

Neutron activation analysis for studies of elemental variability in the wild and farmed molluscs

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The neutron activation analysis as a primary method for determination of mass fraction of high number of elements was applied for investigation of their temporal and spatial distribution among edible mussels and oysters. It allowed to find levels of the 29 macro and microelements in soft tissues and 24 in shells of such molluscs. To compare the samples of wild and farmed mussels were collected from the sites with different anthropogenic pressure in the coastal zones of South Africa, Namibia, Mozambique and Crimea. For determination of the long term physiological state, the length and wet weight of soft tissues were measured before analysis. Obtained data were used for calculation of the specific elemental ratios such as enrichment factors, soft tissue/shell ratios and condition factors.

In general, the mussels from harbor zones contained higher levels of such elements as Sc, V, Cr, Mn, Co, Ni, Sb, Cs, Th, U could be considered as terrigenous origin, while Co, Ni, Zn, As, Se, Br, I, Sb could have anthropogenic contribution to the soft tissue of organisms. The governmental organizations usually establish the maximum permissible levels for the most dangerous elements in edible food. Except well-known Cd, Hg and Pb, such trace elements as Cr, Ni, Zn, As, and Se could reach in mussels harmful levels. In addition, the effects of many others microelements to the human health were slight investigated. For human health such elements as Al, Cr, Co, Zn, As and I revealed high risks in consumption of mussels from the polluted marine water areas.

Another direction of biomonitoring studies is to define the levels in wild and farmed mussels from the natural and anthropogenic water areas (harbours). The non-destructive neutron activation analysis could be used for simple solving such task.

According to our studies, the main factors affect spatial variability of elements in the soft tissues and shells of mussels depend on the presence of resuspended bottom sediments, concentration and content of phytoplankton, lithogenic composition of the coastal rocks, freshening of coastal waters, storm activities and hydrological parameters of environment waters and anthropogenic influence (wastewater discharges, marine transport, and harbor loadings).

The obtained results were used for creation of database for future biomonitoring studies with attention to the redistribution of harmful trace elements and characterization of environmental parameters of a specific coastal zone.

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