosphere.

The mushrooms of canes :Suillus, Leccinum, Baletus, Armillariella, Xerocomus and Craterellus were collected. The samples were prepared by liquide extraction with Aliquat 336. The samples were measured by α – barrier spectrometry.

The results of total activity of plutonium, thorium, uranium and americium in the mushrooms and the layers of forest litter were summarized. The specific activity of samples of nuclides of uranium content in the interval $(2,71 \pm 3,07) \cdot 10^{-3}$ - $(3,43 \pm 0,36)$ Bq.kg⁻¹, activity fo nuclides of thorium content varied $(1,77 \pm 1,55) \cdot 10^{-3}$ – $(2,98 \pm 0,33)$ Bq.kg⁻¹. Activity of nuclides of plutonium content varied $(4,7 \pm 1,67) \cdot 10^{-2}$ – $(2,59 \pm 0,23)$ Bq.kg⁻¹ and activity of americium varied $(0,106 \pm 0,055)$ – $(0,831 \pm 0,395)$ Bq.kg⁻¹.

INTRODUCTION: Mushrooms are unicellular or polycellular organisms, which are feed lateral or saprophytic. Mainly their cells have developed cellular sheet and definite form. Polycellular mushrooms generate the fibers, called hyphs, which make twine, called mycelium, which side as feeding tissue. From mycelium grow fertile body, which have reproductive function. These fertile bodies with their speed and period of grow, as possible bio-indicators of contamination biosphere by heavy metals, present applicable matrix for analysis. In this work the determination of radioisotopes U, Th, Pu and Am in the different samples of mushrooms and their background soils from the areas of East and West Slovakia for to get the results of contamination of biosphere by determined radionuclides in chosen areas and define possible effect of these radionuclides for rising the effective ration, which are getting by ingestion of individual, is presented.

The analyzed radionuclides were determined using by followed algorithm - the U, Th and Pu were separated by liquid extraction with Aliquat-336 (Methyl-tridecyl ammonium chlorid in nitrate form) and for the determination of Am was used liquid extraction with TOPO (Tri-n-octylphosphinoxid).

For the determination of chemical recovery were used tracers ^{236}Pu with activity 4.16×10^{-2} Bq, respectively ^{243}Am with activity $6,08 \cdot 10^{-2}$ Bq.

The samples after separation were precipitated, micro-filtrated and follow measured by α -spectrometer Ortec.

Tab.1 Specific activity in the mushrooms 1998 - 2000

	Xerocomus 1997 Cz	Armillariella mellea 1997 Cz	Leccinum 1998 East Slovakia
^{232}Th	0.017	0.370	0.002
^{230}Th	0.071	0.260	0.009
^{228}Th	0.214	0.666	0.062
^{238}U	-	0.262	-
^{235}U	-	0.024	-
^{234}U	-	0.223	-
$^{239,240}\text{Pu}$	0.186	0.135	0.047
^{238}Pu	0.384	0.080	0.022

Tab. 2 Specific activity in the mushrooms 2001

	Boletus East Slovakia	Craterellus cornucupoides E. Slovakia	Grifola umbellata E.Slovakia	Leccinum West Slovakia	Xerocomus West	Moss from East Slovakia	Soil from East Slovakia	Moss from West Slovakia	Soil from West Slovakia
^{232}Th	0.036	1.900	1.050	0.024	0.030	0.396	0.398	0.205	1.970
^{230}Th	0.049	1.410	0.618	0.063	0.095	0.264	0.206	0.272	2.310
^{228}Th	0.379	2.00	2.490	0.330	0.974	0.525	0.417	0.431	2.980
^{238}U	0.165	-	-	0.801	0.015	-	-	0.110	3.430
^{235}U	-	-	-	0.037	0.003	-	-	0.040	-
^{234}U	0.181	-	-	0.939	0.015	-	-	0.154	3.240
$^{239,240}\text{Pu}$	0.071	0.139	0.081	1.220	0.065	0.821	2.590	0.065	1.880
^{238}Pu	0.720	0.110	0.116	0.408	0.175	0.190	2.140	0.047	0.373

Tab. 3 Specific activity in the mushrooms 2002

	Suillus West Slovakia	Xerocomus West Slovakia	Moss West Slovakia	Armillariella East Slovakia
$^{239,240}\text{Pu}$	0.115	0.167	0.385	0.711
^{238}Pu	0.106	0.146	0.248	0.628
^{238}U	0.710	1.666	5.064	8.300
^{234}U	1.003	1.831	6.315	8.025
^{228}Th	-	1.795	4.610	2.820
^{232}Th	-	0.282	0.659	0.482
^{230}Th	-	0.209	0.959	0.565
^{241}Am	0.106	0.721	-	0.831

CONCLUSION: Determined specific activities of radioisotopes in the mushrooms are divided in some graphs selected by the years of collected samples. From the obtained results in this time was not settled ability of the mushrooms concentrate radionuclides in enhanced rate, but quantity and type determined radioisotopes occurring in the fertile body of the mushrooms argue the ability about transfer and integral of radioisotopes from the background soils to mushrooms. Concerning for this ability, next study is get more samples of the mushrooms and their background soils from the areas of Slovakia, which are known high contents of U, Th and other radionuclides in the soils (regions with uranium deposit or increasing Ra duty). Another subject for this study is get better algorithm for back extraction U and Th from Aliquat-336 with exactly determination of the contents of uranium and thorium using by tracers ^{232}U and ^{220}Th . For another analysis would be better to reduce the transfer M^{2+} during the back extraction to final product, which makes increase in a quantity of precipitate and causes the incorrect result in consequence the self-absorption of measured sample.

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