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BOOK OF ABSTRACTS

SEVENTH INTERNATIONAL CONFERENCE ON RADIATION IN VARIOUS FIELDS OF RESEARCH

June 10-14, 2019
Herceg Novi
Montenegro

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Instrumental neutron activation for analysis of spatial distribution of heavy metals in surface sediments of the Danube River

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In this paper, the spatial distribution of the heavy metals including technology-critical elements (TCE) in the surface river sediments was investigated. The surface sediments of the Danube River in the Republic of Serbia, as well as three tributaries were analysed. Instrumental neutron activation analysis (INNA) has been applied for quantification of the selected element in the samples. The main featues of INAA are: simultaneously determining more than 40 elements with high sensitivity and low detection limit, high selectivity due to specific nuclear reaction for each element, the nondestructive method, the sample stays intact and no chemical separation treatment is involved, simple sample preparation step, especially solid samples, a small quantity of sample (≈ 200 μg) and determination of the total element concentration independent of chemical species, real total analysis since the test portion does not have to be dissolved. The heavy metal concentration in the sediments connected with hydropower dam and accumulation of sediments in the reservoir systems Iron gate I and Iron gate II were discussed.

Surface river sediments were collected from the river bottom at the central and the deepest part using an Ekman grab sampler and air-dried in a thin layer in the dark at room temperature (23 ± 1 °C). Also, deep river sediments (1.5 and 7 m) were collected and used for comparison purpose. After drying, the samples were homogenized using a pestle and mortar and sieved through a 1-mm sieve to ensure sample homogeneity. INAA were used to quantify following elements: Na, K, Rb, Cs, Mg, Ca, Sr, Ba, Al, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Zn, Ga, As, Se, Yr, Ag, Cd, Sb, La, Ce. Nd, Sm, Eu, Gd, Tb, Dy, Tm, Yb, Th, Hf, Ta, W, Au, Hg and U. Irradiations were performed at the pulsed reactor IBR 2 (Frank Laboratory of Neutron Physics, JINR, Dubna, Russian Federation) using epithermal neutrons. Principal Component Analysis (PCA) and Power transformation as a pretreatment method were applied for analysis of experimental data.

It was found that the increase in the amount of sediment in the reservoir prior to the dam Iron gate I was accompanied by an increase in the concentration of the following metals: antimony, arsenic, chromium, europium, neodymium and samarium.

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